August 28, 2015

Ashley Hoekstra
Wisconsin Department of Natural Resources
Bureau of Drinking Water and Groundwater
Box 7921
Madison, Wisconsin 53707-7921
DNRWaukeshaDiversionApp@wisconsin.gov

Re: Draft Technical Review and Draft Environmental Impact Statement on the City of Waukesha's Diversion Application

Dear Ms. Hoekstra:

The Compact Implementation Coalition and its regional partners, the National Wildlife Federation, Natural Resources Defense Council, and Alliance for the Great Lakes, submit the attached comments on the Department of Natural Resources' ("DNR's") draft Technical Review and draft Environmental Impact Statement ("EIS") on the City of Waukesha's Diversion Application.

Waukesha's proposed diversion is the first one to test the "overarching principle" of the Great Lakes – St. Lawrence River Basin Water Resources Compact ("Compact") since it became effective in 2008. Wisconsin and its sister Great Lakes States agreed then that "the protection of the integrity of the Great Lakes – St. Lawrence River Basin Ecosystem" is that principle, and they agreed that they must adhere to this principle in reviewing proposals to divert water from the Great Lakes Basin in order to protect the integrity of the Basin Ecosystem. Accordingly, the Compact States agreed to use caution in determining whether a proposed diversion meets the Compact's stringent criteria for approval, which Wisconsin has made even more stringent in several instances.

DNR has not exercised the requisite caution in determining whether Waukesha's proposed diversion meets these criteria. Contrary to DNR's review and preliminary findings, Waukesha's proposal fails to satisfy the criteria necessary to approve the city's proposed diversion of water from Lake Michigan in the following ways:

- Waukesha has not shown that either it or the other communities included in the city's application do not have adequate supplies of potable water;

- Waukesha has not shown that there are no reasonable alternatives to the proposed diversion;

- Waukesha has not shown that the proposed diversion will be implemented to incorporate water conservation measures;

- Waukesha has not shown that the proposed diversion appropriately manages return flows; and

- Waukesha has not shown that the proposed diversion will result in no significant or cumulative adverse impacts.

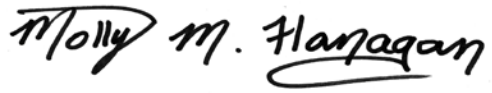
In addition, DNR has not complied with the Wisconsin Environmental Protection Act because it failed to include critical analysis and information in the draft EIS.

We firmly believe every person in Wisconsin is entitled to a ready supply of clean, healthy, safe water, now and in the future. Waukesha has access to such a supply in its existing wells if the city invests in additional water treatment infrastructure. This non-diversion solution would cost much less than the proposed diversion, secure water independence for Waukesha, protect public health, and minimize adverse resource impacts. Above all, it would stay true to the Compact's overarching principle: to protect the integrity of the Basin ecosystem. That will benefit not just the residents of Waukesha and Wisconsin, but every person in the Great Lakes States.

Because Waukesha has not satisfied the Compact's and Wisconsin's stringent criteria for approval, DNR must deny Waukesha's proposed diversion of water from Lake Michigan. The undersigned are happy to meet with DNR at any time to discuss these comments.

Thank you for this opportunity to comment.

On behalf of the Compact Implementation Coalition,

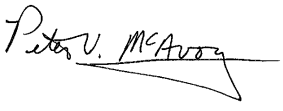


Molly Flanagan
Alliance for the Great Lakes

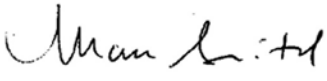
Jodi Habush Sinykin
Midwest Environmental Advocates

Mark Redsten
Clean Wisconsin

Cheryl Nenn
Milwaukee Riverkeeper

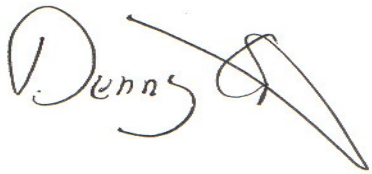


Peter McAvoy
McAvoy and Associates



Marc Smith
National Wildlife Federation

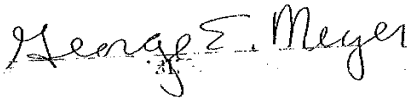
Karen Hobbs
Natural Resources Defense Council



Denny Caneff
River Alliance of Wisconsin

Steve Schmuki
Waukesha County Environmental Action League

Kerry Schumann
Wisconsin League of Conservation Voters



George Meyer
Wisconsin Wildlife Federation

Joint Comments of the Wisconsin Compact Implementation Coalition, National Wildlife Federation, Natural Resources Defense Council, and Alliance for the Great Lakes on the Draft Technical Review and Draft Environmental Impact Statement on the City of Waukesha's Diversion Application

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Joint Comments of the Wisconsin Compact Implementation Coalition, National Wildlife Federation, Natural Resources Defense Council, and Alliance for the Great Lakes on the Draft Technical Review and Draft Environmental Impact Statement on the City of Waukesha's Diversion Application

I. OVERVIEW

The Compact Implementation Coalition ("CIC") and its regional partners, the National Wildlife Federation ("NWF"), Natural Resources Defense Council ("NRDC"), and Alliance for the Great Lakes ("AGL"), submit the attached comments on the Department of Natural Resources' ("DNR's") draft Technical Review and draft Environmental Impact Statement ("EIS") on the City of Waukesha's Diversion Application.

Waukesha's proposed diversion is the first one to test the "overarching principle" of the Great Lakes – St. Lawrence River Basin Water Resources Compact ("Compact") since it became effective in 2008. Wisconsin and its sister Great Lakes States agreed then that "the protection of the integrity of the Great Lakes – St. Lawrence River Basin Ecosystem" is that principle, and they agreed that they must adhere to this principle in reviewing proposals to divert water from the Great Lakes Basin in order to protect the integrity of the Basin Ecosystem.[1] Accordingly, the Compact States agreed to use caution in determining whether a proposed diversion meets the Compact's stringent criteria for approval, which Wisconsin has made even more stringent in several instances.[2]

DNR has not exercised the requisite caution in determining whether Waukesha's proposed diversion meets these criteria. Contrary to DNR's review and preliminary findings, Waukesha's proposal fails to satisfy the criteria necessary to approve the city's proposed diversion of water from Lake Michigan in the following ways:

- Waukesha has not shown that either it or the other communities included in the city's application do not have adequate supplies of potable water;
- Waukesha has not shown that there are no reasonable alternatives to the proposed diversion;
- Waukesha has not shown that the proposed diversion will be implemented to incorporate water conservation measures;
- Waukesha has not shown that the proposed diversion appropriately manages return flows; and
- Waukesha has not shown that the proposed diversion will result in no significant or cumulative adverse impacts.

[1] Compact, art. 4, § 4.5.1.d.
[2] *Id.* at § 4.9.3.e.

In addition, DNR has not complied with the Wisconsin Environmental Protection Act because its draft EIS fails (1) to examine an important and reasonable alternative, and (2) to dispel significant uncertainty regarding important aspects of Compact compliance. These failures significantly undermine informed and meaningful decision-making and public participation.

For these reasons, expounded in detail in the comments that follow, the CIC and its regional partners, NWF, NRDC, and AGL submit that DNR must deny Waukesha's proposal for a diversion of water from Lake Michigan.

II. COMMENTERS

The Compact Implementation Coalition ("CIC"), collectively representing tens of thousands of Wisconsinites, has a long history of working on the Compact. From ensuring the adoption and implementation of a strong Compact to aiding the DNR in the promulgation of administrative rules to implement the Compact, the CIC has passionately and consistently advocated for the strongest protections possible for the waters of the Great Lakes, in keeping with the spirit and the letter of the Compact.

CIC's mission is to ensure a thorough legal, economic, environmental and ***public*** review of the first application for an out-of-basin diversion of Great Lakes waters under the Compact, in full recognition of the precedent-setting impact of this first application. To that end, the CIC advocates for strict adherence to the Compact's exacting standards.

Member organizations of the Compact Implementation Coalition include: Clean Wisconsin, Midwest Environmental Advocates, Milwaukee Riverkeeper, River Alliance of Wisconsin, Waukesha County Environmental Action League ("WEAL"), Wisconsin Wildlife Federation, and Peter McAvoy, of Counsel.

The National Wildlife Federation ("NWF") is America's largest conservation organization, inspiring Americans to protect wildlife for our children's future. Since 1982, NWF's Great Lakes Regional Center has been a leader in protecting the Great Lakes for the wildlife and humans that depend on this invaluable resource.

The Natural Resource Defense Council ("NRDC") is an international, nonprofit environmental organization with more than 2.4 million members and online activists. More than 107,000 of these members and online activists live in the eight Great Lakes states, including more than 8,000 in Wisconsin.

The Alliance for the Great Lakes ("AGL") is a nonprofit organization that has advocated on behalf of the Great Lakes and the people who enjoy them for decades. The Alliance's mission is to conserve and restore the world's largest freshwater resource using policy, education, and local efforts, ensuring a healthy Great Lakes and clean water for generations of people and wildlife.

III. GENERAL PRINCIPLES

A. The Compact Is The Governing Law, Except To The Extent Wisconsin Law Is More Restrictive

The Compact and Wisconsin law implementing the Compact prohibit all new diversions of water outside of the Great Lakes Basin, with limited, narrow exceptions.[3] One exception is "A Proposal to transfer Water to a Community within a Straddling County that would be considered a Diversion under this Compact."[4] Waukesha seeks to take advantage of this exception, which means it has to demonstrate that its application satisfies both Compact §§ 4.9.3 and .4, and Wis. Stat. § 281.346(4)(e) and (f).

The Compact establishes the minimum requirements,[5] providing that each state … shall manage and regulate … Exceptions … in accordance with this Compact."[6] No state may approve a diversion if the state determines that the diversion "is inconsistent with this Compact or the Standard of Review and Decision."[7] For purposes of Waukesha's proposal, the "Standard of Review and Decision" is the Exception Standard found in Compact § 4.9.4.[8] and Wis. Stat. § 281.346(4)(e) & (f).

In ratifying the Compact, Wisconsin expressly agreed to abide by the Compact's minimum requirements.[9] However, the state has implemented more restrictive laws and regulations, as allowed by the Compact.[10] For instance, the Compact only requires an applicant to demonstrate that water from outside the basin, when returned to the basin, will be "treated to meet applicable water quality discharge standards."[11] This requirement might be satisfied by a condition attached to an approval of a proposed diversion requiring the applicant to get a Wisconsin Pollutant Discharge Elimination System ("WPDES") permit after the application has been approved. But Wisconsin's statute does not allow a demonstration of compliance with water quality standards to be deferred. Instead, it expressly makes the issuance of a WPDES permit a prerequisite to approval of a diversion.[12]

Because Wisconsin has implemented more restrictive measures – like the measure regarding return flows, Waukesha's application may not be approved unless it meets the more restrictive

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[3] Compact art. 4, § 4.8; Wis. Stat. § 281.346(4).
[4] Compact, art. 4, § 4.9.3; Wis. Stat. § 281.346(4)(e).
[5] Compact, art. 4, §§ 4.3.1 and .3, 4.12.1.
[6] Compact, art. 4, § 4.3.1.
[7] Compact, art. 4, § 4.3.3.
[8] Compact, art. 1, § 1.2.
[9] Wis. Stat. § 281.343(1b), (4d)(a) and (c).
[10] Compact, art. 4, § 4.12.1.
[11] Compact art. 4, § 4.9.4.c.ii.
[12] Wis. Stat. §§ 281.346(4)(e)1.b. (DNR may approve a new diversion if "all the following apply: … The proposal meets the exception standard under par. (f).") *and* 281.346(4)(f)4.b. ("A proposal meets the exception standard if all of the following apply: … No water from outside the Great Lakes basin will be returned to the source watershed unless … The returned water will be treated to meet applicable permit requirements under s. 283.31 … and the department has *approved* the permit under s. 283.31.") (emphasis added).

measures, even if it meets the Compact's Standard of Review and Decision.[13] Each of Wisconsin's more restrictive measures will be identified and addressed in detail where appropriate in the balance of these comments.

B. Waukesha Must Establish That A City, Village, Or Town Meets The Compact's Standard Of Review And Decision And Wisconsin's More Restrictive Measures

Waukesha claims the proposed diversion is needed to supply the city's proposed water supply service area,[14] and the city submitted a proposed water supply service area plan as part of its application. The proposed water supply service area plan "includes parts of … the City of Pewaukee, the Town of Delafield, the Town of Genesee, and the Town of Waukesha."[15] Waukesha justifies its inclusion of parts of these four communities on Wisconsin's requirement that "the proposal is consistent with an approved water supply service area plan under s. 281.348 that covers the public water supply system."[16]

However, a water supply service area may not propose a diversion. Both the Compact and Wisconsin law allow a diversion to a "community within a straddling county," but Wisconsin's definition of this term is more restrictive than the Compact's definition. Wisconsin's definition of "community within a straddling county" is expressly limited to "any city, village, or town," [17] while the Compact's definition is facially expansive, including not only cities and towns, but "the equivalent thereof," [18] as well.

Because Wisconsin's definition is more restrictive,[19] Waukesha has to show compliance with Wisconsin law.[20] (As the applicant, Waukesha has the burden of proving that its proposal meets all of the applicable criteria.[21]) Since a water supply service area is not a city, a village, or a town, this means Waukesha may not assert that its proposed water supply service area is a "community" eligible for a diversion, and DNR may not regard it as one.

Wisconsin's requirement of "consistency" with an approved water supply service plan does not transform a water supply service provider into a "community," as DNR maintains. Rather, if a

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[13] *See* Compact art. 4, § 4.12.1.
[14] Application, Vol. 1, at 1-1.
[15] Application, Vol. 2, at 2-1.
[16] Wis. Stat. §281.346(4)(e)em.
[17] Wis. Stat. § 281.346(1)(d).
[18] Compact, art. 1, § 1.2.
[19] The term "the equivalent thereof" in the Compact was intended to be just as restrictive as the plain language used in Wisconsin's implementing measure; the term was meant to include only local municipalities, whether a state or province called them towns, cities, villages, townships, boroughs, or something else. *Hearing before the DNR on City of Waukesha's Diversion Application* (Aug. 17, 2015) (statement of Todd Ambs). The notion that the term "the equivalent thereof" should include Waukesha's proposed water supply service area was specifically rejected by the Compact negotiators. *Id.* As the former Administrator of DNR's Water Division, Mr. Ambs was intimately involved in the negotiations that led to the final language of the Compact.
[20] *See* Compact, art. 4, § 4.12.1.
[21] Compact, art. 4, § 4.9.4; Wis. Stat. § 281.346(4)(f); *see Sterlingworth Condo. Ass'n v. Dep't of Natural Res.*, 205 Wis. 2d 710, 726 (Wis. Ct. App. 1996).

single jurisdiction within a multi-jurisdiction water supply service area applies for a diversion because it lacks an adequate water supply, then DNR merely must assess whether a diversion to supply that single jurisdiction's lack is consistent within the context of the plan for the larger water supply service area. That is the most natural reading of the plain language of the statute. In contrast, DNR's interpretation, which would effectively re-write the statutory definition of "community" to include the entire water supply service area, is a strained reading of the statute.

But whether or not Waukesha's inclusion of Pewaukee and the towns of Delafield, Genesee, and Waukesha in the proposal was proper, the city has to show that each of these communities, individually, satisfies all the applicable criteria for approval, including the following criteria:

- "[t]here is no reasonable water supply alternative within the basin in which the community is located, including conservation of existing water supplies";[22]
- "[t]he need … cannot be reasonably avoided through the efficient use and conservation of existing water supplies";[23]
- "[t]he Exception will be limited to quantities that are considered reasonable for the purposes for which it is proposed";[24] and
- "[t]he Exception will be implemented so as to ensure Environmentally Sound and Economically Feasible Water Conservation Measures to minimize Water Withdrawals or Consumptive Use."[25]

Because Waukesha has failed to show either that it or the other communities meet each applicable criterion, as explained in these comments, DNR must deny the proposal.

IV. WAUKESHA HAS NOT SHOWN THAT EITHER IT OR THE OTHER COMMUNITIES INCLUDED IN THE CITY'S APPLICATION FOR A PROPOSED DIVERSION DO NOT HAVE ADEQUATE SUPPLIES OF POTABLE WATER, AS REQUIRED BY THE COMPACT'S STANDARD OF REVIEW AND DECISION AND WISCONSIN'S MORE RESTRICTIVE MEASURES (DNR Water Supply Related Criteria S1, S3, S4)

A. Waukesha's Reliance On Its Proposed Water Supply Service Area Plan Is Improper (DNR Water Supply Related Criterion S3)

As explained above, Waukesha's proposed water supply service area is not a "community" and therefore is not eligible to propose a diversion. But even if a water supply service area were eligible to propose a diversion, Waukesha may not obtain approval of the proposed diversion on behalf of its ***proposed*** water supply service area.

Wisconsin has explicitly authorized DNR to approve a proposed diversion ***only*** if, among other things, "The proposal is consistent with an *approved* water supply service area plan under s.

[22] Compact, art. 4, § 4.9.3.d.
[23] Compact, art. 4, § 4.9.4.a.
[24] Compact, art. 4, § 4.9.4.b.
[25] Compact, art. 4, § 4.9.4.e.

281.348 that covers the public water supply system."[26] In this regard, Wisconsin law is more restrictive than the Compact, and under the terms of the Compact, this more restrictive measure controls.[27]

Waukesha's water supply service area plan has not been approved, merely proposed.[28] Indeed, the process for approving such a plan has not been established by rule, as required by Wisconsin law.[29] DNR has taken no action on its draft water supply service area planning rule since 2010.[30] Until Waukesha's water supply service area plan has been approved in accordance with Wisconsin law, DNR is statutorily prohibited from approving the proposed diversion.

B. Even If Waukesha's Inclusion Of Other Communities And Reliance On The Proposed Water Supply Service Area Plan Are Proper, The City Has Failed To Show That It And The Rest Of The Communities Meet The "Need" Criterion In The Compact And Wisconsin's More Restrictive Measures (DNR Water Supply Related Criterion S1)

1. Waukesha's demand projection overstates future demand for water

Waukesha's forecasts of average-day demand and maximum-day demand are based on models that inflate the city's need for water in the future. In forecasting average-day demand, the city used a model employing an average of gallons per capita per day ("GPCD") calculated from data over the last ten years.[31] Using this average is inappropriate to predict future demand because GPCD has been steadily decreasing over the last few decades.[32] The invalidity of the model becomes apparent from its failure to replicate the actual demand from 1991 to 2008.[33] Instead of tracking the historical data, the model over predicts the average-day demand by forty percent.[34]

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[26] Wis. Stat. § 281.346(4)(e)1.em. (emphasis added).
[27] Compact, art. 4, § 4.12.1.
[28] *See* DNR, Draft Technical Review, *For the City of Waukesha's Proposed Diversion of Great Lakes Water for Public Water Supply with Return Flow to Lake Michigan* (Jun. 2015) at 46 ("*Prior to the department approving the Applicant's water supply service area plan*, the Applicant must amend its sewer service area plan.") (emphasis added) [hereinafter "Technical Review"].
[29] Wis. Stat. § 281.348(3)(a)1. ("The department shall establish, by rule, … a continuing water supply planning process for the preparation of water supply plans for persons operating public water supply systems.")
[30] *See* DNR, Water Use Administrative Rules, NR 854 water supply service area plans, http://dnr.wi.gov/topic/WaterUse/rules.html (last visited Jun. 20, 2014); State of Wisconsin, Administrative Rules, Clearinghouse Number CR10-132, https://health.wisconsin.gov/admrules/public/Rmo?nRmoId=9903 (last visited Jun. 20, 2014).
[31] Memo from Jim Nicholas, Nicholas-H2O, to Marc Smith, National Wildlife Federation, at 1 (Nov. 25, 2013) (attached at Appendix tab 1) [hereinafter "Nicholas Memo"]. Mr. Nicholas 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. Nicholas, An Analysis of the City of Waukesha Diversion Application at 33 (Feb. 2013) (attached at Appendix tab2) [hereafter "Nicholas Analysis"]. He is the former Director of the U.S. Geological Service's Michigan Water Science Center, and his career with the U.S.G.S. spanned thirty-three years. *Id.*
[32] Nicholas Memo at 1; Nicholas Analysis at 10.
[33] *Id.* at 12.
[34] *Id.* at 12, 13 (Fig. 5).

In forecasting maximum-day demand, the city used a ratio of maximum-day to average-day demand of 1.68.[35] However, this ratio is inappropriate because it does not accurately reflect historic ratios.[36] The average ratio over a 40-year period from 1970 to 2010 was not 1.68, but 1.46, the ratio exceeded 1.50 in only thirteen of those forty years, and the ratio exceeded 1.68 in only one year – 1992.[37] When Waukesha used a ratio of 1.65 rather than the actual 1.30 ratio for 2010, it over predicted maximum-day demand by seventy-eight percent.[38] Instead of using the unwarranted 1.68 ratio, then, Waukesha should have used a ratio reflecting recent history and the implementation of water conservation and efficiency measures.[39]

Waukesha's failure to use valid models led it to make over predictions of future demand. Consequently, the city's claimed need for water is unjustified.

2. The record does not establish that the other communities included in the application for a proposed diversion need potable water

The primary threshold to qualify for a diversion is a lack of "adequate supplies of potable water."[40] As explained above, Waukesha must demonstrate that each community included in the application for the proposed diversion meets this criterion. However, the city's application does not demonstrate that any of these communities comply with the "need" criterion. In fact, some, if not all of them currently have adequate supplies of potable water and are not actively seeking a supply through the Waukesha Water Utility. The city implicitly acknowledged that the Town of Genesee does not need water diverted from Lake Michigan because private wells provide the town's water supply.[41]

3. Neither Waukesha nor the other communities have implemented conservation and efficiency measures (DNR Water Conservation Related Criterion C1)

The environmental and economic advantages of the effective management of water resources are well-documented. Water conservation practices that reduce overall water consumption can help to alleviate stress on water resources; save money both for water consumers and providers; minimize water pollution and health risks; maintain the health of aquatic environments; and reduce the energy used to pump, heat, and treat water.

Predictable conservation savings can also allow major infrastructure projects to be deferred or downsized, thus saving both construction and long-term maintenance costs. For instance, water

[35] Nicholas Memo at 1.
[36] Nicholas Analysis at 11.
[37] *Id.*
[38] *Id.* at 13.
[39] Nicholas Memo at 1.
[40] Compact, art. 4, § 4.9.3.a.; Wis. Stat. § 281.346(4)(e)1.a.
[41] Letter from Daniel Duchniak, General Manager, Waukesha Water Utility, to Sharon L. Leair, Chairman, Town of Genesee, at 1-2 (Jan. 12, 2011). Attached at Appendix tab 3. Waukesha added the Town of Genesee to the proposed water supply service area plan ostensibly to address bacteria contamination, but the town can address this issue by complying with existing state requirements for installation of "well casings," without going to the impractical and enormously expensive extent of hooking up to the City of Waukesha for water. Wis. Admin. Code § NR 812.12(3).

conservation can reduce the need for costly water supply and new wastewater treatment facilities. The American Society of Civil Engineers estimates that the State of Wisconsin must invest $7.1 billion in drinking water infrastructure needs over the next 20 years; for its wastewater infrastructure, an estimated $6.4 billion is needed over the same time period.[42] Water conservation helps to address this deficit by lowering the costs to pump, transport, treat, and heat water for consumers and communities. Water conservation measures can be applied at a range of levels – the state level, the utility level, and the consumer level – resulting in a wide-ranging set of practices at the system and individual level that can be utilized to meet conservation goals.

a) Communities applying for a diversion are required to implement certain conservation and efficiency measures before submitting an application for a diversion.

Under DNR's rules, as a "person" applying for a new diversion under Wis. Stat. § 281.346(4)(e), Waukesha – and the communities the city includes in its application – "*shall* implement" certain conservation and efficiency measures ("CEMs") "*prior* to submitting an application."[43] This is a more restrictive measure than the criteria in the Compact. Under the terms of the Compact, however, Waukesha must satisfy this state criterion to receive approval of its proposed diversion.[44]

The obligation to implement CEMs before submitting an application for a new diversion is reinforced by DNR rules requiring communities to document the efficient use and conservation of existing water supplies by providing an analysis of community water use over at least the past five years.[45] Such an analysis "shall quantitatively describe water use through time and how it has changed with the implementation of CEMs."[46] This language shows that the CEMs had to have been implemented before Waukesha submitted its application.

b) Waukesha has not implemented conservation and efficiency measures in its existing water conservation plan

Waukesha originally submitted its application for a diversion in 2011 and later submitted an update in 2013. Significant CEMs in the city's Water Conservation Plan[47] ("WCP") were to be implemented in 2012-2016, ***after*** the application was first submitted and subsequently updated; still more components of the WCP are forecast to be implemented in 2040 and beyond. Waukesha thus could not have implemented the CEMs slated for implementation after 2013

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[42] American Society of Civil Engineers, "Key Facts About Wisconsin's Infrastructure," 2013, *available at* http://www.infrastructurereportcard.org/wisconsin/wisconsin-overview/.
[43] Wis. Admin. Code §§ NR 852.05(5) (emphasis added); *see id.* at § NR 852.02(3)(a).
[44] *See* Compact, art. 4, § 4.12.1.
[45] Wis. Admin. Code § NR 852.06(2).
[46] *Id.*
[47] City of Waukesha, *Application for Lake Michigan Supply for a Lake Michigan Diversion with Return Flow, Volume 3: Final Water Conservation Plan* (May 2012), available at http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=af92d4a8-b5d0-43f3-afa5-8e147068efbc&groupId=10113 [hereinafter "Application, Vol. 3"].

prior to submitting its application, contrary to Chapter 852 of the Wisconsin Administrative Code.[48] For this reason alone, DNR may not approve the proposed diversion.

In addition, Waukesha has not implemented CEMs slated for implementation by this time. DNR cannot find that the city has complied with this criterion by citing CEMs that the city has not yet implemented. By the end of 2014, the city was supposed to have implemented three rebate programs:[49] high efficiency toilet ("HET") replacement for commercial and industrial users; a showerhead rebate; and a pre-rinse spray rinse valve rebate. Waukesha estimated these three rebate programs together would save 5.5 million gallons of water from 2012-2016.[50]

(1) High Efficiency Toilet (HET) replacement for commercial and industrial users (2012 target date; not implemented to date)

Waukesha did not pursue HET replacement for commercial and industrial users. The city explained that this failure is "due to the uncertainties surrounding the drain line transport issues in commercial buildings, many commercial/industrial and public accounts are unable to install the 1.28 gpf toilets."[51] However, a 2012 study by the Plumbing Efficiency Research Coalition, "The Drainline Transport of Solid Waste in Buildings," found no problems with transport issues in 1.28 gpf toilets.[52] The study also found that "Toilet hydraulics (percent trailing water and flush rate) were found to be non-significant variables. As such, the effect that toilet fixture designs have on drain line transport in long building drains has been found to be minimal."[53]

In Waukesha's WCP, the city estimated savings from HET Replacement for Commercial and Industrial customers of 0.41 million gallons from 2012-2016.[54]

(2) Showerhead rebate (2012 target date; not implemented to date)

As noted in the WCP, "Showering accounts for about 17 percent of indoor water use. … It is estimated that the average household could save 2,300 hundred [sic] gallons per year by replacing old showerheads with a WaterSense-certified showerhead. Residents would also save energy to heat water." [55]

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[48] See note 35, *supra*.
[49] Rebates play an important role in encouraging consumers to switch from low to high efficiency products, and they can be structured to ensure a high cost-benefit ratio. The WCP identified rebates and other financial incentives as a key element, "especially for commercial and industrial customers." Application, Vol. 3, at VI.
[50] *Id.*.
[51] Waukesha Water Utility, "Annual Report of Waukesha Water Utility," April 1, 2014, p. 11.
[52] "Drainline Transport of Solid Waste in Buildings," Plumbing Efficiency Research Coalition, November, 2012, http://www.plumbingefficiencyresearchcoalition.org/projects/drainline-transport-of-solid-waste-in-buildings/.
[53] *Id.* at 45.
[54] Application, Vol. 3, at VII.
[55] *Id.*. at 1-3.

In its WCP, Waukesha estimated savings from high efficiency residential showerheads of 0.88 million gallons; on the non-residential side, Waukesha estimated 0.04 million gallons savings from 2012-2016. [56]

(3) Pre-Rinse Spray Rinse Valve rebate (2013 target date; not implemented to date)

As noted in the WCP, "The Food Service Technology Center estimates that certified pre-rinse spray models can save approximately 60 gallons of water (and wastewater) for every hour used."[57] In its WCP, Waukesha estimated savings from spray-rinse valve replacements of 4.24 million gallons from 2012-2016.[58]

(4) Residential Toilet rebate (2012-2104 implementation far short of plan levels)

The most significant water savings (7.33 million gallons from 2012-2016) for any rebate in the WCP were attributed to the residential toilet rebate, but Waukesha has failed to meet the plan's goals. At $100 per toilet, the plan projected rebates of 512 toilets during 2012 through 2014.[59] However, the actual number of units rebated by the city was 276, barely half the amount called for in the plan.[60]

(5) Other conservation program elements not implemented

In addition to Waukesha's failure to implement these three CEMs, the city has failed to implement a rebate program for high-efficiency washing machines that it was supposed to initiate in 2014.[61] Nor has the city implemented a rebate program targeted for implementation by 2015 for urinals in public, commercial, and industrial buildings (0.28 million gallons projected savings from 2012-2016). [62]

Waukesha has also not implemented other programs outlined in its WCP. For example, Waukesha has largely not begun to implement programs to reduce commercial and industrial water use. Waukesha's WCP found that, for commercial users, the highest volume of "commercial accounts use a disproportionate volume of water, with the top 1 percent of accounts using 29 percent of commercial water demand." [63] These accounts include hospitals and medical and senior care centers.[64] In addition, the WCP found moderately high (twenty-nine percent)

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[56] *Id.*. at VII.
[57] *Id.*. at 2-6.
[58] *Id.*. at VII.
[59] *Id.* at VIII, Table ES-3.
[60] See Annual Report of Waukesha Water Utility to the Wisconsin Public Service Commission, 2012, 2013, 2014, at Copy 1 of p. w-27.
[61] *Id.*. at Table F-2.
[62] *Id.*. at VII.
[63] *Id.*. at 4-16.
[64] *Id.*

seasonal/outdoor demands, with the top ten percent of accounts using sixty-nine percent of commercial water demand.[65]

Presumably because of these findings, Waukesha identified the need to develop a plan to increase water conservation by the top one percent of commercial and industrial users in 2012, but this plan has not been developed.[66] The potential for such a plan to reduce water (and energy) use is significant. For example, U.S. hospitals use an average of 570 gallons of water per staffed bed, per day.[67] A study by the U.S. Department of Energy found that hospitals could realize "significant savings by upgrading toilet, shower, and faucet technologies."[68]

Both in 2013 and 2014, Waukesha spent far less on CEMs than it had estimated it would spend because it did not implement key CEMs. In 2013, estimated costs were $141,700; actual costs were $68,599.[69] In 2014, estimated costs were $167,900; actual costs were $66,943.[70]

c) Waukesha failed to show that the other communities included in its application for a diversion implemented conservation and efficiency measures

Waukesha's WCP covers only Waukesha's current service territory. It does not include CEMs that must be implemented by surrounding communities. In fact, Waukesha has no authority to require surrounding communities to implement CEMs or to implement CEMs for those communities.[71]

Nothing in the record indicates that the Town of Waukesha, Town of Delafield, Town of Genesee, or City of Pewaukee adopted or implemented CEMs prior to Waukesha's submission of its application for a diversion. Thus, because Waukesha has not fully implemented CEMs prior to the city's submission of the application, and none of the other communities have implemented any CEMs, DNR cannot approve the proposed diversion.

V. WAUKESHA HAS NOT SHOWN THAT THERE ARE NO REASONABLE ALTERNATIVES TO THE PROPOSED DIVERSION, AS REQUIRED BY THE COMPACT'S STANDARD OF REVIEW AND DECISION AND WISCONSIN LAW (DNR Water Supply Related Criterion S2)

Waukesha's proposal fails to satisfy a key criterion of the Compact, which conditions the approval of a diversion to a community within a straddling county on an applicant's demonstration that "[t]here is no reasonable water supply alternative within the basin in which

[65] *Id.*
[66] *Id.*. at 8-8.
[67] U.S. Department of Energy, "Hospitals Save Costs with Water Efficiency," July, 2011, p. 2, http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/hea_water_efficiency_fs.pdf.
[68] U.S. Department of Energy, p. 2.
[69] Waukesha Water Utility, "Public Service Commission of Wisconsin Report on Water Conservation Programs," April 1, 2014, p. 2.
[70] Waukesha Water Utility, "Annual Report of Waukesha Water Utility," December 31, 2014, Copy 1 of Page W-27.
[71] *See* Wis. Admin. Code § NR 852.05(5).

the community is located, including conservation of existing water supplies."[72] To satisfy this criterion, Waukesha must show that it has fully evaluated all viable alternatives to a diversion and shown that none of them is reasonable. To date, neither Waukesha nor DNR has demonstrated the requisite evaluation of alternatives or shown that no alternative is reasonable; to the contrary, their respective analyses ignore reasonable water supply alternatives.

A full consideration of reasonable alternatives is required by the Compact, Wisconsin's legislation implementing the Compact, and the Wisconsin Environmental Policy Act ("WEPA").[73] Nevertheless, despite the CIC's repeated urging,[74] DNR for years has declined to consider water demands and potential impacts attributable to a ***smaller*** water supply service area than the one proposed by the city, specifically, Waukesha's ***existing*** water supply service area. Instead, DNR has limited its alternatives analysis to the city's proposed expanded water supply service area plan, which projects greater water demand and a heightened risk of adverse environmental impacts.

Waukesha and DNR can no longer limit their consideration and analysis of alternatives in the face of new and compelling data and modeling already in DNR's possession. During DNR's Summer 2015 public comment period, the CIC provided DNR with the following memos and report, which compile the data, modeling, research, and opinions of independent engineers and technical experts retained to examine reasonable water supply alternatives for the City of Waukesha:

- GZA GeoEnvironmental, Inc.'s, Memo to Clean Wisconsin and Milwaukee Riverkeeper, dated July 9, 2015 (Attached hereto in Appendix tab 6);
- Mead & Hunt, Inc.'s, memo to Clean Wisconsin, dated July 7, 2015 (Appendix tab 6); and
- Mead & Hunt, Inc.'s, report to Clean Wisconsin, dated April 6, 2015 (Appendix tab 7).

These reports are included in the attached appendix and incorporated here by this reference.

This information demonstrates the reasonableness of a non-diversion alternative, or set of alternatives, available to meet the city of Waukesha's future water needs. The Compact, Wisconsin's implementing statute, and WEPA all require DNR to consider and document its evaluation of these alternatives as part of its Environmental Impact Statement ("EIS") and Technical Review.

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72 Compact, art. 4, § 4.9.3.d. *See also* Wis. Stat. § 281.346(4)(e)1.d.

[73] As further detailed in Section IX below, DNR's failure to consider reasonable alternatives to the diversion sought by Waukesha renders the agency's draft Environmental Impact Statement and draft Technical Review fatally flawed under federal and state law and non-compliant with the Compact.

[74] For example, on December 2, 2013 (Appendix tab 4), the CIC commented to WDNR as follows: "One set of alternatives that Waukesha has not considered are those based on diverting a smaller amount of water than requested in their application. For example, they did not conduct analyses of the amount of water needed to supply only its *current* service area in future scenarios including aggressive conservation and/or peak demand reduction practices." In an April 28, 2015 CIC letter to DNR (Appendix tab 5), the CIC again urged DNR to broaden its consideration of the available alternatives as part of the process leading up to the release of the draft EIS and Technical Review, to no avail.

The July 9, 2015, memo, in particular, provides a wealth of new, significant information that substantiates the viability of a Non-Diversion Solution that meets the "reasonable water supply alternative" definition both under Wisconsin law[75] and the Compact's parallel provision.[76] The Non-Diversion Solution, in brief, accounts for the city of Waukesha's own forecasted water demand through 2050 and anticipated buildout for its current water supply service area, without any new environmental impacts or public health problems, and at a significantly reduced cost compared with the city's diversion proposal. [77] The Non-Diversion Solution, described in the attached memos and report, accomplishes this by relying on (1) Waukesha's existing deep and shallow aquifer wells, and (2) modest investments in additional treatment and well infrastructure to facilitate blending outside of the distribution system compliant with state and federal drinking water quality standards.

As amplified in the memos and report, as well as other communications with DNR, the Non-Diversion Solution represents a reasonable alternative that inarguably necessitates agency consideration and analysis before finalizing the draft EIS and draft Technical Review. WEPA considerations aside,[78] because the Non-Diversion Solution demonstrates that a reasonable water supply alternative ***does*** exist in the basin in which the City of Waukesha is located, the city has failed to meet a critical Compact requirement and, accordingly, its application for a diversion of Great Lakes water must be denied.

VI. WAUKESHA HAS NOT SHOWN THAT THE PROPOSED DIVERSION WILL BE IMPLEMENTED TO INCORPORATE WATER CONSERVATION MEASURES, AS REQUIRED BY THE COMPACT'S STANDARD OF REVIEW AND DECISION AND WISCONSIN LAW (DNR Water Conservation Related Criterion C2)

Waukesha's application fails to show that either the current or projected future water demands for itself or the surrounding communities include the conservation measures required by the Compact and Wisconsin law. Both the Compact and Wisconsin's statute implementing the Compact require water conservation measures to minimize withdrawals or consumptive use.[79] Waukesha's 2012 WCP fails to satisfy this criterion in a number of ways, including its failure to

[75] Wis. Stats. §281.346 (4)(e)1.d.
[76] Compact, art. 4, § 4.9.3.d.
[77] Letter from Jiangeng (Jim) Cai, P.E., *et al.*, GZA GeoEnvironemntal, Inc., to Ezra Meyer, Clean Wisconsin, *et al.* at 1-2 (Jul. 9, 2015) (Appendix tab 6) ("[A] 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 … 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 engineering cost analyses … 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.").
[78] DNR's failure to examine the Non-Diversion Solution or other reasonable alternatives based on a water supply service smaller or different than the one proposed by the city of Waukesha makes the agency's draft EIS inadequate. *Oregon Natural Desert Ass'n v. Bureau of Land Management*, 625 F.3d 1092, 1100 (9th Cir. 2008) ("the existence of a viable but unexamined alternative renders an environmental impact statement inadequate").
[79] Compact, art. 4, § 4.9.4.e; Wis. Stat. § 281.346(4)(f)6.

implement measures to reduce peak demand, its failure to incorporate local and national declining water use trends in its conservation goals, and its reliance on voluntary and educational measures, and its minimal and highly attenuated program goal.

The 2009 Radium Stipulation and Order directs Waukesha to minimize the use of non-compliant wells.[80] Since then, such wells have only been used during summer peak demand (and as back-up for equipment failures at compliant wells). However, the WCP's goal is to make modest reductions, at best, in average-day demand over a 35-year time-frame.[81] Measures to address peak demand are either undefined or not implemented.

For example, the WCP notes that "The top 50 percent of accounts have high outdoor/seasonal usage (approximately 47 percent of the total gpcd is seasonal use)."[82] And yet, none of the measures identified in the 2012-2016 timeframe to address this outdoor/seasonal usage have been implemented, including "conducting onsite irrigation audits for large users"[83] (which was supposed to be implemented in 2013) and "identifying top 1 to 5 parks with high outdoor water use and estimate retrofit costs"[84] (which was supposed to be implemented in 2014).

Waukesha's conservation goals of "reducing average day demand by 0.5 mgd by year 2030 and by 1.0 mgd by year 2050"[85] representing roughly one-quarter of one percent in additional annual water savings each year are insubstantial and fail to incorporate the reality of local and national declining water use trends.

Since 1999, Waukesha has seen a general decline in water use,[86] which is consistent with national trends. A recent peer-reviewed study in *Journal AWWA* reported a significant nationwide decline in residential water use over the last 30 years; a typical single-family household in 2008 used 11,678 gallons *less* water annually (*i.e.*, 32 gallons less per day) than an identical household did in 1978. The study identified the installation of water-efficient indoor appliances and fixtures – such as those meeting standards set by the 1992 Energy Policy Act – as the predominant factor explaining this decrease.[87]

This trend is likely to continue for years, if not decades, to come. As inefficient fixtures and appliances currently in use are replaced over time, further reductions can be expected. For example, in single-family homes, nearly twenty percent of all the water used indoors is for washing clothes. As of 2011, water-efficient Energy Star labeled clothes washers achieved more than sixty percent of new washer sales. A washer meeting these new specifications will use about half as much water as the typical top loader it will replace. When new regulatory standards for clothes washers take full effect in 2018, all new washers will meet or exceed today's Energy Star efficiency levels. Moreover, as of 2011, toilets that meet EPA's voluntary

[80] State of Wisconsin, "Stipulation and Order for Judgment," Circuit Court Branch 1, Waukesha County, Case No. 2009-CX-4, p. 5.
[81] Application, Vol. 3, at 2-1.
[82] *Id.* at 4-18.
[83] *Id.* at XI.
[84] *Id.* at 8-7.
[85] *Id.* at 2-1.
[86] *Id.* at 4-6.
[87] Rockaway, et al. 2011. "Residential water use trends in North America." *Journal AWWA*. Vol. 103, Issue 2.

WaterSense efficiency standards comprised the majority of sales for tank-type toilets. Lastly, the bodies that write model building codes for state adoption have added new provisions to their 2015 model codes that would further decrease indoor water usage, including insulation requirements for hot water distribution piping.[88] The cumulative effect of these changes is that, as existing fixtures and appliances are replaced over the years and decades ahead, existing trends in decreased indoor water use can be expected to continue, or even accelerate.[89]

Waukesha's conservation goals also significantly underestimate potential savings when compared to other cities and utilities. The U.S. EPA looked at the water conservation efforts of seventeen water systems, ranging in size from small to very large. Their efficiency programs incorporate a wide range of techniques for achieving various water management goals, some of which are summarized below.

U.S. EPA Water Conservation Case Studies		
City/Utility	**Approach**	**Results**
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	Projected 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 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.
Massachusetts Water Resources Authority (MWRA)	Leak detection and repair, plumbing retrofits, water management program, education program, and meter improvements.	Average daily water demand from 336 mgd (1987) to 256 mgd (1997). MWRA deferred a water-supply expansion project and reduce the capacity of the treatment plant, resulting in total savings from $1.39 million to $1.91 million per mgd.

[88] Ed Osann, "Waiting for Hot Water." Natural Resources Defense Council, January 22, 2014, http://switchboard.nrdc.org/blogs/eosann/waiting_for_hot_water.html; and Ed Osann, "Our Web Poll results: Waiting for hot water is the real national pastime," April 24, 2014, http://switchboard.nrdc.org/blogs/eosann/our_web_poll_results_show_that.html#comment49649.

[89] Lee, *et al*, "Urban Sustainability Incentives for Residential Water Conservation: Adoption of Multiple High Efficiency Appliances," *Water Resources Management* 27(7): 2531-2540.

Waukesha is seemingly content with voluntary and educational programs for its commercial and industrial sector, despite the evidence of the effectiveness of mandatory programs.

Waukesha has introduced two mandatory programs, a sprinkling ordinance and residential inclining water rates; both significantly reduced water usage. In 2006, Waukesha introduced an outdoor sprinkling ordinance that restricts summer usage; the city estimates an eighteen to twenty-eight percent reduction in summer watering from 2005 to 2010.[90] Waukesha introduced conservation water rates for residential customers in 2007;[91] since implementation of these conservation rates, also known as an inclining water rate block structure, residential water use has decreased.[92]

However, commercial, industrial and public rates are structured with declining blocks, meaning that as more water is used, the cost per unit of water is reduced, which tends to promote consumption. Despite the fact that price incentives are a proven conservation strategy and have been shown to significantly reduce water use, Waukesha reports that"…the Utility uses "efforts, other than the rate structure, to incent conservation."[93] Unfortunately, those "other efforts," apart from the sprinkling ordinance, which applies to all classes of users, are all focused on education and outreach.

The City ignores the potential for water reuse, pushing the development of a water reuse demonstration project to 2040. Water reuse is an increasingly common conservation strategy. Water recycling (or wastewater reuse) is the beneficial use of wastewater from a treatment plant or after another use.

Gray water is defined as "untreated wastewater which has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and which does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes."[94] Gray water includes wastewater from bathtubs, showers, bathroom washbasins, clothes washers, and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers. One study estimated that a typical home with older fixtures could generate 35,000 gallons (132.5 m3) of graywater per year while a newer more efficient home could generate 25,000 gallons (94.6 m3) of graywater per year.[95] The City of Austin, Texas, estimates that a 2.6 person household, with all available fixtures connected, could save forty to ninety gallons per household per day.[96] To encourage the use of graywater systems, the City of San

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[90] *See* City of Waukesha, *Application Summary, City of Waukesha Application for a Lake Michigan Diversion with Return Flow, Volume 1* (October 2013) , at 5-7, *available at* http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=a972a2e4-d45b-4748-9948-17c0ce17b692&groupId=10113 [hereinafter "Application, Vol. 1"].
[91] *Id.*
[92] Application, Vol. 3, at 4-1.
[93] Waukesha Water Utility, "Report on Water Conservation Programs," March 1, 2015, p. 12.
[94] California Water Code Section 14876, *available at* http://law.onecle.com/california/water/14876.html.
[95] Alliance for Water Efficiency, "Graywater Introduction," *available at* http://www.allianceforwaterefficiency.org/graywater-introduction.aspx.
[96] Austin Water, "Residential Gray Water Collection & Use in Austin, Texas," undated, http://www.austintexas.gov/sites/default/files/files/Water/Conservation/Gray_Water_FAQ_09-09-2013.pdf.

Francisco offers a grant program, called Laundry-to-Landscape and a rebate program for residential graywater permits.[97] It has also developed a Graywater Design Manual for Outdoor Irrigation, which provides homeowners with a step-by-step process to install a graywater system.[98]

Waukesha also ignores the use of green infrastructure as a water reuse and conservation strategy. Green infrastructure refers to the use of more natural systems, such as wetlands, street trees, and other types of vegetation to store and treat stormwater instead of the "hard infrastructure" that is traditionally used, such as pipes, pumps, and storage tunnels.[99] Green infrastructure is one of the core elements identified by USEPA in its "Planning for Sustainability: A Handbook for Water and Wastewater Utilities."[100]

Finally, inefficient irrigation practices can cause observed water loss of twenty to fifty percent of outdoor water use. The WCP contemplates a number of programs to improve the efficiency of irrigation systems, including the distribution of rain gauges or sensors to high water users with large lots or high peak seasonal use; providing an irrigation technology or sprinkler head replacement rebate; or the requirement of annual irrigation inspections for customers with large irrigated areas; or rebates for commercial and industrial customers to capture condensate and reuse it for non-potable purposes such as landscape irrigation.[101] However, none of these programs are included in the 2012-2016 WCP.

VII. WAUKESHA HAS NOT SHOWN THAT THE PROPOSED DIVERSION MEETS THE RETURN FLOW PROVISIONS REQUIRED BY THE COMPACT'S STANDARD OF REVIEW AND DECISION AND WISCONSIN LAW (DNR Wastewater Return Flow to the Great Lakes Basin Related Criteria R1-R5)

The Compact and Wisconsin law condition the approval of a diversion to a community within a straddling county on an applicant's demonstration that its proposal meets several criteria related to the return flow of wastewater to the Great Lakes Basin. Generally, the applicant must demonstrate that:

- the proposal maximizes the basin water returned to the basin and minimizes return flow water coming from outside the basin;
- all withdrawn water will be returned to the Basin, less an allowance for consumptive use. No water from outside the basin may be used to satisfy this requirement, except under limited circumstances;
- the return location is as close as practicable to the place where the water is withdrawn;

[97] San Francisco Water Power Sewer, "Graywater," *available at* http://sfwater.org/index.aspx?page=100.
[98] City of San Francisco, "San Francisco Graywater Design Manual," June 2012, *available at* http://sfwater.org/modules/showdocument.aspx?documentid=55.
[99] *See, generally*. U.S. Environmental Protection Agency, "Green Infrastructure," *available at* http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm#tabs-2.
[100] U.S. Environmental Protection Agency, "Planning for Sustainability: A Handbook for Water and Wastewater Utilities," February, 2012, p. 5, *available at* http://water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf.
[101] Application, Vol. 3, see Section 7.

- if the water is returned to a Great Lake through a tributary, the physical, chemical, and biological integrity of the receiving water must be protected and sustained; and
- the return flow will not cause any significant individual or cumulative adverse impacts to the quantity or quality of the waters of the basin.[102]

DNR has preliminarily determined that Waukesha's return flow proposal meets all of the above criteria. However, this preliminary determination is erroneous for several reasons. Neither DNR nor Waukesha has demonstrated that the water quality of the Root River will be protected. There are still significant issues related to the permitting of Waukesha's return flow that need to be resolved before DNR can adequately evaluate the environmental impacts of the discharge. Moreover, many of DNR's findings in the draft Technical Review are not supported by the record. Until DNR conducts a fully informed analysis, there is no way for the agency or the public to determine whether Waukesha's return flow proposal meets the requirements of the Compact and State law.

A. Waukesha Has Not Demonstrated That The Return Flow Will Protect And Sustain The Integrity Of The Root River And Will Not Cause Significant Adverse Impacts To The River

DNR has preliminarily determined that the "physical, chemical and biological integrity" of the Root River will be protected and sustained as required under Wis. Stat. §§ 30.12, 281.15, and 283.31, *so long as* Waukesha meets future permit requirements under Wis. Stat. §§ 30.12, 281.15, and 283.31.

This determination is both legally and factually premature. As explained above, Wisconsin's statute does not allow a demonstration of compliance with water quality standards to be deferred. Instead, it expressly makes the issuance of a WPDES permit a prerequisite to approval of a diversion.[103]

Because DNR has not issued the permit as state law requires, the agency has not actually established what the final requirements will be. This limits DNR's ability to assess the environmental impact of Waukesha's discharge. In addition, Waukesha has not shown it is feasible to meet several of the "draft" requirements outlined the DNR's draft Technical Review.

1. DNR cannot adequately assess the impacts of Waukesha's return flow on the Root River without finalizing the various wastewater discharge requirements that will apply to Waukesha's discharge

[102] Compact, art. 4, §§ 4.9.3.b., 4.9.4.c.; Wis. Stat. §§ 281.346(4)(e)1.c, 281.346(4)(f)3. & 4.
[103] Wis. Stat. §§ 281.346(4)(e)1.b. (DNR may approve a new diversion if "all the following apply: … The proposal meets the exception standard under par. (f).") *and* 281.346(4)(f)4.b. ("A proposal meets the exception standard if all of the following apply: … No water from outside the Great Lakes basin will be returned to the source watershed unless … The returned water will be treated to meet applicable permit requirements under s. 283.31 … and the department has *approved* the permit under s. 283.31.") (emphasis added).

The draft Technical Review and corresponding environmental analyses of Waukesha's return flow proposal are largely based on "draft" effluent limits and several "recommended" approaches that DNR may or may not ultimately incorporate into a final WPDES permit for the Waukesha wastewater treatment plant ("WWTP").[104] The issuance of a WPDES permit is an iterative process that often results in changes to draft limits and initial recommendations in response to new information, public input, comments from the applicant, and in some cases, court orders. Without going through the permit issuance process, DNR cannot reasonably evaluate the impact of the proposed return flow discharge on the Root River, nor can it adequately determine whether the proposal meets the requirements of the Great Lakes Compact and Wisconsin law. Thus, Wisconsin law requires the issuance of a WPDES permit prior to approval of a proposed diversion for good reason.

Of particular importance, the City of Waukesha has already called into question the DNR's determination that Waukesha would be a "new discharger" to the Root River.[105] Whether or not Waukesha meets the regulatory definition of a new discharger is of central importance to both the WPDES permitting process and DNR's review of Waukesha's diversion application. Several of the draft effluent limits referred to in the draft Technical Review, as well as the requirement that the return flow discharge comply with Wisconsin's antidegredation procedures, are premised on the fact that Waukesha's return flow would constitute a new discharge.[106] The final WPDES permit for the Waukesha WWTP, and accordingly, DNR's evaluation of the environmental impacts of the return flow, would look dramatically different if this finding were reversed.

There are several other permitting issues that require further attention before DNR forwards its determination for Regional review, including those that follow.

a) DNR must clarify what the return flow discharge will look like on a daily basis

Waukesha has changed its preferred return flow alternative to a new alternative first presented in January 2015.[107] Under this new alternative, referred to as Alternative 6, Waukesha plans to return an amount of water on a daily basis that is equal to the previous year's average daily withdrawal.[108] According to DNR staff, the return flow range listed by the applicant for Alternative 6 is an estimate that is based on several assumptions about the loss and gain of water into Waukesha's distribution system that may or may not reflect actual conditions.[109] For example, Waukesha's estimated return flow range assumes that fourteen percent of the diverted

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[104] *See generally* Technical Review at 75-91.
[105] *See* Draft Memorandum, Antidegradation Evaluation for the City of Waukesha Application for a Lake Michigan Water Diversion with Return Flow, CH2MHILL, May 25, 2015 (stating that "it could be argued that the return flow does not meet" Wisconsin's definition of a new discharge).
[106] *See, e.g.*, Draft Technical Review, pp. 78, 83-84.
[107] Waukesha Water Utility, Revised Exhibit 3, January 6, 2015, *available at* http://dnr.wi.gov/topic/waterUse/documents/waukesha/2015-01-06ReturnFlowExhibit3Rev3.pdf) (last visited Aug. 20, 2015).
[108] *Id.* at 3.
[109] Telephone Call between Nicki Clayton, Water Supply Specialist, WDNR, and Helen Sarakinos, River Alliance of Wisconsin, August 11, 2015.

water will be lost from the distribution system due to consumptive uses, and that inflow and infiltration will contribute an amount of water into the system that is close to ten percent of the diverted water.[110]

The actual amount of water that the distribution system will lose and gain will vary by season, and will further be impacted by climate and other external factors. While the applicant estimates a 96-100% return of diverted water, ***actual*** percentages may vary considerably. Furthermore, neither the draft Technical Review nor the draft EIS specify what the return flow will look like on a daily basis. Will the water be returned as a continual flow, or will the rate of flow fluctuate daily?

b) DNR must clarify the final phosphorus effluent limits that will apply to Waukesha's discharge

Because Waukesha will be a new discharger of phosphorus to an already impaired waterway, DNR has determined that it must impose phosphorus effluent limits that are "well below" the phosphorus water quality criteria at the point of Waukesha's proposed discharge.[111] DNR has not, however, actually established a final phosphorus effluent limit. Instead, DNR has identified a potential range of limits that Waukesha may be required to meet: 0.03-0.069 mg/L.[112] There is a dramatic difference in both treatment costs and phosphorus loading from this range of potential effluent limits.[113] DNR should establish the final limit now, so that it can fully evaluate the impact of Waukesha's discharge on the Root River.

c) The draft Technical Review must clarify how the TSS limits were calculated

The draft Technical Review indicates that Waukesha will likely be required to meet a total suspended solids ("TSS") limit of 5 mg/l for summer months and 10 mg/l limits for winter months, but fails to provide any information about how DNR arrived at these limits.[114] The Root River is listed as impaired for TSS at the point of Waukesha's proposed discharge.[115] Given this, DNR should include more analysis or explanation of whether this new discharge complies with Clean Water Act requirements for new discharges of a listed pollutant into an already-impaired waterway.

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[110] *Id.*

[111] Draft Technical Review, p. 78.

[112] *Id.*

[113] Cheryl Nenn. Ms. Nenn has a M.S. of Natural Resources and Environment from the University of Michigan. Ms. Nenn consulted on environmental projects for the U.S. Forest Service and Wisconsin DOT wetland mitigation sites; provided forestry and wildlife management planning for private landowners for the Michigan DNR and Department of Agriculture; and helped manage forest restoration, reforestation, and erosion control projects for the City of New York, Department of Parks and Recreation. Milwaukee Riverkeeper, http://milwaukeeriverkeeper.org/about/. Ms. Nenn serves on the Technical Advisory Committees for the Southeastern Wisconsin Regional Planning Commission's ("SEWRPC's") Regional Water Quality Management Plan and the Milwaukee River Estuary Area of Concern Remedial Action Plan.

[114] Draft Technical Review, p. 80.

[115] *Id.*

Without addressing these issues, it is not possible for DNR to assess the true environmental impact of Waukesha's return flow on the Root River, and thus, DNR cannot determine whether the Waukesha's proposal meets the requirements of the Great Lakes Compact and Wisconsin state law.

d) DNR must clarify that Waukesha will be required to demonstrate that it can meet all of its final effluent limitations prior to discharging to the Root River

DNR's evaluation of impacts to the Root River is based on the assumption that Waukesha will meet all of its final effluent limits upon permit issuance. The Draft Technical Review, however, does not clearly establish that Waukesha will be required to demonstrate that it can meet the final effluent limits for *all* water quality parameters prior to discharging to the Root River.

For example, the Waukesha WWTP currently has a variance for chloride. The draft Technical Review intimates that Waukesha will need to implement its existing compliance plan to meet the chloride effluent limits for a discharge to the Root River.[116] It is not clear, however, whether or not Waukesha will actually need to achieve its chloride limits prior to discharging to the Root River or whether it may be eligible for another variance.

With respect to temperature, Waukesha has not shown it can reliably meet the proposed effluent limits for the months of October to January. Based on Waukesha's own preliminary analysis, DNR concludes that the WWTP is likely to exceed the proposed temperature effluent limits during those months.[117] The draft technical review states that this will need further attention before a new permit to discharge can be met.[118] DNR must clarify that Waukesha will not be eligible for a compliance schedule to meet its temperature limits.

2. Waukesha has not shown that it is feasible to meet the "draft" effluent limitations prior to discharging to the Root River

Much of DNR's analysis of the impact of Waukesha's return flow on the Root River is premised on the assumption that the Waukesha wastewater treatment plant will be able to meet its effluent limits immediately upon discharging. At least with respect to two pollutants, phosphorus and chlorides, neither DNR nor Waukesha has shown that it is feasible to achieve the proposed effluent limits.

DNR bases its finding that it is feasible for Waukesha to meet a phosphorus effluent limit in the range of 0.03 mg/L to 0.069 mg/L on "several documented studies that illustrate treatment options to meet low phosphorus concentrations are available."[119] The studies that DNR references, of which there are three, do not entirely support the DNR's conclusion. In one case, only five of the sixteen facilities that were evaluated could meet the effluent limits that may

[116] *Id.* at 82-83.
[117] *Id.* at 78.
[118] *Id.*
[119] *Id.* at 79.

apply to Waukesha's return flow.[120] Moreover, the authors of one of the other studies caution against using the information from the study to draw conclusions about the ability to meet the effluent limits over the long-term:

> "It has been demonstrated that the Blue PRO process can achieve monthly average effluent total phosphorus levels as low as 0.009 mg/L to 0.036 mg/L in certain plants. *However, further full scale data is needed to determine how consistently these levels could be achieved and assess the ability of this and other competing technologies to address fluctuations in influent phosphorus flow and loading due to diurnal or seasonal conditions.*"[121]

Similarly, Waukesha's evaluation of its own facilities calls into question whether it is feasible to consistently meet such stringent effluent limitations. As DNR notes in the draft Technical Review, Waukesha recently completed a Phosphorus Operational Report demonstrating that the facility was able to achieve a phosphorus concentration of 0.03 mg/L to 0.05 mg/L over a 3-month period.[122] The DNR omits the ultimate finding of the report, however, which is that achieving an effluent concentration limit for phosphorus of ***0.075 mg/L*** "represents a very challenging level for wastewater facilities to meet with current technology and operation."[123] Waukesha's report goes on to state that "even with source reduction and treatment optimization, the City of Waukesha treatment system is insufficient to consistently meet [a limit of 0.075 mg/L]," and therefore indicates that the facility needs an additional six years to explore and implement alternatives before it can come into compliance with the 0.075 mg/L limit.[124]

With respect to chlorides, Waukesha acknowledged that in order to meet its new limit it would have to reduce chloride loading from both residential and industrial/commercial customers by at least sixty percent.[125] The EIS claims that lake water is less hard, so the need for salt would be decreased dramatically.[126] However, it is unclear whether residents will get off their softeners or whether the chloride reductions are achievable.

B. Waukesha Has Failed To Demonstrate That There Will Not Be Any Significant Adverse Impacts To The Water Quality Of The Root River

DNR has preliminarily determined that the return flow will not have any significant impacts to the water quality of the Root River. This finding is not supported by the data or the city or DNR's analysis, and is in direct contrast to DNR's own statements in the draft Technical Review and Draft EIS.

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[120] *See Advanced Wastewater Treatment to Achieve Low Concentration of Phosphorus,* EPA 910-R-07-002, April 2007.
[121] *See Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Management*, EPA 832-R-011, March 2013, at 2-6.
[122] Draft Technical Review, p. 79.
[123] City of Waukesha WWTP Phosphorus Operational Evaluation Report, Strand and Associates, June 2014, p. 1.
[124] *Id.*
[125] Application Vol. 4, at Appendix A, Facility Plan Amendment—City of Waukesha Wastewater Treatment Plant Improvements for Returning Water Withdrawn from Lake Michigan.
[126] Draft Technical Review, pp. 82-83.

DNR's ultimate conclusion is that "the Department expects minimal, if any, impacts from the return flow to the water quality of the Root River."[127] However, in several instances the draft EIS concludes that the return flow ***will*** likely have negative impacts on the water quality and aquatic life of the Root River, as follows:

- "The addition of phosphorus loading to the Root River from the return flow may increase the planktonic algal, periphyton and aquatic plant communities in the river and estuary. An increase in the communities could increase the range of diurnal dissolved oxygen swings within portions of the Root River wherever the biological community is utilizing the increased phosphorus. Turbidity increases due to planktonic algae growth may also occur."[128]
- "[T]otal [phosphorus] loading effects to the biological community may be seen further downstream in the Root River and in the Root River estuary."[129]
- "There could be potential impacts to the Root River with the proposed return flow due to an increased toxicity risk to the biota resulting from the current elevated chlorides levels in the Root River combined with the additional chloride loading from the Applicant's return flow effluent."[130]
- "The addition of chlorides, and possibly pharmaceuticals, could have a negative effect on the Root River fishery and estuary."[131]
- "Chlorides contained in the proposed discharge would likely have a negative effect on the fish community of the Root River. Current chloride levels in the Root River exceed both chronic and acute toxicity. Adding effluent flow from Waukesha could exacerbate chloride issues in the Root River, resulting in a negative effect on the fish community."[132]
- "In addition, some pharmaceuticals are known to pass through wastewater treatment plants. Accordingly, there is a risk of pharmaceuticals exposure to resident fish within the Root River. Pharmaceutical exposure from treated effluent have been shown to alter sex ratios in some fish species."[133]

DNR never explains how it determined that these expected adverse impacts are or are not significant. In short, the finding is completely unsupported.

Beyond the inconsistencies identified above, there are several other areas where the DNR's conclusions are either unsupported or specifically contradicted by the information in the record. Those areas are discussed in more detail below.

[127] *Id.* at 95.
[128] Draft EIS, p. 166.
[129] *Id.*
[130] *Id.* at 167.
[131] *Id.* at 168.
[132] *Id.* at 170.
[133] *Id.*

1. Phosphorus and TSS

Both DNR and EPA agree that the Waukesha's return flow discharge could result in a "significant lowering of water quality" for some pollutants, namely phosphorus and TSS.[134] This is in direct contrast to the DNR's finding in the draft Technical Review that Waukesha's proposal will not cause any significant individual or cumulative impacts to the water quality of the State.

DNR implies that this potential lowering of water quality is permissible because "the Applicant proposes a new discharge in order to correct a public health problem i.e. radium in its current drinking water supply).[135] This justification, however, is not consistent with the Compact's requirements. Although there is an exception to the prohibition of significantly lowering the water quality of waters under Wisconsin's antidegredation rules,[136] there is no such exception in the Compact. The Compact plainly and unequivocally requires Waukesha to demonstrate that its return flow will not result in "any significant individual or cumulative adverse impacts to the water quantity or quality of the Waters or Water Dependent Natural Resources of the Basin" – without exception.[137]

2. Habitat

Waukesha claimed that the return flow will benefit the fishery in the Root River and the Great Lakes and will not adversely impact the geomorphic stability of the river.[138] These claims are flawed because they are not based on site-specific analyses of impacts downstream of the proposed return flow outfall. Waukesha did not evaluate the impacts of return flow on in-stream habitat in the Root River by analyzing the river itself. Rather, Waukesha based its evaluation of these impacts primarily on desktop analyses.

In Appendix K to Volume 4 of Waukesha's application, the city evaluated the flow change at only two spots on the Root River: the proposed return flow outfall and a location about 150 feet downstream of the Root River Steelhead Facility.[139] In the Technical Review, DNR used the same two monitoring locations. Data from these two monitoring stations cannot be used to support Waukesha's claims regarding the impacts of return flow through the length of the Root River downstream of the proposed outfall.

For instance, Appendix K's evaluation is insufficient to draw conclusions regarding the area between 60th and 43rd streets on the Root River, where there are a number of meanders.[140] The section between 60th and 43rd streets is a high risk area in terms of sheer stress concerns because

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[134] Draft Technical Review, p. 84.
[135] *Id.*
[136] *See generally* Wis. Admin. Code § NR 207. Waukesha has not demonstrated that it meets the standard for an exception to the prohibition of significantly lowering the water quality of a waterbody set out in NR 207, which among other things requires the city to demonstrate that there are no pollution control alternatives or alternative discharge locations. *See* Wis. Admin. Code §§ NR 207.04 and .05.
[137] Compact art. 4 § 4.9.4.d.
[138] Application, Vol. 4, at 22-24, Appendix E.
[139] Application, Vol. 4, at 22, Appendix K.
[140] Cheryl Nenn.

the area is particularly curvy and has a lot of fine sediment accumulations.[141] With the proposed return flow's increases in base flow, such fine sediments in the Root River would be mobilized and cause adverse impacts on water quality, the fishery, and sheer stress.[142]

In fact, neither DNR nor Waukesha has provided any information about the potential for the return flow to increase the TSS loading in the Root River due to streambank erosion. This is of especial concern because the Root River is on the 303(d) list for TSS and also because during extremely low flows (the 7Q10 flow), the returned effluent will constitute 80-90% of the river, making it an effluent-dominated stream. Given the volume of water that Waukesha will be discharging to the Root River, it is likely that bank erosion and scour will cause movement of sediment downstream, which could further impair water quality and wildlife habitat, affecting viability of fish and other aquatic life.[143] DNR must conduct an analysis of sheer stress, erosion potential, and sediment transport for the proposed return flow location prior to any discharge. DNR should also consider mitigation measures, such as distributing discharge points or installing pre-treatment wetlands.

3. Flooding

Relying on Appendix K, Waukesha claims that "[r]eturn flow to the Root River would be small compared to the 100-year return period flood flows," and the 10-year return period flow.[144] However, as noted above, the scope of Appendix K's was limited to two spots in the Root River: (1) immediately downstream of the 60th Street Bridge, and (2) 150 feet downstream of the Root River Steelhead Egg Harvesting Facility in Racine.[145] This analysis does not suffice to demonstrate that the return flow to the Root River will not lead to flooding and related adverse environmental, property, and economic impacts.

In fact, routing additional return flow through the Root River may exacerbate the river's existing tendency to flood.[146] The Root River experienced major floods in 2008 and 2010.[147]

4. Bacteria

The draft technical review omits information that is critical to developing an understanding of how Waukesha's proposed discharge will impact the Root and Fox Rivers. For example, there is no information provided about how often Waukesha has sanitary sewer overflows, and what the expected impact of any overflows would be on these surface waters and Lake Michigan. The

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[141] Cheryl Nenn.

[142] Cheryl Nenn.

[143] Cheryl Nenn.

[144] Application, Vol. 4, at 26, Appendix K, at 1.

[145] *Id.*

[146] *See* Waukesha Diversion Comments, the Great Lakes and St. Lawrence Cities Initiatives, Great Lakes Mayors Criticize Waukesha's Lake Michigan Diversion Plan, Want Tough Scrutiny (Dec. 3, 2013) (Appendix tab 8), http://thepoliticalenvironment.blogspot.com/2013/12/great-lakes-mayors-criticize-waukeshas.html.

[147] *Id.*; *See* Don Behm, Waukesha's Root River Water Plan: Better Fishing or Worse Flooding?, MILWAUKEE WISCONSIN JOURNAL SENTINEL (Nov. 13, 2013), http://www.jsonline.com/news/waukesha/waukeshas-root-riverwater-plan-better-fishing-or-worse-flooding-b99140148z1-231752221.html.

draft EIS should have included a discussion of the impact of overflows on the water quality of affected surface waters.

5. Viruses and Pathogens

In the Draft EIS, DNR acknowledges that "there is a risk to human health from this added return flow" due to residual pathogens in Waukesha's treated wastewater. Moreover, DNR indicates that the extent of the risk is unknown because the "concentrations of pathogens in wastewater are unknown."[148] The proposed wastewater discharge to the Root River will add approximately 11 cubic feet per second ("cfs") to 16 cfs to the Root River. The Root River's baseflow from July through October averages under 30 cfs with summer monthly averages frequently less than 10 cfs.[149] Thus, the Root River at the point of discharge will be effluent dominated during low flow conditions, and at times the return flow may constitute up to eighty to ninety percent of the river's flow.[150] Under these conditions, there could be a significant public health risk to recreational users of the Root River.

It is unclear how DNR has determined that there will not be a significant lowering of water quality of the Root River if, by its own admission, the agency has not evaluated the potential levels of viruses and pathogens in Waukesha's discharge.

6. Invasive Species

Waukesha claims that the return flow through the Root River will satisfy the Compact requirement of preventing the introduction of invasive species into the Great Lakes basin.[151] In the very next sentence, however, Waukesha states only that it will use best practices to *reduce* the potential of introducing or spreading invasive species and viruses.[152] *Reducing* the potential for invasive species does not equate to *preventing* invasive species.

In addition, Waukesha does not commit to use any particular practices. It only states that "[p]ractices … *will be considered*[,] includ[ing] washing equipment and timber mats before entering wetlands or watercourses, removing aquatic vegetation from equipment leaving waterways, steam cleaning and disinfecting equipment used in waterways where invasive species may exist, using noninvasive construction techniques, and others."[153] Moreover, Waukesha has provided no evidence showing that the practices it will consider using are effective in preventing the introduction and spread of invasive species.

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[148] Draft EIS, p. 168.
[149] U.S. Geologic Survey, River Gauge Data, *available at* http://waterdata.usgs.gov/usa/nwis/uv?04087233 (last accessed Aug. 27, 2015).
[150] Draft Technical Review, p. 81.
[151] Application Vol. 4, at 37.
[152] *Id.*
[153] *Id.* (emphasis added).

The Application asserts that the WWTP is an advanced facility with biological treatment systems and its disinfection procedures would remove and inactivate viruses.[154] Although Appendix A Facility Plan Amendment explains the WWTP's ultraviolet light disinfection system and the flow path through disinfection procedure,[155] these do not sufficiently show that the level of treatment will not allow transfer of invasive species through the water distribution system.

In sum, the Application should have provided better documentation showing that Waukesha commits to particular practices, that those practices are effective, and how Waukesha's WWTP disinfestation procedure meets DNR water quality standards.

VIII. WAUKESHA HAS NOT SHOWN THAT THE PROPOSED DIVERSION WILL RESULT IN NO SIGNIFICANT OR CUMULATIVE ADVERSE IMPACTS, AS REQUIRED BY THE COMPACT'S STANDARD OF REVIEW AND DECISION AND WISCONSIN LAW (DNR Impact Assessment Related Criterion IA2)

The Compact requires a the diversion to "be implemented so as to ensure that it will result in no significant individual or cumulative adverse impacts to the quantity or quality of the Waters and Water Dependent Natural Resources of the Basin."[156] However, the draft EIS does not contain any formal review of cumulative effects of the proposed diversion on Lake Michigan or on the Root River. The draft EIS contains only a general explanation of the environmental effects of the various water supply and return flow alternatives, as well as a cursory comparison of water supply source alternatives (section 5.2), comparison of natural resource impacts from pipeline construction (section 5.3), comparison of return flow discharge alternatives (section 5.4), and comparison of return flow pipeline routes (section 5.5).[157]

The draft EIS may be read to imply that there are no cumulative effects to Lake Michigan water quality or water quantity from the diversion based on statements such as the following:

- "No impacts to minimal impacts to the water quality of the deep waters of Lake Michigan are expected from the Root River return flow alternative. In the very long term, nutrient loadings from the entire Root River watershed to Lake Michigan may contribute towards a more eutrophic condition, however, the wastewater discharge is less than two percent of the overall loading, so this project will have minimal impacts. Near the shore of Lake Michigan, at the mouth of Racine Harbor and south along the breakwater, minimal impacts may result from elevated levels of chlorides and increased turbidity associated with phosphorus fueled planktonic algae growth coming from the estuary and the Root River."[158]

[154] *Id.*
[155] *Id.* at Appendix A Facility Plan Amendment—City of Waukesha Wastewater Treatment Plant Improvements for Returning Water Withdrawn from Lake Michigan (2013).
[156] Compact, art. 4, § 4.9(4)(d). *See also* Wis. Stat. § 281.346(4)(e)1.e. & (f)5.
[157] *See* Draft EIS, pp. 194-198.
[158] *Id.* at 164.

- "None of the return flow discharge alternatives would involve significant adverse impacts to Lake Michigan water quality, quantity and biota. The MMSD and Root River alternatives would not involve any construction activities in Lake Michigan."[159]

In the Comparison of Water Supply Source Alternatives section, the draft EIS states the following:

- "The proposed diversion would not result in significant adverse direct impacts or cumulative impacts to the quantity or quality of the waters of the Great Lakes basin or to water dependent natural resources, including cumulative impacts that might result due to any precedent-setting aspects of the proposed diversion. The proposed annual diversion represents 0.00028 percent of the volume of Lake Michigan and 0.000061 percent of the volume of the Great Lakes. These totals do not take into account any treated wastewater returned to the Lake Michigan basin. Based on the Applicant's preferred return flow alternative, the Department determined that 95- 109 percent of the water withdrawn (using water use data from 2005-2012) would have been returned to the basin had the return flow plan been in place over that time period."[160]

Thus, the draft EIS essentially states that the Great Lakes diversion will not have cumulative effects because the water will all be returned, and that if the discharge will meet effluent limits, then there are unlikely to be "significant" impacts, but only "minimal" impacts. This does not address future diversions or their likely cumulative impact on Lake Michigan water quality, for example, nor does it address the cumulative effects to the Lake or Root River from discharges over time and changes to geomorphology.

Likewise, the draft EIS does not address cumulative effects on water quality and biota of the Root River. It does imply that "impacts" to the Root River would be minimal if water quality-based effluent limitations ("WQBELs") are met, as follows: "The proposed Root River return flow would be subject to WQBELs for TSS. TSS levels under the permit would likely be very low, therefore the Root River should experience little to no impacts from this return flow."[161]

The draft EIS also states as follows:

"The proposed additional flow to the Root River during low-flow periods may positively impact the Root River fish community. Phosphorus may both negatively and positively impact the fish community of the Root River and estuary. Temperature impacts to the Root River would likely be minimal, and the addition of chlorides, and possibly pharmaceuticals, would likely negatively affect the fish of the Root River and possibly have a slightly negative effect on the fish community in the Root River estuary and possibly the near shore areas of Lake Michigan"[162]

However, the draft EIS provides little explanation of what a "minimal" impact is or how it made the determination that impacts would be "minimal." Nor is there any discussion of whether or

[159] Draft EIS, p. 194.
[160] Draft EIS, p. 195.
[161] Draft EIS, p. 166.
[162] Draft EIS, p. 196.

how the return flow, in combination with other projects and conditions (*e.g.*, climate change, increasing development, *etc.*) could pose cumulative risks to the watershed over time.

Similarly, Waukesha did not demonstrate that changes in water depth and habitat available for fisheries in the Fox River would cause no significant adverse impact. It merely asserted an expectation that such changes would cause no significant adverse impact.[163] In fact, in the draft EIS, DNR states that flows to Fox River under Alternative 6 would shrink to 3-5 cfs from currently 15-16 cfs.[164] Using the ELOHA model, DNR estimates that this is likely to have significant impacts on fisheries and other aquatic life such as mussels and aquatic macroinvertebrates.[165] As Waukesha improves its sewer system, discharge to the Fox River is expected to decrease, which could lower water levels even further. DNR does not appear to have evaluated the potential reduction of return flow to the Fox River with infiltration and inflow improvements that the applicant has committed to, or the impacts to water quality and habitat under the best- and worst-case scenarios.

IX. BECAUSE DNR HAS FAILED TO INCLUDE CRITICAL ANALYSIS AND INFORMATION IN THE DRAFT ENVIRONMENTAL IMPACT STATEMENT, THE AGENCY HAS FAILED TO COMPLY WITH THE WISCONSIN ENVIRONMENTAL PROTECTION ACT

DNR's draft Environmental Impact Statement ("EIS") is inadequate, particularly with respect to its failure to consider a reasonable alternative and to provide for appropriate public participation. If DNR's does not correct these deficiencies in the final EIS, it will be legally invalid.

The U.S. Supreme Court has articulated two primary purposes of an EIS.[166] First, the EIS ensures that the reviewing agency, in this case, DNR, in reaching its decision, will have available and will carefully consider detailed information concerning environmental impacts that may be significant. Second, the EIS guarantees that the relevant information will be made available to the public at large, who also may play a role in the decision-making process and implementation of that decision. Because the Wisconsin Environmental Protection Act ("WEPA") was patterned after the National Environmental Policy Act ("NEPA"), Wisconsin courts view the construction of NEPA by the federal courts as persuasive authority in interpreting WEPA.[167]

Under the law, an EIS must be prepared with "objective good faith" and take a "hard look" at environmental consequences and alternatives. The EIS must contain "a reasonably thorough discussion of the significant aspects of the probable environmental consequences and must make a pragmatic judgment as to whether the EIS can foster both informed decision-making and informed public participation."[168] A court may overturn an agency's decision under the "hard

[163] Application, Vol. 5, at 5-39.
[164] Draft EIS Version 1.2, p. 153.
[165] *Id.* at 154.
[166] *Department of Transp. V. Public Citizen*, 541 U.S. 752, 756-57, 124 S.Ct. 2204, 159 L.Ed.2d 60 (2004), citing *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350, 109 S.Ct. 1835, 104 L.Ed.2d 351 (1989).
[167] *Larsen v. Munz Corp.*, 482 N.W.2d 332, 342 (1992).
[168] *Natural Resource Defense Council, Inc. v. Evans*, 279 F. Supp. 2d 1129 (N.D. Cal. 2003).

look standard" if the agency failed entirely to consider an important aspect of the problem or if the decision does not rely on the factors that Congress intended the agency to consider. [169]

Finally, when preparing an EIS, the agency's analysis of alternatives is of particular importance, even deemed the "linchpin" of the document; as such, agencies are to rigorously explore and objectively evaluate "all reasonable alternatives." [170] The scope of alternatives that must be considered is dictated by regulations promulgated by the Council on Environmental Quality ("CEQ"), which are given "substantial deference" by courts "when interpreting NEPA."[171] The CEQ has described the alternatives analysis section as "the heart of the environmental impact statement," mandating that "in this section agencies shall: … Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."[172]

Thus, in order for the state of Wisconsin to conduct a fair and proper assessment of the potential environmental effects of the diversion proposed by Waukesha, the EIS must identify and rely upon important, up-to-date information and contingencies germane to this proposed taxpayer–funded project. DNR's draft EIS, however, falls short of this basic standard by virtue of (i) the agency's failure to examine an important and viable alternative and (ii) the extent of uncertainty remaining with respect to important aspects of Compact compliance, significantly undermining informed and meaningful public participation.

Neither Waukesha's application nor the draft EIS adequately address critical components of the Compact. Most notably, neither adequately address the Compact's requirement that no reasonable water supply alternative exists to the proposed diversion. This requirement bears on DNR's obligation to consider alternatives to the proposed diversion.[173] DNR has failed to fulfill this obligation, because the draft EIS fails to examine, as part of its alternatives analysis, water demand parameters or modeling predicated upon the City of Waukesha's *existing* water supply service area.

Notwithstanding repeated indications of the legal and technical infeasibility of the city's proposed water supply service area plan – see, *e.g.*, the Compact Coalition's letter to DNR dated April 30, 2015, and the "Non-Diversion Solution" released to the public by GZA GeoEnvironmental, Inc., this past July – DNR has persisted in its refusal to integrate into its draft EIS an analysis of water demands attributable to the City of Waukesha's current water supply service area. Instead, the DNR has limited its alternatives analysis to the expanded water supply service area proposed by the City of Waukesha (pursuant to an outdated SEWRPC study), which encompasses an additional 17 square miles and portions of four neighboring communities. Unsurprisingly, this analysis points to greater water demands and a heightened risk of adverse environmental impacts.

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[169] *Sierra Club v. U.S. Army Corps of Engineers*, 295 F.3d 1209, 1216 (11th Cir. 2002).
[170] *Dubois v. U.S. Dep't of Agriculture*, 102 F.3d 1273, 1268-87 (1st Cir. 1996).
[171] *Habitat Educ. Ctr., Inc. v. U.S. Forest Serv.*, 673 F.3d 518, 527 (7th Cir. 2012).
[172] 40 C.F.R. § 1502.14(a).
[173] Wis. Stat. § 1.11(2)(c)3.

DNR's failure to examine a viable alternative renders the draft EIS inadequate. Indeed, the U.S. Court of Appeals for the Ninth Circuit held an EIS inadequate on this very basis, reasoning that "the existence of a viable but unexamined alternative renders an environmental impact statement inadequate."[174]

Moreover, too much uncertainly still remains regarding critical "factors that Congress intended the agency to consider" pertaining to compliance with the Compact, especially those related to the reasonableness of the amount of Lake Michigan water requested by the City of Waukesha and the feasibility of the city's proposed water supply service area. As such, significant information shortfalls remain in Waukesha's application and the draft EIS. For one, no showing has been made as to the feasibility of providing Waukesha municipal water to any of the households or portions of the communities included in the proposed expanded water supply service area. Also, incomplete information has been provided relating to the inadequacy of the existing water supplies relied upon by households within the expanded water supply service area. Likewise, neither the Waukesha's application nor the draft EIS have made the requisite showing regarding what, if any, conservation efforts have been accomplished by any of those households or the communities in the expanded water supply service area. These deficiencies have legal consequences; indeed, as plainly articulated in a federal appellate court ruling issued earlier this month, an agency cannot hide behind outdated or incomplete information in formulating or relying upon an EIS.[175]

Because these and other persistent information shortfalls pertain to a "linchpin" component of the Great Lakes Compact – that is, the "no reasonable water supply alternative" criterion – Wisconsin's public, and the public of the region at large, has been deprived of the opportunity to conduct a meaningful evaluation of the potential environmental impacts of Waukesha's proposed diversion.

Consistent with the law governing the EIS process, the Compact provides that each Party or the Council, in order to ensure "adequate public participation," shall implement procedures that "[a]ssure public accessibility to all documents relevant to an Application …"[176] Relying on this directive, the CIC has sent a series of letters spanning the past six years notifying DNR of information gaps relating to Waukesha's diversion application and need for rule-making concerning the Compact's public participation process. The following letters, in particular, challenge the extent of pivotal information still unclear or withheld from the public and the rule-making yet to be accomplished:

1. To date, DNR has issued no final determination on the City of Waukesha's proposed water supply service area, an area potentially adding 17 square miles to the city's existing 22 square mile service area, including households and communities non-compliant with key Compact requirements (water conservation and inadequate water supplies), rendering a critical aspect of the city's application incomplete and

[174] *Oregon Natural Desert Ass'n v. Bureau of Land Management*, 625 F.3d 1092, 1100 (9th Cir. 2008).
[175] *See WildEarth Guardians v. United States Dep't of Agriculture*, ___ F.3d ___, 2015 WL 4604142 (9th Cir., Aug. 3, 2015).
[176] Compact, art. 6, § 6.2.

unfinished for purposes of public input during the public comment period ending August 28, 2015.

- See Coalition letter dated August 12, 2015, identifying the public participation implications of DNR's decision to delay approval of the operative water supply service area ("WSSA") and to proceed without requisite rule-making, attached at Appendix tab 9;

- See Coalition letter to Waukesha Mayor Nelson, dated September 19, 2009, identifying "the need for a more comprehensive evaluation of Waukesha's water supply options and potential service area mindful of the Compact's 'no reasonable alternative' provision," Appendix tab 10;

- See Coalition member Waukesha County Environmental Action League letter dated March 26, 2010, questioning the feasibility and likelihood of the projected water supply service area expansion proposed by the City of Waukesha, per the SEWRPC plan, "These far-flung areas would require enormous investments in infrastructure to bring city services to this largely rural area," Appendix tab 11.

2. As previously stated, the public has had no opportunity to evaluate or comment on DNR's response to the formal report developed by GZA GeoEnvironmental, Inc., regarding a reasonable non-diversion alternative water supply option or "Non-Diversion Solution." This is because the draft EIS fails to make mention, in an addendum or otherwise, of the report's findings notwithstanding multiple meetings and letters issued by the Coalition requesting DNR evaluation.

   - See Coalition letter dated April 28, 2015, Appendix tab 5;

   - See Coalition letter dated July 15, 2015 Appendix tab 12.

3. DNR should reconsider its decision to respond only to public comments on the draft EIS, not on the draft Technical Review.

   - See letter dated August 12, 2015, Appendix tab 9.

4. Wisconsin should complete necessary rule-making pertaining to public participation, water conservation, return flow and "water supply plans that are used to define the 'area' to be served by a proposed diversion," ***before***, not after, its review of the City of Waukesha's diversion application.

   - See Memo directed to DNR Secretary Matt Frank, dated March 11, 2009, Appendix tab 13.

If DNR fails to address these significant shortfalls before finalizing the EIS, or limits the opportunity for public comment only to the instant inadequate draft EIS, the public's legally

guaranteed right to participate in the Compact's decision-making process will have been compromised to a degree that renders the state's EIS legally infirm under state and federal law.

X. CONCLUSION

For the foregoing reasons, DNR must deny Waukesha's proposed diversion of water from Lake Michigan.

APPENDIX LIST

1. Jim Nicholas, Nicholas-H2O, Memo to Marc Smith, National Wildlife Federation (November 25, 2013)

2. Nicholas, An Analysis of the City of Waukesha Diversion Application (February 2013)

3. Daniel Duchniak, Waukesha Water Utility, Letter to Sharon L. Leair, Town of Genesee (January 12, 2011)

4. Compact Implementation Coalition Comments to Wisconsin Department of Natural Resources (WI DNR) (December 2, 2013)

5. Compact Implementation Coalition Letter to WI DNR (April 28, 2015)

6. GZA GeoEnvironmental, Inc. Report to Clean Wisconsin, et al. (July 9, 2015)

7. Mead & Hunt Report to Clean Wisconsin (April 6, 2015)

8. The Great Lakes and St. Lawrence Cities Initiative Comments to WI DNR (December 3, 2013)

9. Compact Implementation Coalition Letter to WI DNR (August 12, 2015)

10. Compact Implementation Coalition Letter to City of Waukesha Mayor Nelson (September 19, 2009)

11. Waukesha County Environmental Action League Letter to Waukesha Water Utility (March 26, 2010)

12. Compact Implementation Coalition Letter to WI DNR (July 15, 2015)

13. Compact Implementation Coalition Memorandum to WI DNR Secretary Matt Frank (March 11, 2009)

nicholas-h2o

Memorandum

To: Marc Smith, National Wildlife Federation
From: Jim Nicholas, nicholas-h2o
Date: November 25, 2013
Subject: Brief review of new Waukesha application for a diversion from Lake Michigan

This memo is in response to your request that I review the parts of the subject application regarding demand forecast and alternative sources of water supply. This review is done with the intent of determining if there are substantive differences between the new application and the previous one I reviewed in February 2013. I spent most of my time on (1) the updated demand forecast and (2) the arguments against using the several alternative sources of water supply. These topics are covered in Volumes 1, 2 and 5 of the application. I did not review any revisions to groundwater flow modeling. My understanding is that technical comments on groundwater flow modeling are being provided to DNR from other qualified hydrogeologists familiar with the modeling.

Regarding the average-day demand forecasting, the approach is similar to the original application. There is no substantive change to the demand forecasting model for average day demand. The demand is forecast using a value of gallons per capita per day (GPCD) that is an average from the last 10 years. Since the last 10 years (and the last few decades) show a clear decreasing trend in GPCD, using an average value to predict future demand is inappropriate. As noted in my previous analysis, a forecast model should be able to explain why and when the historical decline in GPCD will stop and why there will be a subsequent increase in GPCD, especially given the implementation of planned conservation and efficiency measures (CEMs). Additionally, the forecast model should be able to backcast, that is, if applied to historical data a forecast model should be able to calculate historical water use reasonably well.

Regarding maximum-day demand forecasting, the approach used is identical to the original application. The approach uses a ratio of maximum-day to average-day demand of 1.68. This is the same ratio used in the original application. As noted in my previous review, this ratio has been exceeded only once since 1970 and that was in 1992. Maximum-day demand in Waukesha is typically caused by hot/dry weather, according to reports to the Public Service Commission of Wisconsin and many of Waukesha's CEMs are focused on reducing demand related to hot/dry weather. Therefore, a ratio reflecting recent history and implementation of CEMs should be used.

Regarding evaluation of water-supply alternatives, summarized in Volume 1, Exhibit 4-18, the new application is similar to the original. All alternative groundwater supplies are concluded to cause significant adverse environmental impacts, are not sustainable, and are not protective of public health. However, these conclusions are all questioned in my previous analysis and no substantive new rationale has been presented that alters my previous conclusions. If one extended the applications approach to all groundwater supplies in Wisconsin, most of Wisconsin's public water supplies would cause adverse environmental impacts, be unsustainable, and not protect public health.

Regarding water-supply alternatives, reasonable use of water, and the Compact decision-making standard, summarized in Volume 1, Exhibit 4-20, the new application is similar to the original. The conclusion in the application is that only use of Lake Michigan would comply with the Compact. However, this conclusion is based on two sets of arguments that are questionable. The first set is that all groundwater sources cause significant adverse resource impacts, are unsustainable, and are not protective of health. The lack of rigor of these arguments is noted in the above paragraph. The second set of arguments is based on assumptions and misunderstanding of issues I outlined in my February 2013 report (pp.15-18). The most notable misunderstanding is that any groundwater use has a significant adverse impact on Waters of the Great Lakes Basin; any impact is trivial and has not been directly tied to Waukesha's alternative groundwater sources. Another is that stopping pumping of groundwater in the deep sandstone aquifer will restore hydrological and ecological functions to Waters of the Great Lakes Basin; any impact of pumping cessation would be trivial. A third is the confusing argument about returning water to its Source watershed. The first row of Exhibit 4-20 should state that "All water is returned to source" for every column, not just for the Lake Michigan alternative. Below I have excerpted two paragraphs from my February 2013 analysis that speak to the above issues:

> 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.
>
> 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.

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,	High-Efficiency Toilet Rebate	0.41	
and Public	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

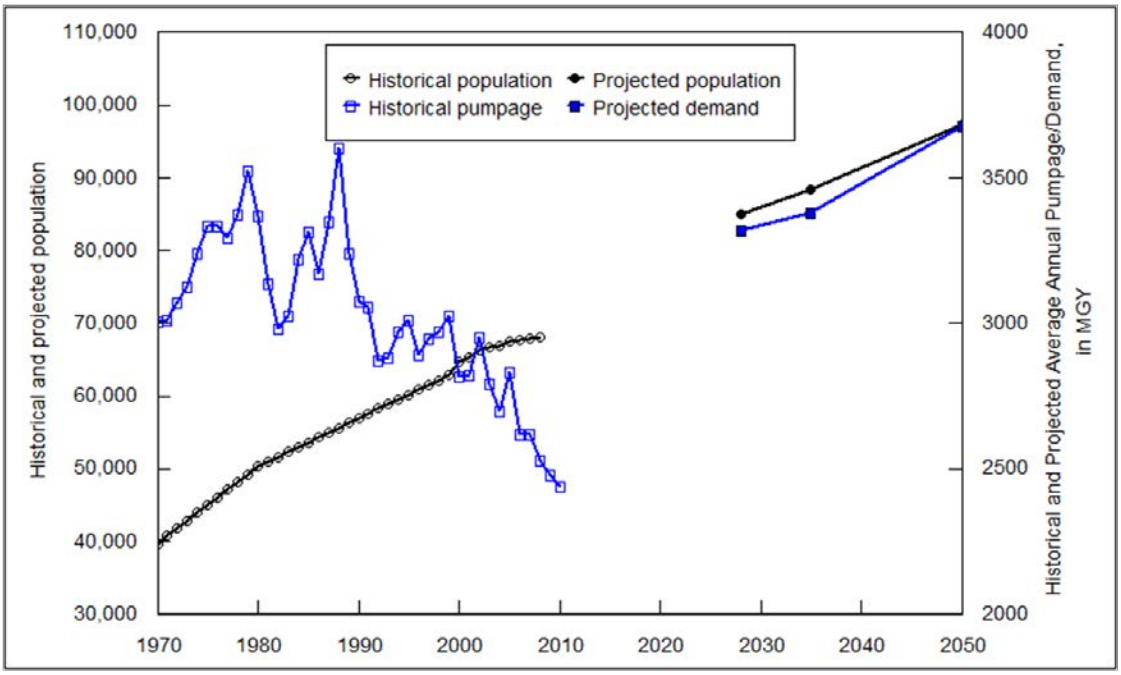
Future water needs are based upon projections of population growth, a future mix of water-use sectors (residential, commercial, industrial, and public), estimates of the amount each sector will use, and improvements and efficiencies in infrastructure and water use that conserve water. Estimates of future 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).

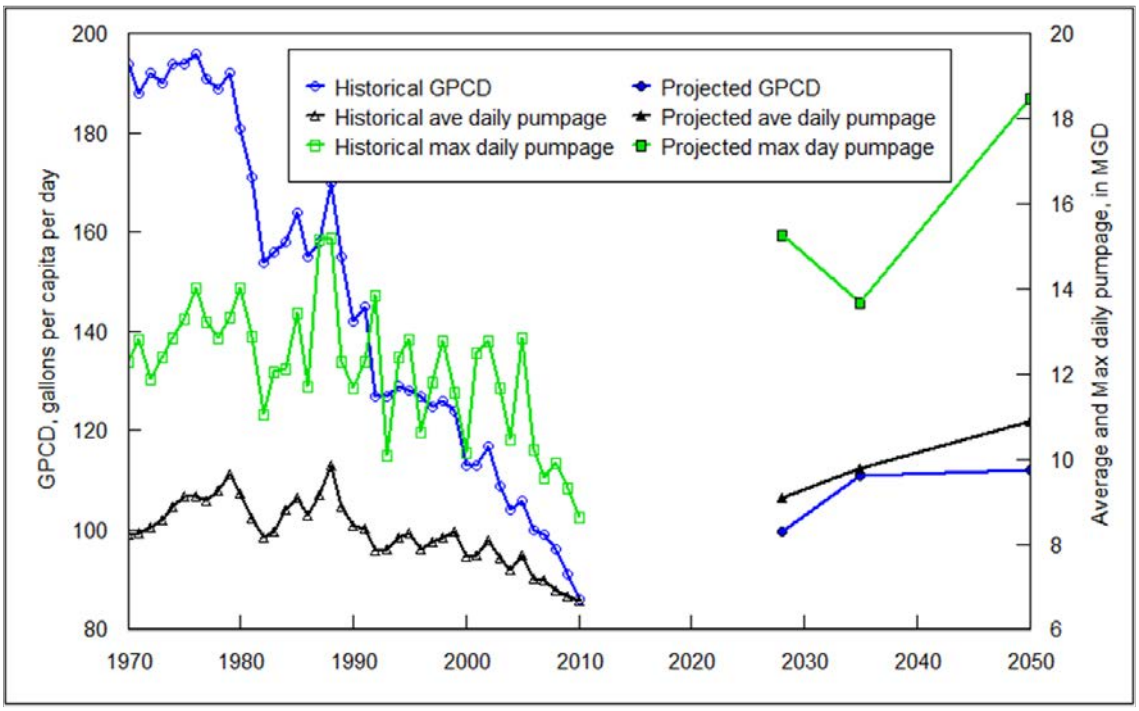
Figure 1 illustrates the historical trends in population and pumpage, along with projected population and demand. Note that both the historical and projected population have increasing trends. In contrast, Historical pumpage has a decreasing trend, and projected demand has an increasing trend.



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.

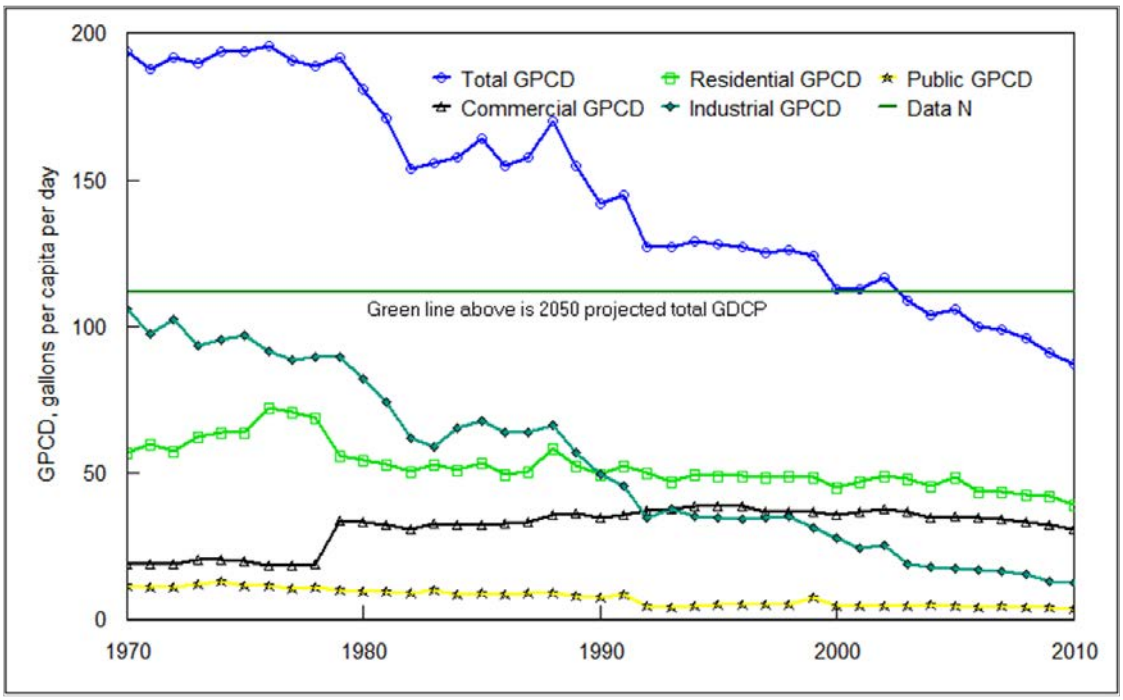
Illustrating similar trends to Figure 1, Figure 2 shows historical declines in GPCD, average day pumpage, and maximum day pumpage, while showing increases in projected values for all three of these.



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.

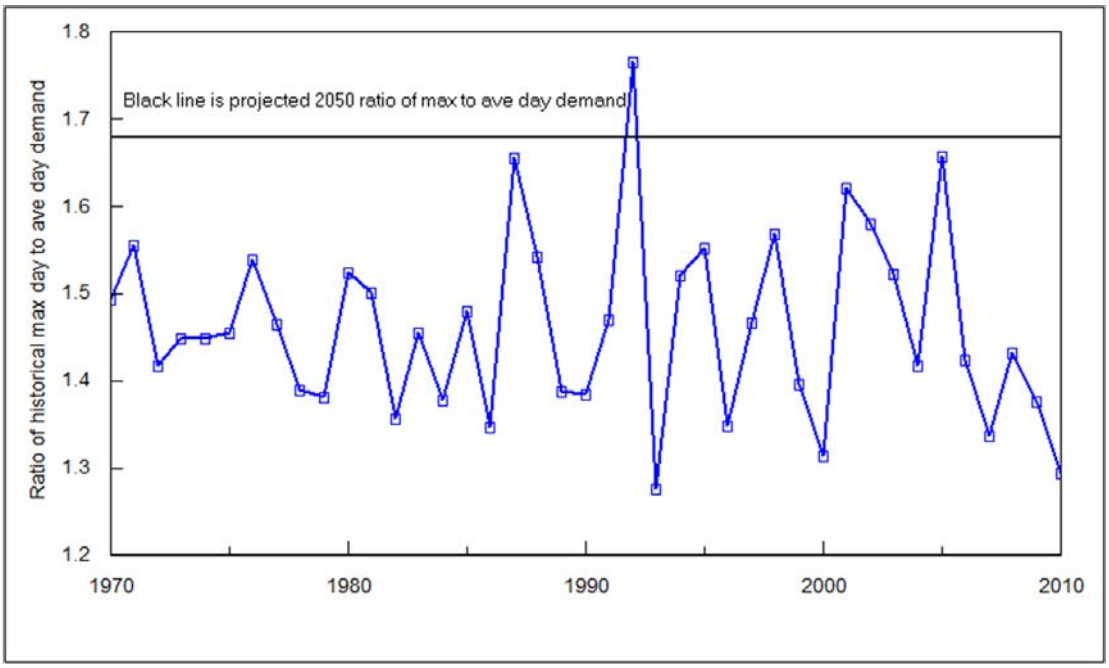
Figure 3 shows trends in GPCD for various use sectors and total GPCD. Aside from the commercial use sector, other use sector GPCDs and total GPCD show historical declines. The horizontal line indicates the total GPCD, 112, which is used to project 2050 average day demand (Appendix D, exhibit 13). In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

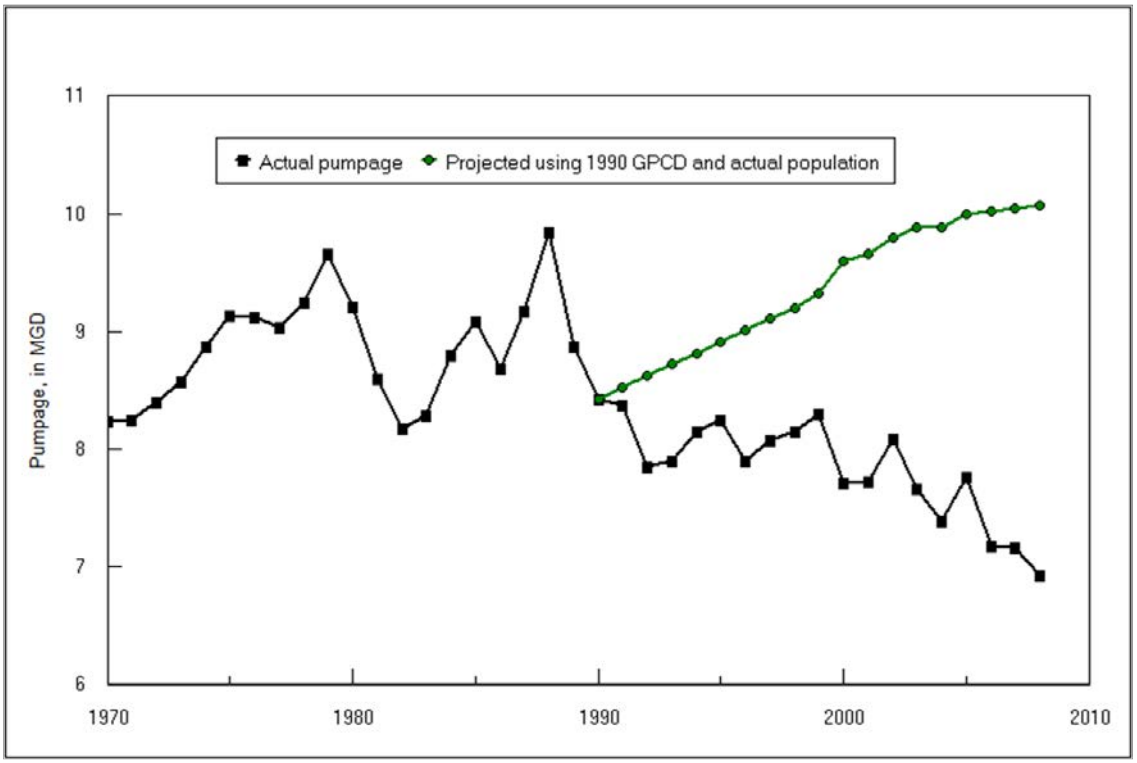
Future maximum day demand is projected by using a ratio of 1.68, based on historical ratios of maximum day demand to average day demand. Figure 4 shows the historical ratios. No trend is apparent. The average ratio is 1.46, and only thirteen years from 1970 to 2010 had ratios above 1.5. The most recent 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).

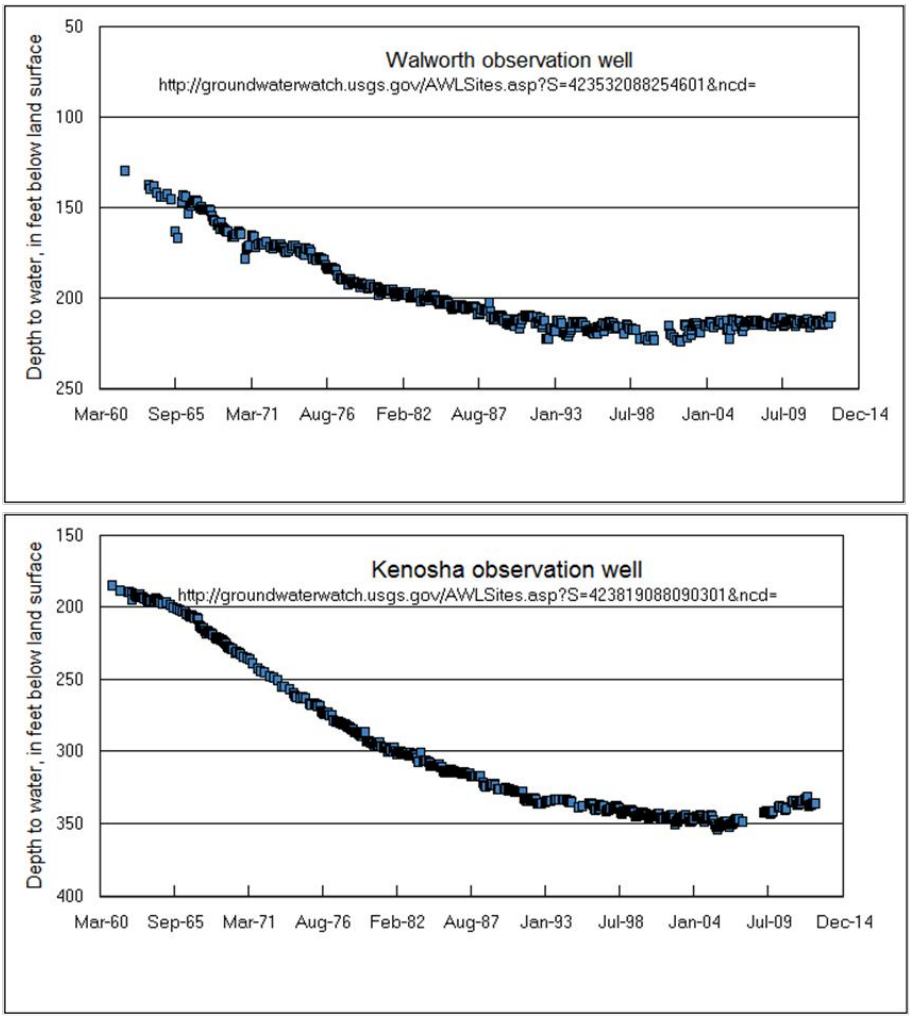
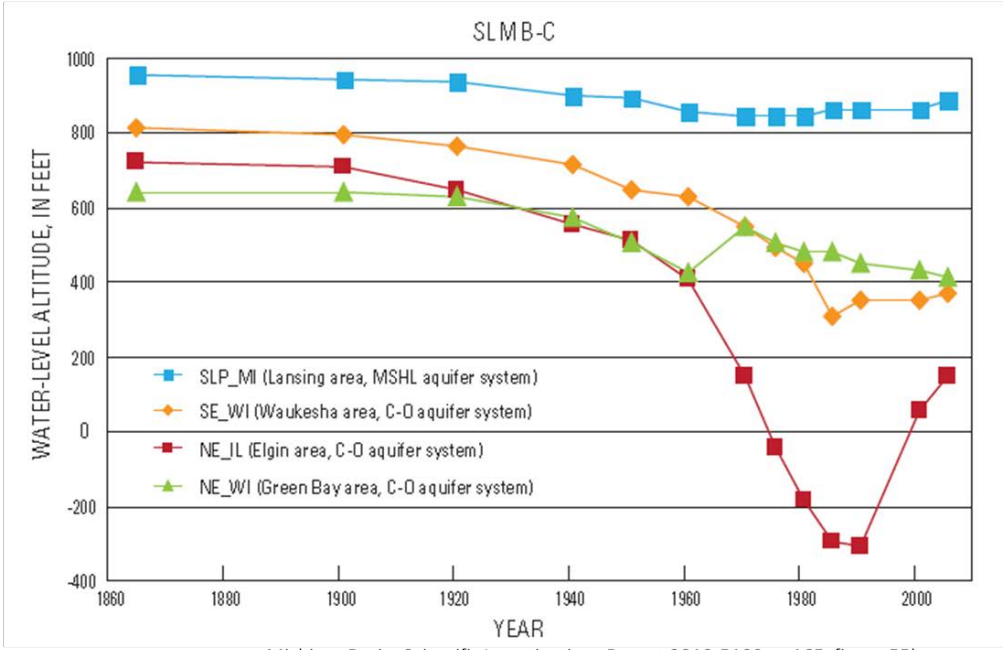


Figure 6—Historical groundwater levels for two observation wells in the deep confined aquifer in southeast Wisconsin.

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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2006, March, Geosyntec Consultants, Appendix A, Waukesha Water Utility Water conservation and protection plan, 28 p. plus addendums and appendices, 176 p.

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

2009, March, 2008 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 91 p.

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

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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.

Waukesha Water Utility
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January 12, 2011

Sharon L. Leair, Chairman
Town of Genesee
S42 W31258 North Street
Genesee Depot, WI 53127

Subject: Request for Approval by the Town of Genesee of the City of Waukesha Water Supply Service Area Plan

Dear Ms Leair:

The purpose of this letter is to request review and approval by the Town of Genesee of the City of Waukesha Water Supply Service Area Plan as discussed below.

Background and Regulatory Requirement

In December 2008, the Southeast Regional Planning Commission (SEWRPC), in conjunction with the Wisconsin Department of Natural Resources, delineated the water supply service area for the City of Waukesha which included an area of the Town of Genesee. (Refer to Attachment 1.) This planning guidance was prepared in a manner consistent with the Waukesha County comprehensive plan, the *Regional Water Supply Plan for Southeastern Wisconsin*, and state planning requirements. The proposed water supply service area and population projections are a basis for the *Draft City of Waukesha Water Supply Service Area Plan, April 2010*. (Refer to Attachment 2.) This proposed water supply service area is consistent with the current sewer system services area that has been approved by the Town of Genesee.

The City of Waukesha is making application for a diversion of Great Lakes water pursuant to Sections 281.346 and 281.348 Wis. Stats. The Great Lakes-Water Resources Compact and the Wisconsin Statutes adopted pursuant to the Compact require that the City document the public participation process conducted for the proposed Water Supply Area Plan, including evidence that the governing body of the Town of Genesee addressed by the plan have approved the Water Supply Service Area Plan, hence this request to the Town of Genesee.

The Town of Genesee water supply is currently provided by private wells. The future decision of whether to develop a Town municipal water supply system is up to the Town of Genesee. Municipal Great Lakes water supply would only be provided if needed and requested by the Town of Genesee. The Town was included by SEWRPC in the City of Waukesha's future water supply service area because it may be served by municipal water service during the planning horizon that extends to year 2035. Approval of the City's Water Supply Service Area Plan does not financially or legally commit the Town to actual Great Lakes water supply but rather acknowledges the potential for Great Lakes Water supply of the designated area of the Town by

So they have no "need" at this time as defined by Compact

But Waukesha will increase their cost of if they will be getting the water w/in the next 2

the City sometime in the future. The Town will remain on its supply of private wells unless there is a water supply need and an initiative by the Town requesting Great Lakes water supply by the City for the designated service area. Non-approval by the Town of the City's Great Lakes water supply for the area of the Town designated by SEWRPC will result in this area being deleted from Great Lakes Water Supply Service by the City of Waukesha and revision of the Water Supply Service Area Plan. Approval of the City of Waukesha Water Supply Service Area Plan provides the Town with a contingency plan (Attachment 3) for water supply in the future if the Town ever decides to replace its private wells with a municipal supply.

But a decision is wanted from

Because our application for a Great Lakes water supply (Attachment 4) is currently pending before the DNR, we would appreciate a response by March 14, 2011. I would be happy to discuss this matter with you at your convenience. Thank you for your consideration.

Sincerely,

Waukesha Water Utility

Daniel S. Duchniak, P.E.
General Manager

If the State will never get to say yea or nay

Cc: Mike Hahn, Southeastern Wisconsin Regional Planning Commission
Dale Shaver, Waukesha County
Dino Tsoris, Wisconsin Department of Natural Resources
Jeff Scrima, City of Waukesha Mayor
Curt Meitz, City of Waukesha Attorney

Attachments

1- Southeastern Wisconsin Regional Planning Commission Letter, December 23, 2008
2- Southeaster Wisconsin Regional Planning Commission Letter, March 17, 2009
3- Draft City of Waukesha Water Supply Service Area Plan, April 2010
4- Application for Great Lakes Water Supply, May 2010 (3 copies)

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February 16, 2011

Sharon L. Leair, Chairman
Town of Genesee
S42 W31258 North Street
Genesee Depot, WI 53127

Subject: Request for Approval by the Town of Genesee of the City of Waukesha Water Supply Service Area Plan

Dear Ms Leair:

Thank you and the Town Board for their time in taking up the Approval of the Water Supply Service Area Plan at your meeting on Monday, February 14, 2011. I appreciate the board's thorough review of the request.

At the meeting, a question was asked related to the financial impact to the Town of Genesee if it was to approve the plan. This letter is to inform you that there are no costs associated with the inclusion of the proposed area within the Town of Genesee into the Water Supply Service Area plan and there are no costs associated with the application for Great Lakes water. The only costs that would be borne by the Town of Genesee would be those costs associated with the development of a water utility by the Town and the construction of facilities necessary to transfer the water from the Waukesha Water utility to the residents within the service area if the Town would choose to provide water service to its residents. Approval of the plan simply gives the Town the option to provide Great Lakes water in the future, not any obligation. Service would only be developed at the request of the Town of Genesee.

requirement

NO COSTS FOR WATER FROM MANAUKEE ?

I trust this answers the questions raised at the meeting. Feel free to contact me at (262) 521-5272 ext. 518 if you have any further questions.

Thank you in advance for your attention to this matter.

Sincerely,

Waukesha Water Utility

Daniel S. Duchniak, P.E.
General Manager

TOWN OF GENESEE
MARCH 14, 2011

Chairman Leair called the meeting to order at 7:02 p.m. Present were Supervisors Reid, Schmittinger and Ross; Morris was absent. Also present were Public Works Supervisor Earl and Clerk Whitmore.

Discussion/action – Awarding of Roadside Weed Cutting bid

Earle went over the two bids received and opened on March 11th at 3 pm. The two bids received were:
Watertown Evergreen - $48.00 per hour, base bid
Butterfield Trucking - $46.00 per hour, base bid

Earle taking the base bid and the additional three pieces of equipment listed on each bid figured the rate per hour per foot mowed which came to $4.00 per foot per hour for the Butterfield bid and $3.94 per foot per hour for the Watertown Evergreen bid.

Earle explained this was not an easy recommendation to make, Watertown was awarded the bid last year and did a good job, with no major complaints. Earle recommended Watertown Evergreen based on the numbers.

Discussion of the way the bid was written and equipment on each bid.

Ross made motion to go with the bid from Mr. Butterfield, his bid is the lower rate per hour based on the bid specs.

Paul Dishneau of Watertown Evergreen stated he uses a mower that is made specifically for hillside mowing, discussion.

Ross stated the base bid requested an hourly rate that is what we have to look at. Leair stated the bid specs will be reviewed and possibly changed before next year.

Schmittinger seconded the motion, motion carried unanimously.

Discussion/action – Minutes to be approved –

Special Town Board Meeting of 2-11-11 Ross made motion to approve, Schmittinger seconded, motion carried unanimously **Regular Town Board Meeting of 2-14-11** Ross made motion to approve, Schmittinger seconded, motion carried unanimously. **Executive Session of 2-18-11** Ross made motion to adjourn, Schmittinger seconded, motion carried unanimously.

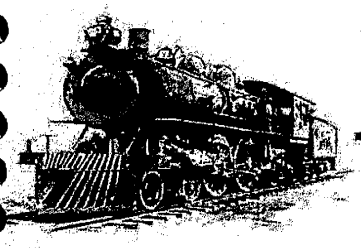
Monthly report from Wales-Genesee Fire Chief Greg Jezak

Board members were copied with the monthly report; there were 23 calls in the month of February with a total of 53 calls as of this evening.

Engine 3761 was sold to the department in Couderay for $15,000. There are currently three people in fire school, one in EMT and 1 in EMT IV tech.

Discussion/action – Request for approval of the City of Waukesha Water Supply Service Area Plan

A letter was received from Daniel Duchniak of the Waukesha Water Utility as requested at the February meeting stating there would be no cost to the town by approving the service area; the only cost to the town would be if the town decided to request service at a later date, by this approval the town would not have to work through the eight Great Lakes states if they did request service, discussion. Ross made motion to approve the request for participation in the City of Waukesha Supply Service Area Plan, Schmittinger seconded, motion carried unanimously.



Town of Genesee est. 1843

S43 W31391 Hwy 83
PO Box 242
Genesee Depot, WI 53127-0242
Phone: 262-968-3656
www.townofgenesee.org

March 15, 2011

RECEIVED
MAR 16 2011
Waukesha Water Utility

Daniel Duchniak, P.E.
Waukesha Water Utility
115 Delafield Street
Waukesha, WI 53186-3615

Re: Request for Approval by the Town of Genesee on the City of Waukesha Water Supply Service Area Plan

Dear Mr. Duchniak,

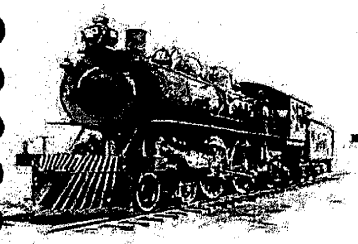
Please be advised the Genesee Town Board at their Regular Town Board Meeting of March 14, 2011, by a motion duly made and seconded, unanimously approved the request by the Waukesha Water Utility for participation in the City of Waukesha Water Supply Service Area Plan. This motion was made pursuant to your letter of February 16, 2011 stating there would be no financial impact on the Town of Genesee associated with the city's application for Great Lakes water. The only costs that would be borne by the town would be those costs associated with the development of a water utility by the Town and the facilities necessary to transfer the water from the Waukesha Water utility to the residents within the service area if the town would choose to provide a water service area to its residents. This approval does not obligate the town in the future unless the Town requested service in the future.

Sincerely,

TOWN OF GENESEE

Barbara A. Whitmore

Barbara A. Whitmore, WCMC
Town Clerk



Town of Genesee est. 1843

S43 W31391 Hwy 83
PO Box 242
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Phone: 262-968-3656
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March 15, 2011

RECEIVED
MAR 16 2011
Waukesha
Water Utility

Daniel Duchniak, P.E.
Waukesha Water Utility
115 Delafield Street
Waukesha, WI 53186-3615

Re: Request for Approval by the Town of Genesee on the City of Waukesha Water Supply Service Area Plan

Dear Mr. Duchniak,

Please be advised the Genesee Town Board at their Regular Town Board Meeting of March 14, 2011, by a motion duly made and seconded, unanimously approved the request by the Waukesha Water Utility for participation in the City of Waukesha Water Supply Service Area Plan. This motion was made pursuant to your letter of February 16, 2011 stating there would be no financial impact on the Town of Genesee associated with the city's application for Great Lakes water. The only costs that would be borne by the town would be those costs associated with the development of a water utility by the Town and the facilities necessary to transfer the water from the Waukesha Water utility to the residents within the service area if the town would choose to provide a water service area to its residents. This approval does not obligate the town in the future unless the Town requested service in the future.

Sincerely,

TOWN OF GENESEE

Barbara A. Whitmore

Barbara A. Whitmore, WCMC
Town Clerk

Clean Wisconsin • Midwest Environmental Advocates
Milwaukee Riverkeeper • Waukesha County Environmental Action League
Wisconsin Wildlife Federation

Mr. Eric Ebersberger
Wisconsin Department of Natural Resources
101 S. Webster St. Madison, WI 53703
VIA EMAIL (sent to *DNRWaukeshaDiversionApp@wisconsin.gov*)

December 2, 2013

Re: The Compact Implementation Coalition's comments on Waukesha's Diversion Application

Dear Mr. Ebersberger,

The undersigned organizations, collectively representing tens of thousands of Wisconsinites, thank you for the opportunity to comment on Waukesha's revised application for a diversion of Great Lakes water under the Great Lakes Compact. Collectively, we have a long history of working on this issue. 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, we have consistently advocated for the strongest protections available for the resource, in keeping with the spirit and the letter of the Compact.

Waukesha's application is historic. As the first ever application of its kind, it will set a precedent for similar future requests under the Compact. Because the Great Lakes are an invaluable local, national, and global natural resource, Waukesha's precedent-setting application deserves the highest degree of scrutiny for meeting the standards established in the Compact. Unfortunately, the Compact Implementation Coalition believes that Waukesha's diversion application does not meet several key standards set forth in the Compact, codified in Wis. Stat. §281.343-346, and therefore is not approvable.

Waukesha's revised application is substantially similar to an application that was submitted to the Department in 2010 and updated at the Department's request in the ensuing years. Over the past three years, our organizations have repeatedly expressed our concerns with Waukesha's proposal, both formally and informally, to Department staff. To the extent that the revised application contains the same or substantially similar information, plans, requests, or proposals for the Department to consider, these comments are meant to reference and build off of our past comments. With regard to the general proposal as described by Waukesha and their underlying assumptions and data, our position is unchanged with the submission of the revised application: we oppose approval of the application as submitted.

Waukesha has applied for a diversion of Great Lakes water as a community within a straddling county under Wis. Stat. §281.346(4). Six critical areas in which Waukesha's revised application fails to meet the approval criteria under Wis. Stat. §281.346(4) are:

I. Waukesha has not considered all reasonable alternatives.
II. The application fails to define a "community within a straddling county" that meets the need requirements established under the Compact and under Wisconsin law.

III. The application fails to show that Waukesha has offset the need for the diversion to the greatest extent possible by maximizing the use of existing water resources and minimizing additional need through water conservation and efficiency measures.
IV. The application's proposed approach to diverting water from and returning it to Lake Michigan fails 1. to minimize the amount of water from outside the Great Lakes basin that would be returned to the source watershed and 2. to return an amount of water to the basin equal to the amount withdrawn (less an allowance for consumptive use).
V. The application fails to show that the returned water will be treated to meet applicable permit requirements under s. 283.31.
VI. The application fails to show that there will be no significant adverse environmental impacts to the waters of the state resulting from the new or increased withdrawal.

The Wisconsin Department of Natural Resources has a duty to ensure that the criteria set forth in Wis. Stat. §281.346 are met to the letter of the law before approving the application. The Great Lakes Compact and Wisconsin law both make clear that the exception under which Waukesha applies for a diversion is only to be used in extraordinary circumstances: "Caution should be used in determining whether or not the proposal meets the conditions for this exception." Wis. Stat. §281.343(4n)(c)e. The Department can expect that an approval of the application will be reviewed with the highest level of scrutiny by interested stakeholders at the state, regional, national, and international level, in addition to review by the regional body. As such, the Department's review should ensure that any decision on the application is defensible and based on sound science. We submit that the current application will not pass that level of scrutiny.

I. Waukesha has not considered all reasonable alternatives.

The Great Lakes Compact's standard is clear. In order for a community within a straddling county to qualify for a diversion of Great Lakes Water, the basic threshold question that they must prove is that there is "no reasonable water supply alternative" for the community. Wis. Stat. § 281.346(4)(e)1.d. Waukesha has failed to show that there is no reasonable water supply alternative.

One set of alternatives that Waukesha has not considered are those based on diverting a smaller amount of water than requested in their application. For example, they did not conduct analyses of the amount of water needed to supply only its *current* service area in future scenarios including aggressive conservation and/or peak demand reduction practices. Sources of water supply for these alternatives could include the current mix of deep and shallow-aquifer wells, the addition of new shallow wells or quarry water, or a wholesale switch to a small number of riverbank inducement wells, to name only a few.

Until Waukesha has evaluated these and potentially other alternatives available to it and shown that those alternatives are not "reasonable" under the standards set forth under the Compact, Waukesha has not adequately demonstrated that there is "no reasonable water supply alternative" as required under Wis. Stat. §281.346(4)(e)1.d.

II. The application fails to define a "community within a straddling county" that meets the need requirements established under the Compact and under Wisconsin law.

Waukesha has applied for a diversion as a "community within a straddling county" as provided under Wis. Stat. §281.346(1)(d) and (4). A "community within a straddling county" is defined in the statute as "any city, village, or town that is not a straddling community and that is located outside the Great Lakes basin but wholly within a county that lies partly within the Great Lakes basin." There is no dispute that the City of Waukesha meets this definition because it is a "city, village or town." However, the application seeks to include an entire proposed (and as-yet unapproved) water supply service area for Waukesha's Water Utility as part of the diversion request. This unapproved planned service area includes portions of four additional communities within a straddling county, none of which can meet the exception standard under s. 281.346(4)(f).

The Compact does contemplate the idea that more than one community may receive water under a single diversion application under Wis. Stat. §281.346(4). However, as the statute states, "[i]f the proposal is to provide a public water supply within more than one city, village or town… any portion of the proposal that provides a public water supply within a community described in par. (e)1. (intro) is subject to par.(e)." Wis. Stat. §281.346(4)(bg)2.

Thus, each of the five communities that are applying for the diversion under consideration must establish that it meets the requirements of Wis. Stat. §281.346(4)(e). The communities included in Waukesha's application have made no such showing. It is not clear whether the other communities implicated in this application are applying for a straddling community diversion along with the City of Waukesha. Thus, the portion of the diversion request pertaining to those communities must be denied.

III. The application fails to show that Waukesha has offset the need for the diversion to the greatest extent possible by maximizing the use of existing water resources and minimizing additional need through water conservation and efficiency measures.

In order for Waukesha to receive an approval for its diversion application, it must prove that the need for the proposed diversion "cannot reasonably be avoided through the efficient use and conservation of existing water supplies." Wis. Stat. §281.346(4)(f)1. This requirement is further defined by Wis. Admin. Code NR 852, which requires Waukesha to complete certain mandatory and required water conservation and efficiency measures, and then to identify additional measures that are "cost-effective or environmentally sound and economically feasible" and implement them before applying for a diversion. NR 852.06(1).

While Waukesha's application clearly states its conservation plan and goals, it does not establish:

1. Whether the conservation plan comports with industry best practices;
2. Exactly how much additional water Waukesha needs to solve its immediate radium contamination problem;
3. Exactly how much water the utility could save on an annual basis if its current conservation plan were implemented more aggressively;

4. Exactly how much water the utility could save on a per year basis if it adopted the most aggressive conservation program, which could yield "saved" water as a reasonable source of water supply going forward and must be evaluated in that way.

In order for Waukesha to prove that it cannot reasonably avoid the need for a diversion through conservation, it must show data to support its assertion, not merely state that it cannot be done. The undersigned request that the Department take a close look at Waukesha's proposal and verify all of the assumptions regarding Waukesha's analysis of future use and need and achievable savings through conservation, in addition to considering whether Waukesha has failed to consider reasonable water supply alternatives that would entail aggressive investment in water savings to help meet both the radium requirements and future water needs for the City.

IV. The application's proposed approach to diverting water from and returning it to Lake Michigan fails 1. to minimize the amount of water from outside the Great Lakes basin that would be returned to the source watershed and 2. to return an amount of water to the basin equal to the amount withdrawn (less an allowance for consumptive use).

Wis. Stat. §§281.346(4)(e)1.c and 281.346(4)(f)3 are critical requirements that minimize the potential environmental impacts and risks associated with a diversion, on both the Great Lakes basin and the adjacent basin, to which a diversion is proposed. These require having as close to 100% of the water returned to the Great Lakes basin originate in the Great Lakes, and having a volume as close as possible to 85% of the water withdrawn returned to that basin (assuming Waukesha's claimed 15% consumptive use). Waukesha's preferred return flow management plan does not meet either of these requirements, and Waukesha has failed to demonstrate an alternative return flow management plan that would meet them.

One action that must be undertaken to meet these requirements is that Waukesha would have to take steps to address the high levels of infiltration and inflow (I/I) in its water supply and sanitary sewer systems. Partly as a result of this I/I, the return flow management alternative that comes closest to meeting the requirements of §281.346(4)(e)1.c would have a return flow made up of 10-15% "out-of-basin water," despite estimates of waste-water-only customers (the non-I/I contribution of out-of-basin water) at only 1.4 – 1.6%. Similarly, the return flow management alternative would that comes closest to meeting §281.346(4)(f)3 would return an amount of water corresponding to 94-100% of the water withdrawn , where the required return rate would be 85% based on Waukesha's assumed 15% consumptive use.

Far from identifying a return flow management alternative that would meet statutory requirements, Waukesha proposes to use a return flow management plan that features 24-44% of return flow originating from outside of the Great Lakes basin, and a return amount of 112-152% of the volume withdrawn on average.

V. The application fails to show that the returned water will be treated to meet applicable permit requirements under s. 283.31.

The Compact requires that if water will be returned to the source watershed through a stream tributary to one of the Great Lakes, the physical, chemical, and biological integrity of the receiving water under subd. 3. must be protected and sustained as required under Wis. Stats. §§ 30.12, 281.15 and 283.31, considering the state of the receiving water before the proposal is implemented and considering both low and high flow conditions and potential adverse impacts due to changes in temperature and nutrient loadings. Wis. Stat. § 281.346(4)4s. Waukesha's application proposes to discharge effluent into the Root River, which is listed on the Department's current and pending 303(d) lists as impaired for both Phosphorus and Total Suspended Solids. In order to discharge in to an impaired waterway, the permittee must show that the discharge will improve water quality. Wis. Admin. Code NR 217.13(8)(b) In addition, Waukesha must show that its discharge would meet relevant Great Lakes Basin water quality standards for all pollutants. The Department must conduct a thorough analysis as a part of the Environmental Impact Statement to show that Waukesha's discharge can meet the standards set forth in Wis. Stats. §§ 30.12, 281.15 and 283.31.

VI. The application fails to show that there will be no significant adverse environmental impacts to the waters of the state resulting from the new or increased withdrawal.

Wis. Stat. §281.346(f)5 and §281.346(6)(b) require that a proposed diversion will "result in no significant adverse individual impacts or cumulative impacts to the quantity or quality of the waters of the Great Lakes basin or to water dependent natural resources, including cumulative impacts that might result due to any precedent-setting aspects of the proposed diversion, based upon a determination that the proposed diversion will not have any significant adverse impacts on the sustainable management of the waters of the Great Lakes Basin." In addition to an analysis of the impacts to the Great Lakes Basin and its tributary waters, the Department must include in its environmental impact statement an analysis of the impacts to the Fox River basin that would result from the proposed diversion.

For the foregoing reasons and those our coalition has communicated to the Department in the past, the undersigned organizations believe that Waukesha's diversion application cannot be approved as submitted. We encourage Department staff to contact us should they wish to discuss these or any past comments submitted by the Coalition on this matter. Thank you for your consideration of our input and for providing this written comment opportunity for all stakeholders and interested members of the public.

Sincerely,

Mark Redsten, Clean Wisconsin

Jodi Habush Sinykin, Midwest Environmental Advocates

Cheryl Nenn, Milwaukee Riverkeeper

Laurie Longtine, Waukesha County Environmental Action League

George Meyer, Wisconsin Wildlife Federation

Clean Wisconsin • Midwest Environmental Advocates
Milwaukee Riverkeeper • River Alliance of Wisconsin
Waukesha County Environmental Action League
Wisconsin Wildlife Federation

Mr. Eric Ebersberger
Section Chief, Water Use
Wisconsin Department of Natural Resources
101 S. Webster St.
Madison, WI 53703

April 28, 2015

Re: Waukesha's diversion application for Lake Michigan water

Dear Mr. Ebersberger,

We are writing to you as a follow up to the March 26th meeting between members of your Water Use Section and representatives from our Coalition and GZA GeoEnvironmental, Inc. We appreciated the opportunity to meet with Department staff, and we are confident that the important information we exchanged will facilitate the best possible evaluation of Waukesha's precedent-setting diversion application under the Great Lakes Compact.

Relating to the Department's assessment of whether there exists a reasonable water supply alternative to a Lake Michigan diversion, we understood from Department staff at the meeting that their modeling work has demonstrated potential environmental impacts from local groundwater pumping, in particular, to wetlands. We understood that this modeling work and prediction of potential environmental impacts relies upon, as a critical input, the applicant's inflated daily water demands that are attributable almost entirely to the proposed expanded water supply service area set forth in the City of Waukesha's application. In other words, the Department has based neither its modeling nor its reasonable water supply alternatives analysis on water demands attributable to a smaller water supply service area, namely, Waukesha's current water supply service area.

Our technical experts have indicated that potential impacts of even Waukesha's inflated level of future demand could be mitigated or avoided through strategic deep sandstone aquifer withdrawals together with appropriately-sited shallow aquifer wells. However, at this point we do not see the value of expending time and resources quibbling over the particularities of well siting or deep-versus-shallow aquifer pumping distribution ratios when the surest, most prudent way to avoid the potential adverse environmental impacts predicted by the Department is to evaluate, as a potential reasonable water supply alternative for the applicant, a more limited future water supply service area for the Waukesha Water Utility.

Indeed, we compliment the Department's concern relating to wetland impacts and view the Department's modeling results as a call to action, obligating the Department to adjust its Fox River modeling work and reassess its reasonable water supply alternative inquiry based upon the water demand amounts attributable to Waukesha's current water supply service area. By adjusting the Department's modeling to reflect a more appropriate service area, we expect the

estimated environmental impacts to be greatly reduced, especially as relates to the wetlands that Department staff have identified as of possible concern.

Equally important, this more conservative approach comports with the Great Lakes Compact's legal requirements that a community within a straddling county seeking a Great Lakes diversion first must show: (1) an inadequate supply of potable water; and (2) demonstrated water conservation. A Waukesha application that is predicated upon an expanded water supply service area and includes portions of "non-compliant" communities, that is, those who satisfy neither of the above criteria, will not pass legal muster upon Great Lakes Compact regional review. Nor does the proposed expanded water supply service area underlying the City of Waukesha's application comply with Wisconsin law, with respect to either the state's definition of a "community" or the provisions of the state's exception standard governing Great Lakes diversion requests.

Thus, on this basis, we urge you to proceed further with your evaluation of the Compact's "no reasonable water supply alternative" requirement by revising or augmenting your modeling work to assess the water supply needs of a service area consistent with the City of Waukesha's current city limits and existing service area. An evaluation based solely on the proposed expanded service area is misleading in terms of potential environmental impacts and does not comply with the Great Lakes Compact. Accordingly, our Coalition requests a response from the DNR as to whether the Department will be willing to pursue the additional modeling work and assessments urged above.

Thank you again for the opportunity to meet and discuss these matters of importance to Wisconsin's and our region's commitment to the Great Lakes Compact.

On behalf of the Compact Implementation Coalition,

Jodi Habush Sinykin
Of Counsel
Midwest Environmental Advocates

Cc: Compact Implementation Coalition:
Clean Wisconsin
Midwest Environmental Advocates
Milwaukee Riverkeeper
River Alliance of Wisconsin
Waukesha County Environmental Action League
Wisconsin Wildlife Federation

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:
.
GZA GeoEnvironmental, Inc.

James F. Drought, P.H.
Senior Consultant

Jiangeng (Jim) Cai, P.E.
Principal Hydrogeologist

John C. Osborne, P.G.
Senior Principal District Office Manager

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.

###

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]

[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:

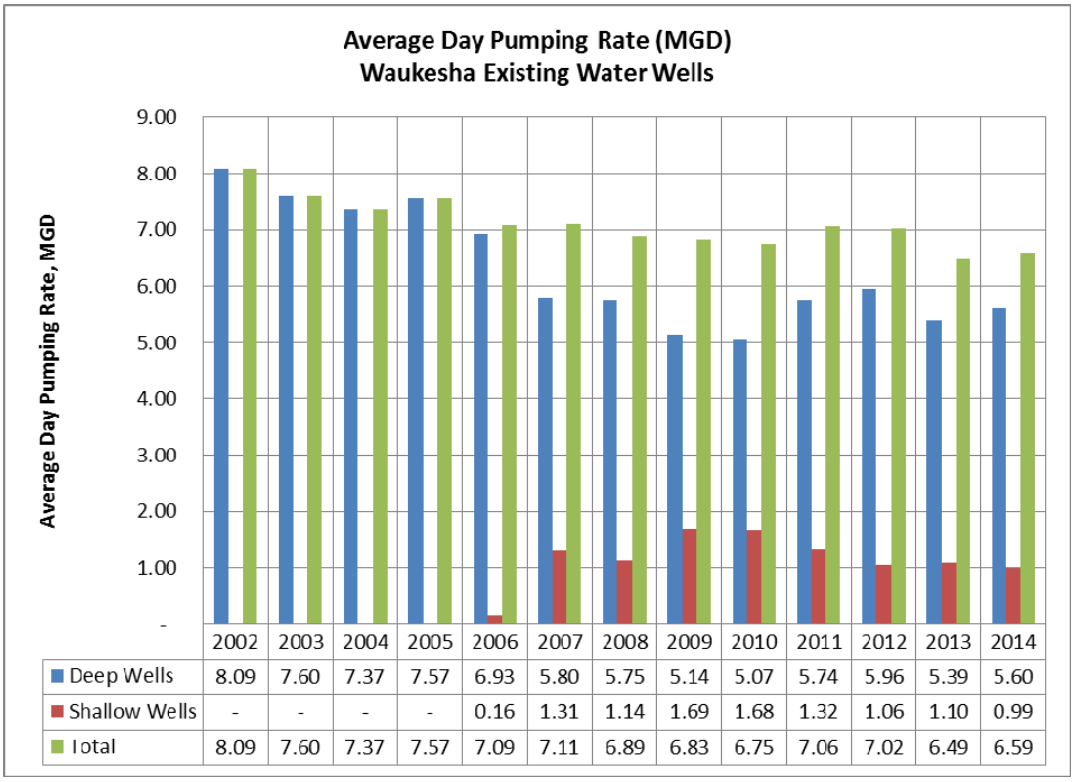
- Average day pumping rates from 2002 to 2014 (Waukesha Water Utility data);
- The City's Revised Application of 2013;
- An Analysis of the City's Diversion Application (Nicholas, 2013);[6]
- Radium data for the City's wells (downloaded from the WDNR);
- Proposed water supply alternative and cost estimates 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.

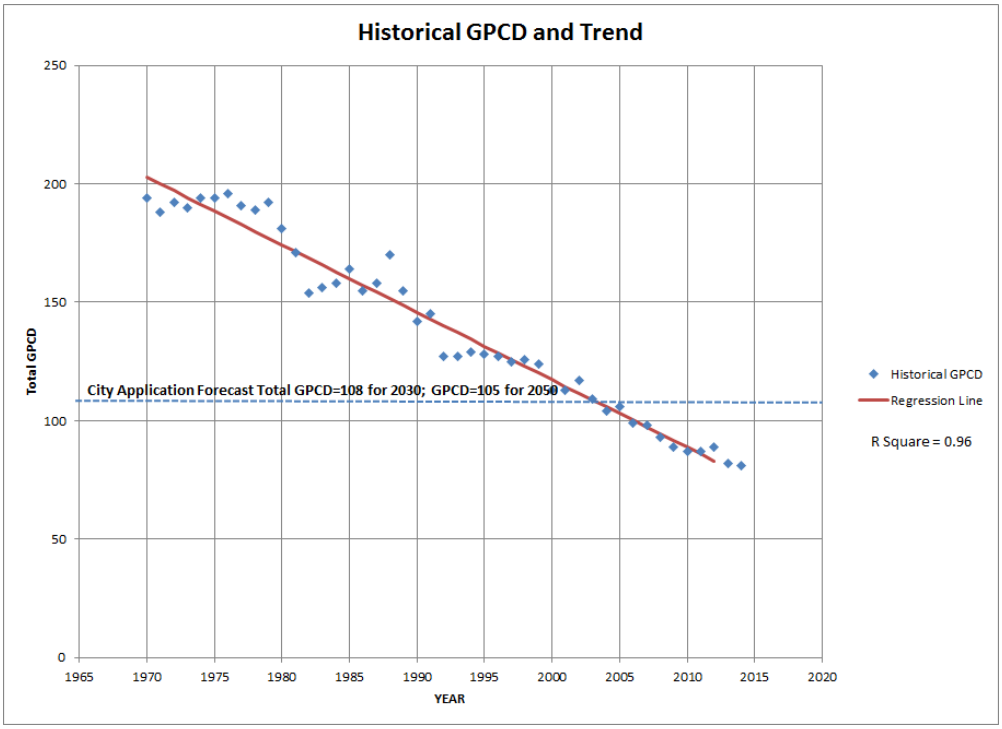


Figure 2: Historical GPCD and Trend

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." (See Attachemnt 2)

(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.

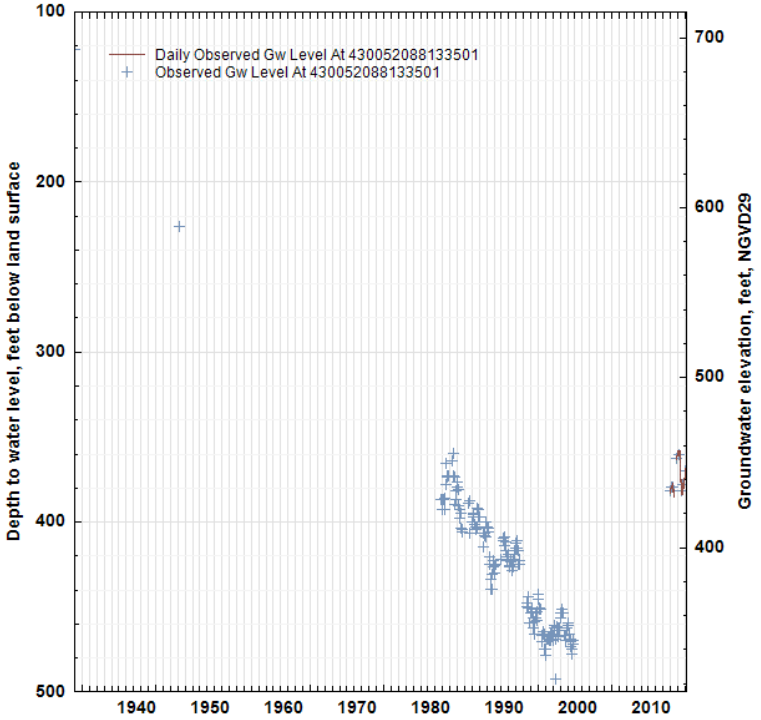


Figure 3: Groundwater Level Data, USGS Monitoring Well ID 430052088133501

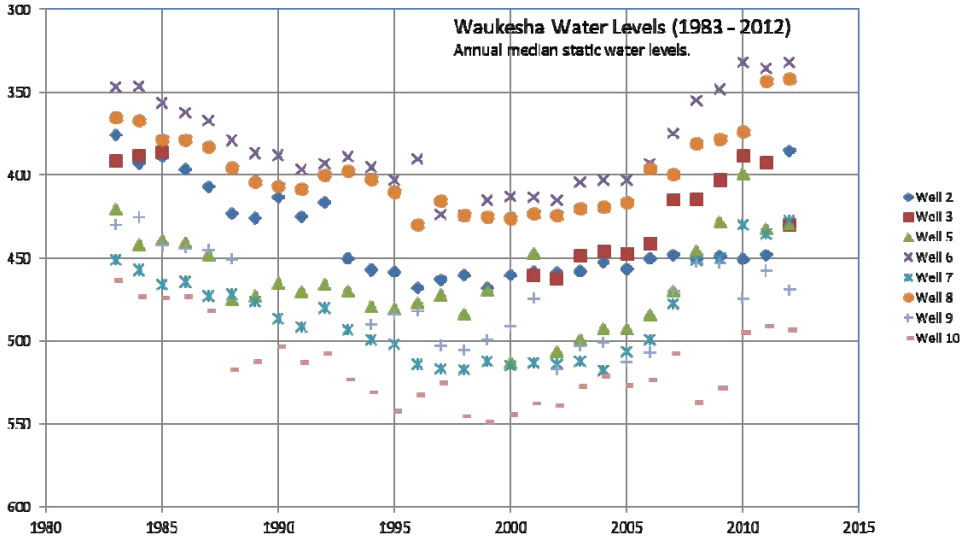


Figure 4: Groundwater Level Data, City of Waukesha Deep Aquifer Wells

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,

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Attachments: Tables 1, 2 and 3
Attachment 1
Attachment 2

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/

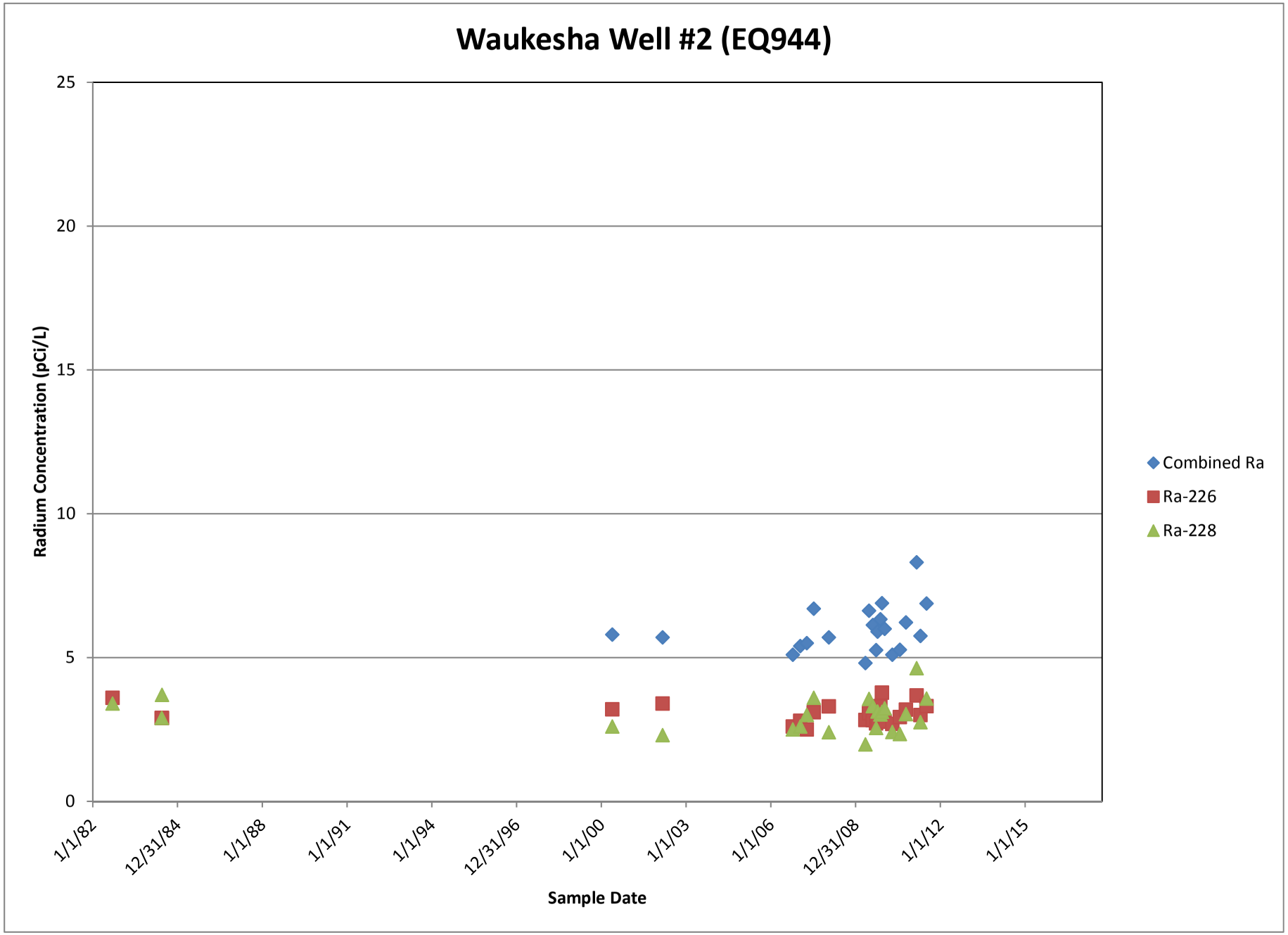
Table 3
Estimated 95% UCLs of Pre-treatment Radium Concentrations, and Post-Treatment Radium Concentrations
Blended Radium Concentrations

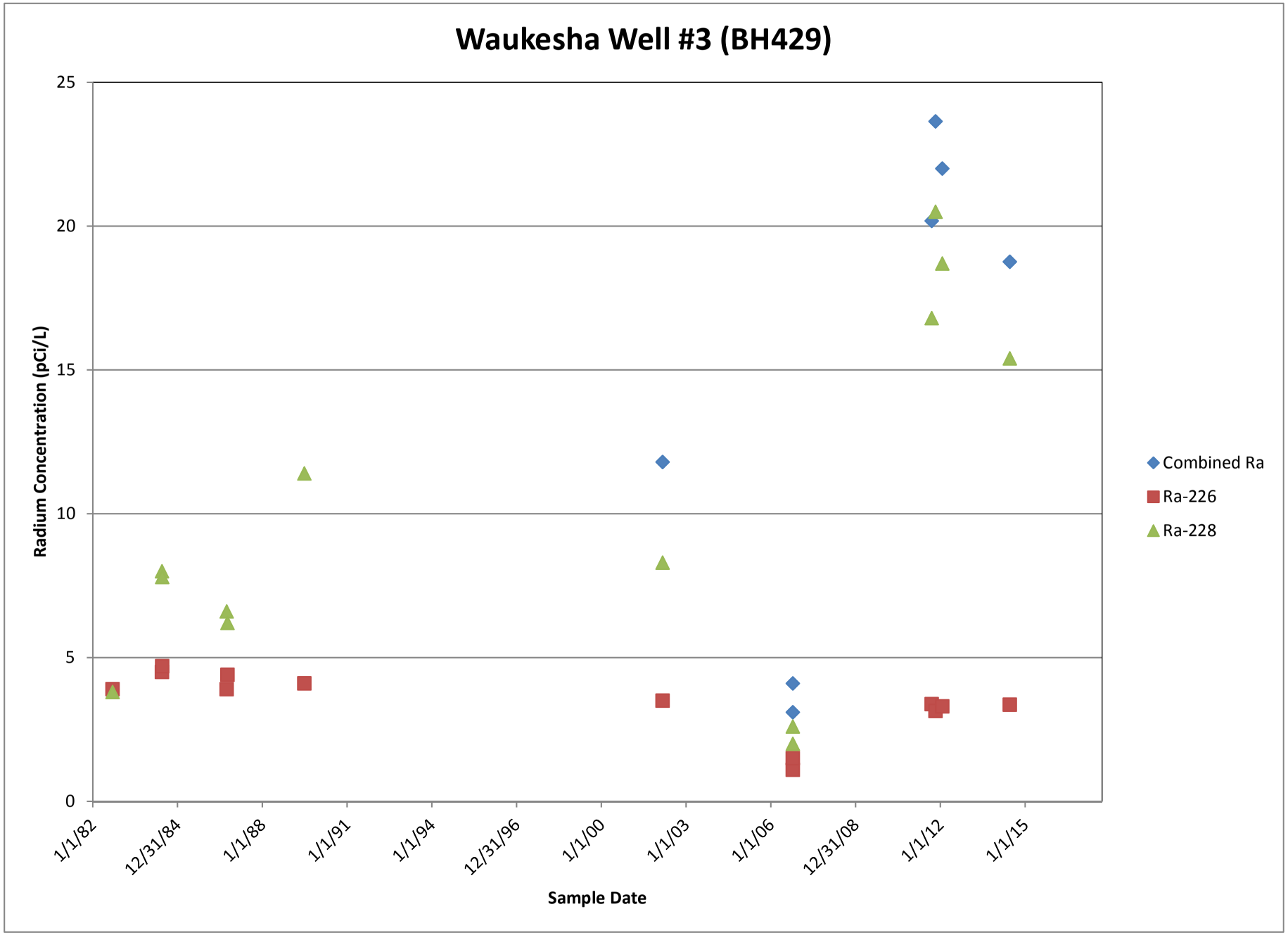
Year	Well 2	Well 3	Well 5	Well 6	Well 7	Well 8	Well 9	Well 10	Blended Concentration if Pumping at Previous Annual Rate, pCi/L
Pre-Treatment Radium Concentration (95 UCL), pCi/L	6.273	21.05	8.461	10.48	5.75	9.879	11.82	11.41	
Proposed Treatment Technology	None	Existing HMO	None	RO	None	RO	None	RO	
Post-Treatment 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**

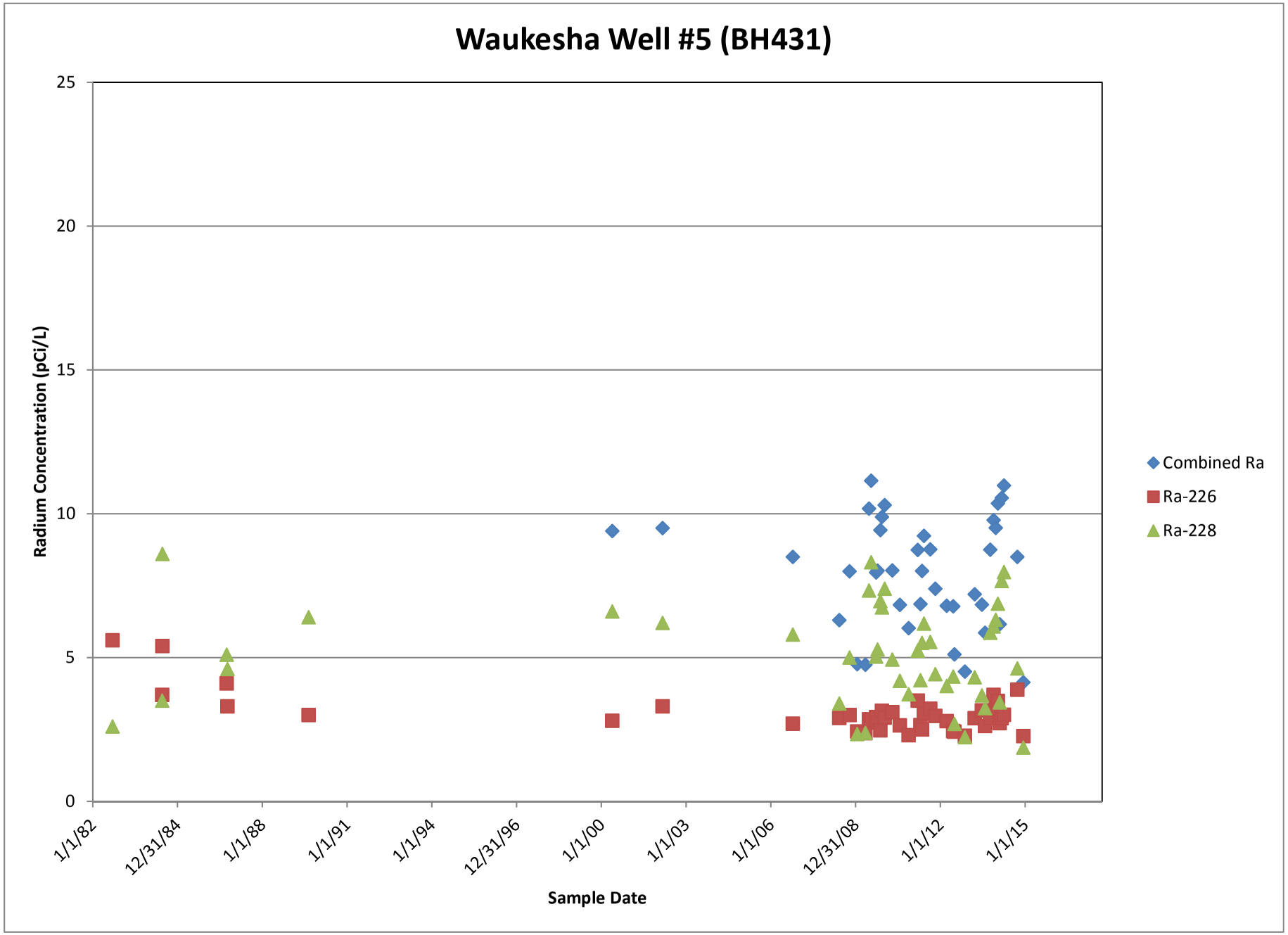
Note: RO denotes reverse osmosis; HMO denotes hydrous manganese oxide treatment.
The Maximum Contaminant Levels (MCLs) for combined radium is 5 pCi/L.

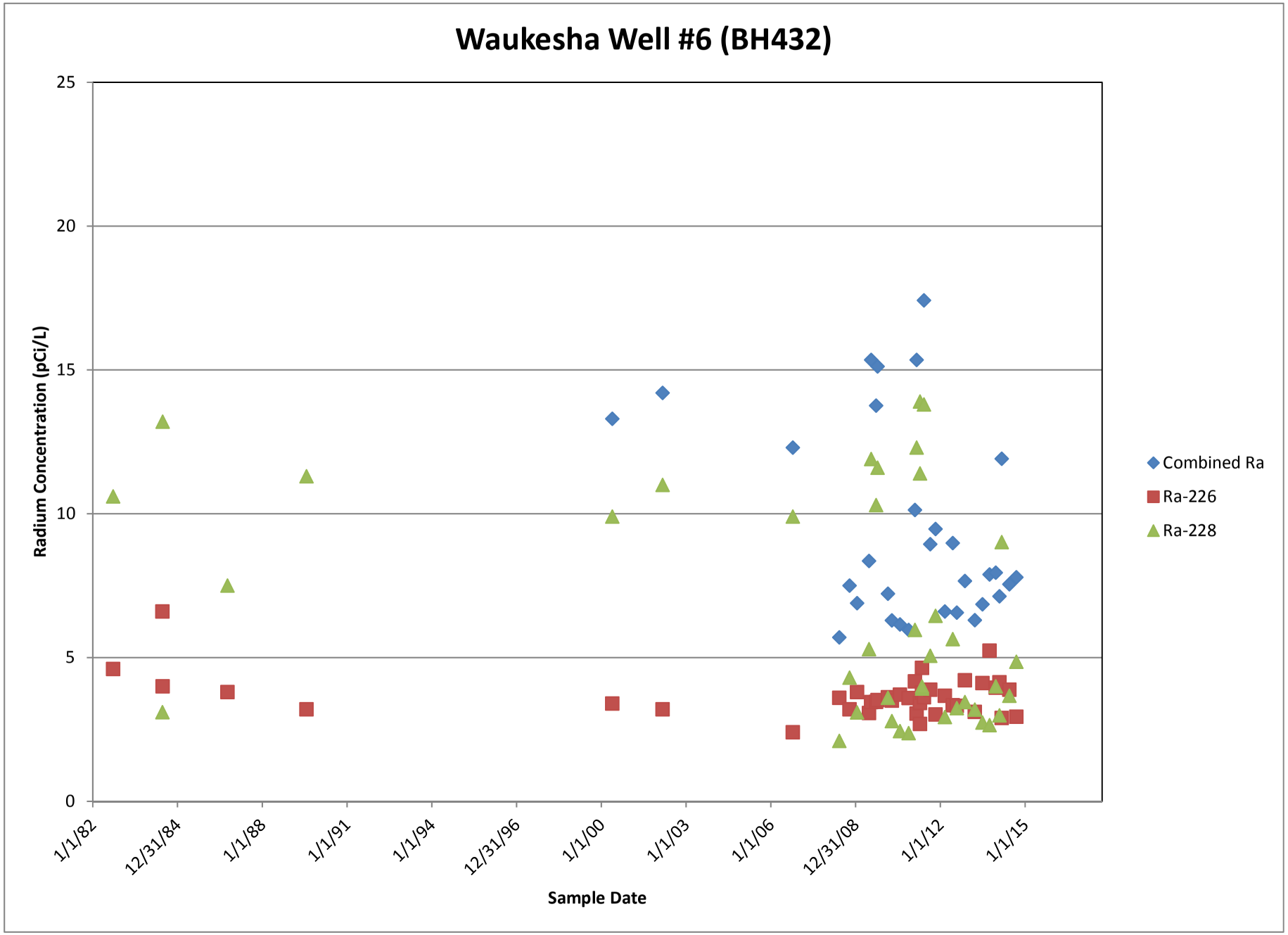
ATTACHMENT 1

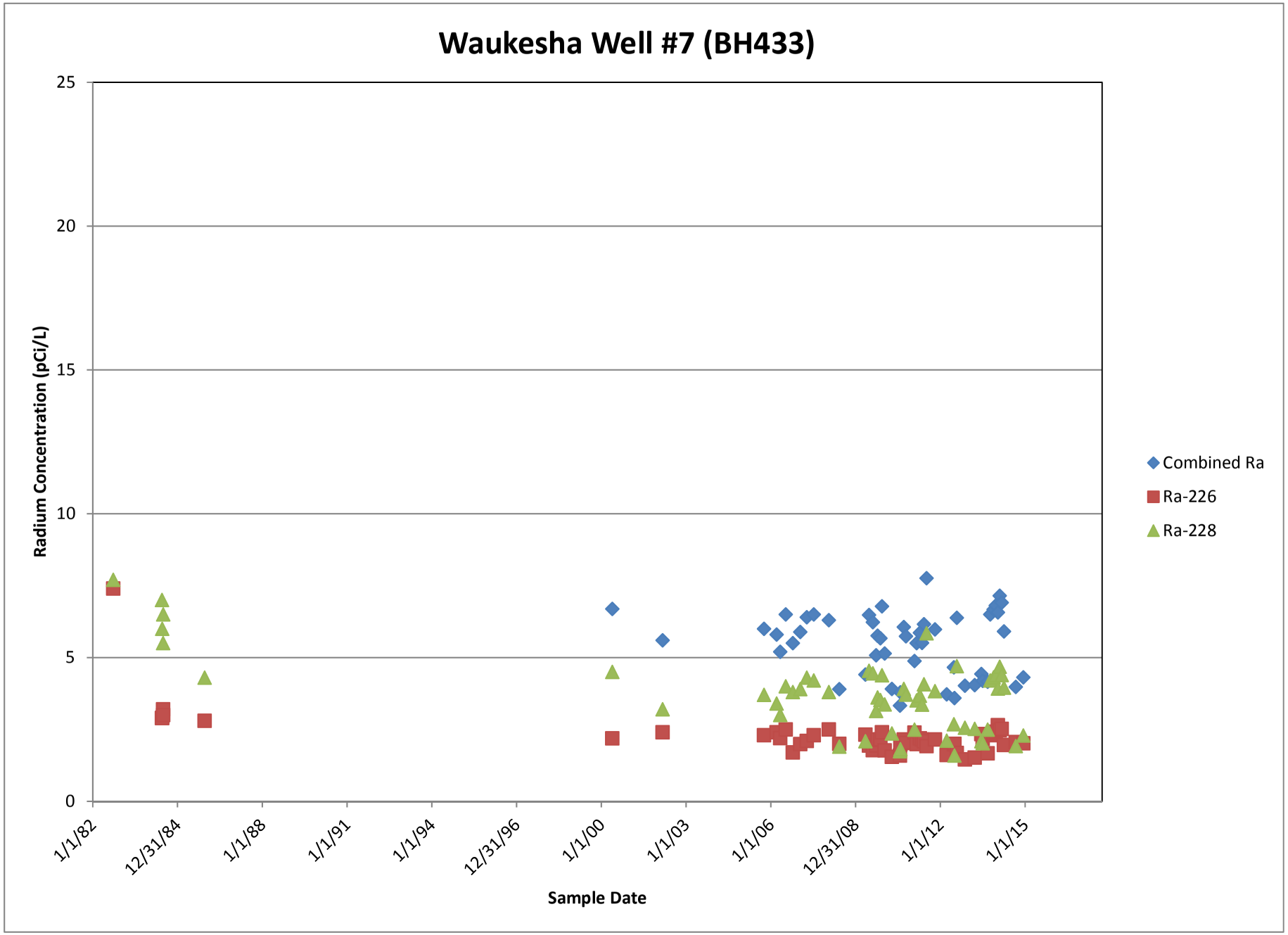
Plots of Pre-Treatment Radium Levels

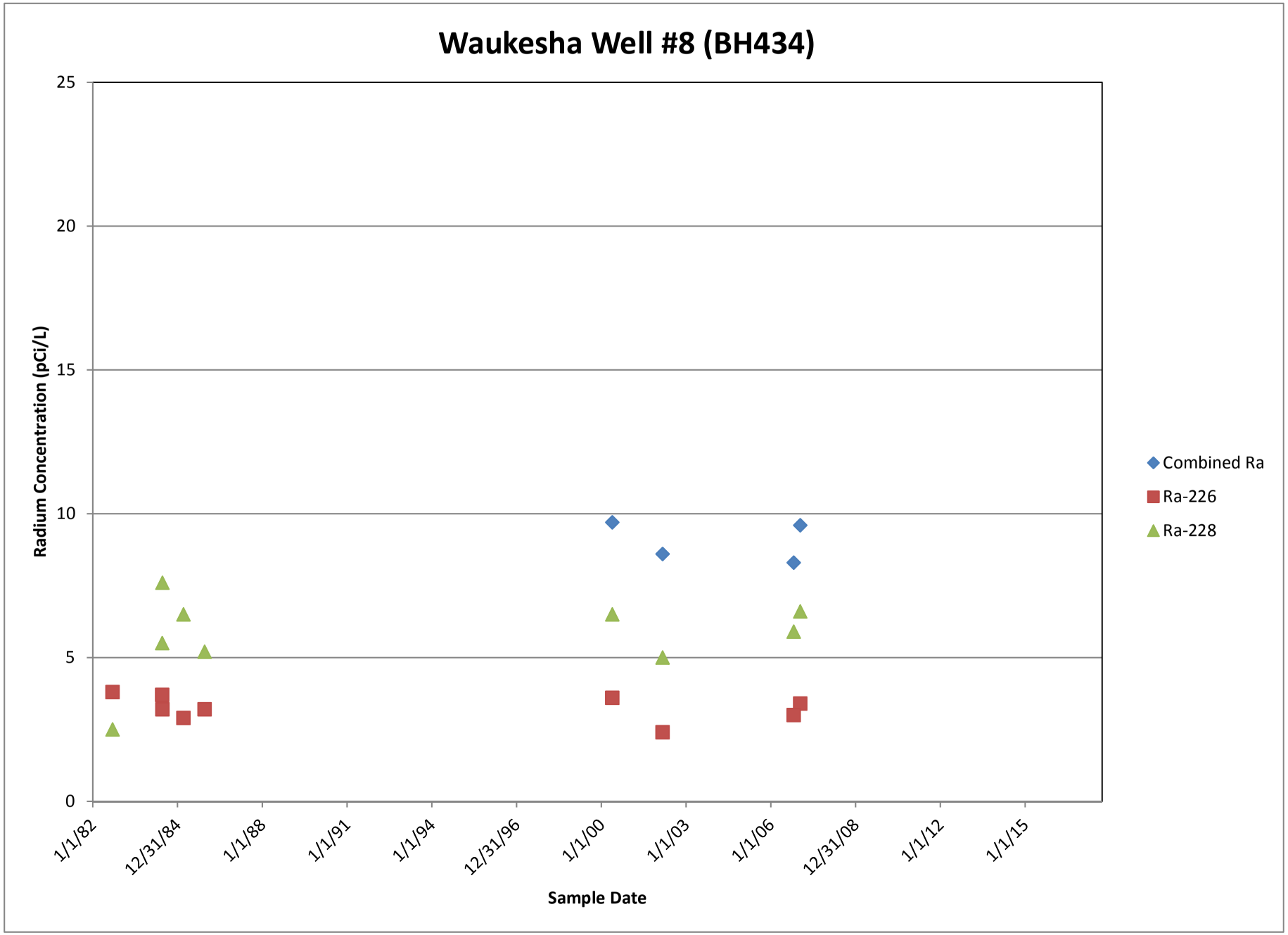

Waukesha Well #2 (EQ944)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228

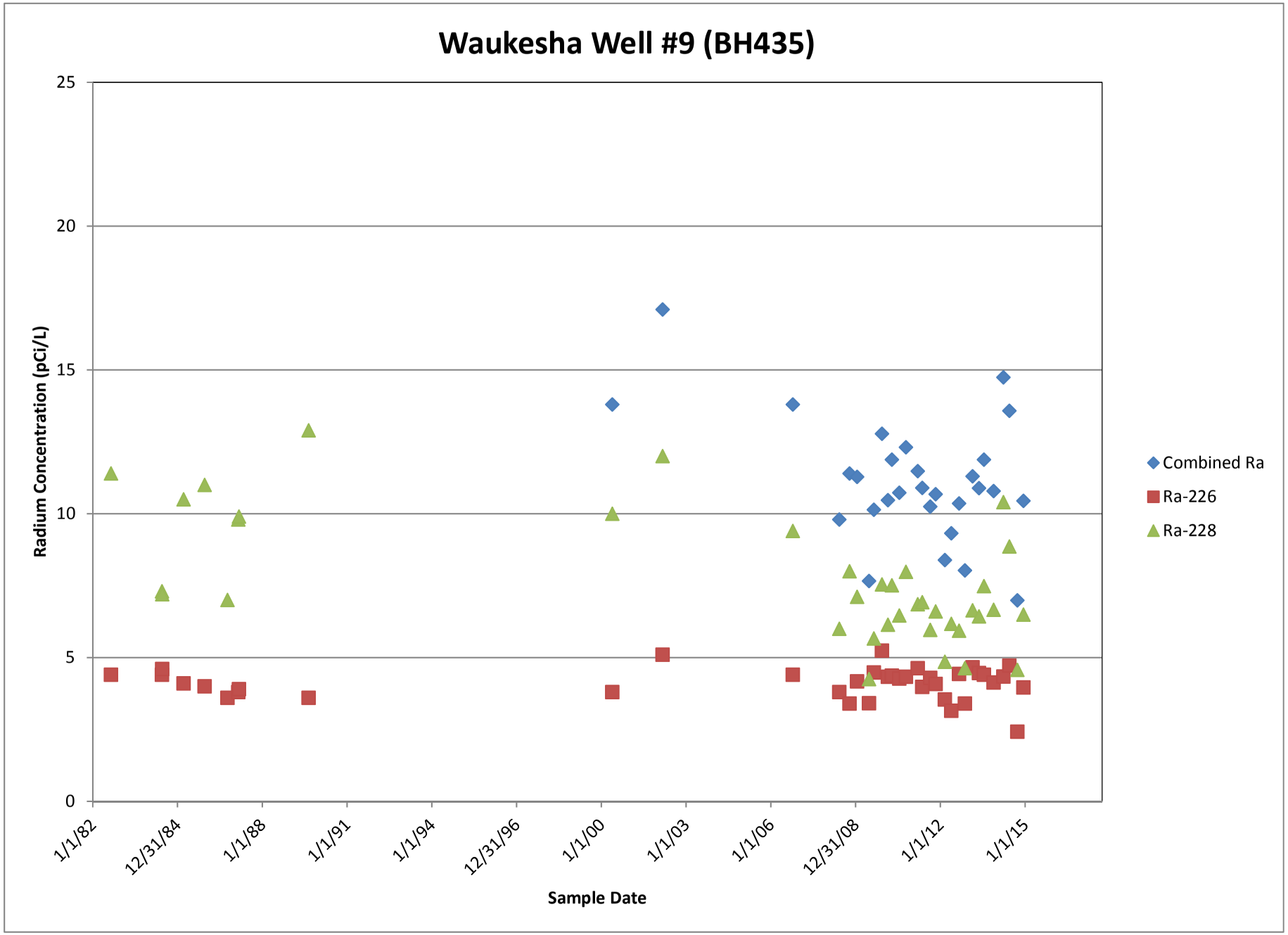

Waukesha Well #3 (BH429)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


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

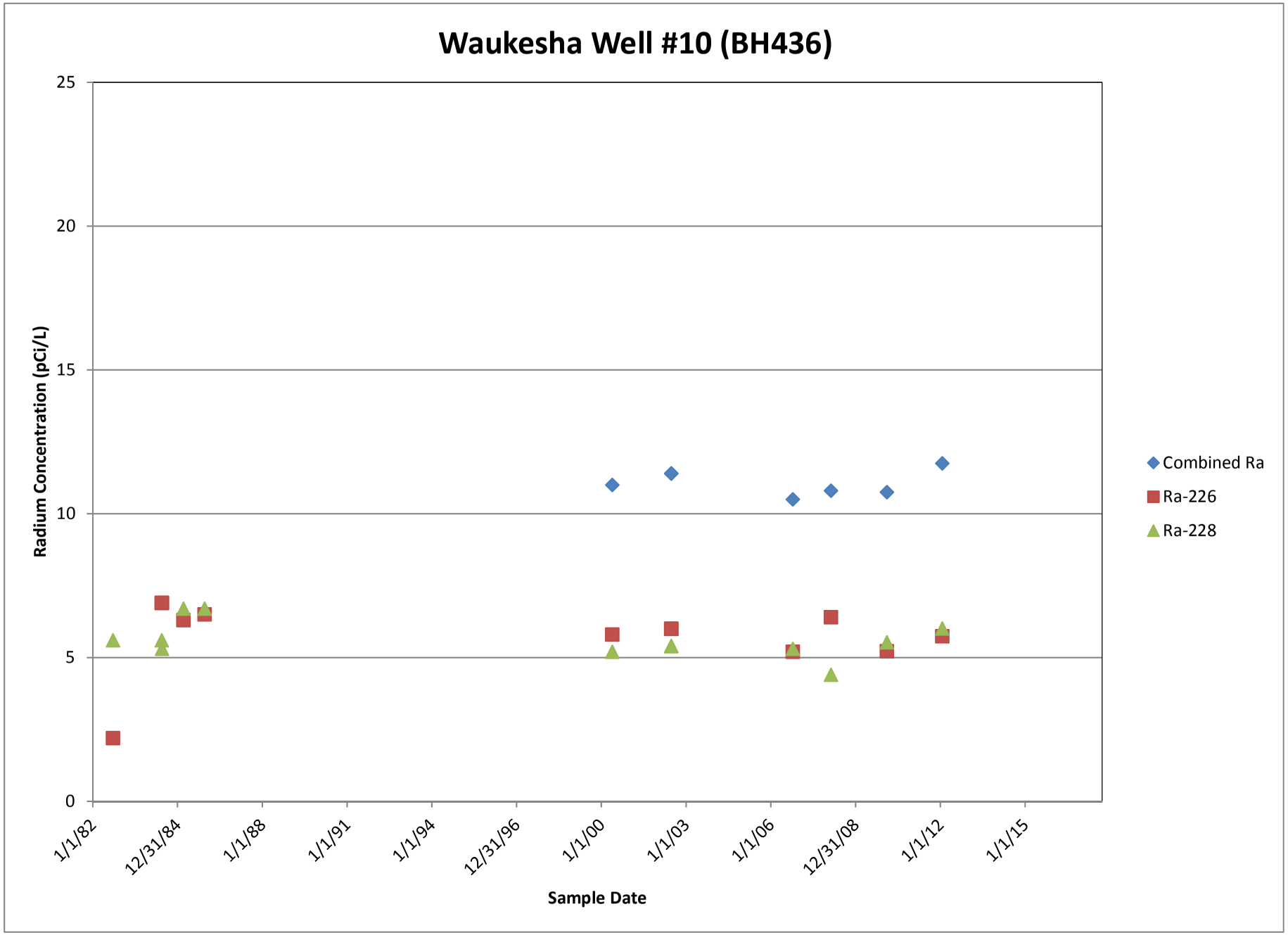

Waukesha Well #10 (BH436)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228

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**
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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**
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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 2

Mead & Hunt, July 7, 2015

"City of Waukesha 6.7 MGD Water Demand

Alternative."

Mead & Hunt
102 W. Washington Street, Suite 213
Marquette, Michigan 49855
906-273-1568
meadhunt.com

July 7, 2015[1]

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

Subject: Waukesha 6.7 mgd Water Demand Alternative

Dear Mr. Meyer:

In accordance with our revised scope of work that you requested in May, Mead & Hunt (M&H) has evaluated the City of Waukesha, Wisconsin (City) groundwater well sources necessary to provide a 6.7 million gallon per day (mgd) average demand water service to the City. This 6.7 mgd water demand has been forecast by GZA in a June 9, 2015 memo as the future 50-year demand for the City of Waukesha's current water supply service area only, with no expanded service area to include adjacent communities as proposed in the Application. Based on the GZA water demand forecasts of 6.7 mgd average demand and 11.1 mgd maximum daily demand for the City, we have evaluated which wells should be included in the City water source to provide those demands, and we have estimated the total project capital cost and the annual operation and maintenance (O&M) cost for that alternative, referred to as Alternative 1C – Existing Deep and Shallow Wells for 6.7 mgd Average Day. This memo is an amendment to the report "CITY OF WAUKESHA'S APPLICATION FOR DIVERSION OF LAKE MICHIGAN WATER PHASE 2: RECOMMENDATIONS FOR AN ALTERNATIVE WATER SUPPLY", prepared by Mead & Hunt and dated April 6, 2015 (Report). It reflects significant new information brought to light in the intervening time by GZA's investigations on behalf of Clean Wisconsin and its coalition partners.

For Alternative 1C, the seven existing Waukesha deep aquifer wells, numbers 3, 5, 6, 7, 8, 9, and 10, would be used to provide 5.7 mgd of the 6.7 mgd average day demand, and 9.6 mgd of the 11.1 mgd maximum day demand. The existing shallow aquifer wells, numbers 11, 12, and 13, would provide 1.0 mgd for average day and 1.5 mgd for maximum day. These well flows represent similar pumping rates for the wells to those flows listed for the wells for Alternatives 1A and 1B in Figure 5 of the Report.

[1] Amended August 27, 2015

Alternative 1C includes three new reverse osmosis (RO) treatment plants for the deep wells 6, 8, and 10, as provided for Alternatives 1A and 1B in the Report. The existing treatment for wells 3, 11, and 12 is proposed to be continued in Alternative 1C. Seven miles of new transmission pipeline between deep wells 5, 6, 7, 8, and 9 would be included in Alternative 1C, to provide blending of the treated and untreated deep wells before pumping water into the Waukesha water system.

All of these recommendations mirror Waukesha's own assumptions in the 2013 diversion application, specifically those detailed in connection with the Water Utility's Alternative 1: Deep Confined Aquifer and Shallow Aquifer.

For example, to facilitate direct, apples-to-apples comparison with the alternatives detailed in the Application, we base this analysis on Waukesha's assumption that the Water Utility and the City's wastewater treatment plant could deal with any waste streams resulting from the current and proposed new drinking water treatment technologies that would be necessary to meet applicable drinking water quality standards. Mead & Hunt did not evaluate the reasonableness of that assumption on Waukesha's part, nor did we estimate costs for treatment of possible waste streams Waukesha may have not included.

It bears mention that Mead & Hunt would not necessarily recommend reverse osmosis treatment for Waukesha's existing deep aquifer wells. Were Waukesha Water Utility our client, we would evaluate the many available options for treatment of radium and other water quality parameters. Reverse osmosis is a tried and true treatment technology[2], and we are aware that at least one Wisconsin water utility has employed RO for its drinking water treatment purposes[3]. We are also aware that many of Wisconsin's forty plus utilities managing for radium compliance use a combination of blending and treatment with technologies other than RO[4]. For purposes of this analysis, we took Waukesha's own assumptions in its application as our own to facilitate realistic side-by-side comparisons.

[2] The United States Environmental Protection Agency notes that "Reverse osmosis has been identified by EPA as a "best available technology"(BAT) and Small System Compliance Technology (SSCT) for uranium, radium, gross alpha, and beta particles and photon emitters. It can remove up to 99 percent of these radionuclides, as well as many other contaminants (e.g., arsenic, nitrate, and microbial contaminants)."
http://cfpub.epa.gov/safewater/radionuclides/radionuclides.cfm?action=Rad_Reverse%20Osmosis.
[3] Waupun Utilities: http://www.ati-ae.com/resources/tech-talk/188-waupun-ro.html and
http://www.waupunutilities.com/media/power_point_on_water_plant.ppt.
[4] http://dnr.wi.gov/files/pdf/pubs/dg/dg0008.pdf: Wisconsin Department of Natural Resources, 2014. And
http://www.sehinc.com/awards/2007/brookfield-square-water-treatment-facility-receives-several-awards.

Deep Well Treatment Plant			
3 RO plants for Wells 6,8,10 @ 5.35 mgd	5,350,000	$4.57	$24,460,000
including land built in 2020			**$24,460,000**
Distribution System Improvements			
4.3 mi of 16", 24", and 30" pipes	22,500	$413	$9,289,000
7.0 mi of 16" pipe for blending	36,960	$323	$11,938,000
			$21,227,000
		Subtotal	$45,687,000
3% markup for Bonds & Insurance			$1,371,000
5% markup for Mob/Demob			$2,284,000
8% markup for Contractors Overhead			$3,655,000
4% markup for Contractors profit			$1,827,000
		Subtotal	$9,137,000
25% Contingency			$13,706,000
		Subtotal Markups and Contingency	$22,843,000
		Total Project Construction Costs	**$68,530,000**
8% allowance for engineering and design			$5,482,000
12% allowance for permitting, legal and admin.			$8,224,000
8% allowance for engr services during construction			$5,482,000
		Subtotal Other Project Costs	**$19,188,000**
		Total Project Capital Cost	**$87,718,000**

FIGURE 1: Alternative 1C: Existing Deep and Shallow Wells — Capital Costs

The Alternative 1C capital cost estimate is $87,718,000, as shown in Figure 1. This cost is much less (50% less) than the $176,287,000 capital cost estimate for Alternative 1A in the Report. The Alternative 1C annual O&M cost estimate is $5,471,000 per year, 20% less than the $6,821,000 per year estimate for Alternative 1A in the Report. The Alternative 1C annual O&M cost is shown in Figure 2. The total present worth of the Alternative 1C costs are

$150,787,000 for 20 years and $173,584,000 for 50 years , 58% and 60% of the Alternative 1A 20- and 50-year costs, respectively, as presented in the Report. The present worth costs are also shown in Figure 2.

Source of Supply	Units	Quantity	Unit Cost	$/year
Deep Well pumping/maintenance	$/1000 gal	2,190,000	$0.35	$728,000
Shallow Well Pumping/Maintenance	$/1000 gal	365,000	$0.14	$51,000
			Total	**$779,000**
Treatment/Pumping				
Deep Wells 6,8,10 starting in 2020	$/1000 gal	1,460,000	$0.61	$891,000
Shallow Wells	$/1000 gal	365,000	$1.09	$398,000
Residuals	$/1000 gal	128,000	$4	$512,000
			Total	**$1,801,000**
Home Softening				
Salt/Equipment/Replacement	$/person/yr	13,683	$209	$2,860,000
			Total	**$2,860,000**
Transmission				
Operation and Maintenance	$/lf/year	59,460	$0.52	$31,000
			Total	**$31,000**
	Alternative 1C Total		**O&M($/yr)**	**$5,471,000**
PRESENT WORTH OF O&M (6%, 20 yrs)	$63,069,000			
PRESENT WORTH OF O&M (6%, 50 yrs)	$85,866,000			
Total Present Worth (6%, 20 years)	$150,787,000			
Total Present Worth (6%, 50 years)	$173,584,000			

FIGURE 2: Alternative 1C: Existing Deep and Shallow Wells — O&M Costs

Alternative 1C includes facilities that are predicted to be capable of meeting the Waukesha Water Utility's 50-year water system demands for the existing City Water Supply Service Area. The alternative provides water to the City from its existing wells, with existing and new treatment facilities to meet the radium water quality standards. The potential for environmental impacts to private wells, tributary streams, and wetlands would be zero in this scenario because no new wells are included. The capital costs for Alternative 1C are significantly less than 1A, 1B and the proposed diversion alternative, and present worth costs are also less than other alternatives. Alternative 1C is very feasible, as it incorporates existing wells, with new radium treatment plants and less piping than other alternatives.

Please advise if you have any questions or require further information. Thank you for the opportunity to be of service.

Sincerely,

Donald DeGrand
Senior Engineer
Mead & Hunt

CC: Jiangeng Cai, GZA GeoEnvironmental, Inc.

CITY OF WAUKESHA'S APPLICATION FOR DIVERSION OF LAKE MICHIGAN WATER

PHASE 2: RECOMMENDATIONS FOR AN ALTERNATIVE WATER SUPPLY

By Mead & Hunt

April 6, 2015

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

Clean Wisconsin retained Mead and Hunt ("M&H") to conduct an analysis and investigation into the City of Waukesha's ("Waukesha") application for diversion of water from Lake Michigan, and to provide comment and recommendation on the feasibility of any already-identified alternative water supplies as well as to provide identification and analysis of any additional alternative water supplies discovered by M&H.

Phase 1 of this analysis and investigation included:

1) Preliminary review of Waukesha's proposed revised application for an alternative water supply.
2) Meeting with Clean Wisconsin to discuss the WDNR application, environmental impacts, alternatives, and schedule.
3) Tour of the proposed alternative supplies and drinking water source area with Clean Wisconsin staff, and discuss potential areas of concern or interest.
4) Existing alternative water supply analysis data and WDNR applications review.
5) Review of Waukesha water quality data, WDNR water sources information, WDNR laboratory analysis/reports, and other technical information.
6) Great Lakes Compact and other state and federal laws and regulations review.
7) Potential alternative water supplies, water quality data, capacities, environmental impacts, and hydraulics research.
8) Phone meetings with Clean Wisconsin to discuss preliminary findings, analysis concerns, and a potential alternative water supply.

Phase 2 of the analysis included recommendations for alternative water supplies to Clean Wisconsin. The alternative identified for further consideration is a combination of ground water sources including the existing deep wells, shallow wells, and new river bank induced flow wells proposed to be installed along the Fox River in the southern part of the City of Waukesha and south of the City.

The estimated total project capital cost for this alternative, referred to as "Alternative 1A – Deep and Shallow RBI Wells", is **$176,287,000**. This cost is nearly $30 million or about 15% ***less than*** the Application estimated total project capital cost for Alternative 2 – Lake Michigan Supply. The Alternative 1A estimated Total Operation and Maintenance (O&M) cost is **$6,821,000 per year**, which is $1.08 million ***less than*** the Lake Michigan Supply. The Alternative 1A estimated 50-year Total Present Worth Cost is about $283 million, which is about 13% ***less than*** the Application estimate for Lake Michigan Supply.

The predicted environmental impact implementing of the alternative 1A project is expected to be somewhat greater than the Lake Michigan Supply. The environmental impacts on wetlands, private wells, and stream base flows are expected to be much less than the ground water alternatives presented in the Application, based on the Fox River Model predicted effects of the RBI alternative on the local water table.

II. SUMMARY OF APPLICATION PROCESS

According to the WDNR website:

The City of Waukesha submitted an updated Application for a Lake Michigan Diversion with Return Flow (Application) in mid-October 2013. The Application states that Waukesha needs a new source of water to address water quantity and quality concerns. Waukesha currently obtains its public water supply primarily from groundwater wells in a deep aquifer where water levels have been drawn approximately 500 feet from pre-development levels. Groundwater pumped from the deep aquifer contains high levels of radium, a carcinogen. The public supply is supplemented by water from the shallow aquifer. Waukesha seeks an exception from the prohibition of diversions under the Great Lakes-St. Lawrence River Basin Water Resources Compact.

Waukesha seeks to divert an annual average of 10.1 million gallons of water per day with a maximum day diversion of 16.7 million gallons per day by final build-out of the water supply service area (approximately 2050). The water is proposed to serve an area that includes all of the City of Waukesha and may also serve portions of the City of Pewaukee and the towns of Waukesha, Genesee, and Delafield in the future.

The Application proposes to purchase treated Lake Michigan water from the City of Oak Creek. The water will be transported to Waukesha via a pipeline and distributed to customers. The application also proposes that, after consumptive use, remaining water along with infiltration and inflow storm water will be treated at the Waukesha wastewater treatment plant before it is piped to the preferred discharge alternative, the Root River. Any amount of treated wastewater in excess of 16.7 million gallons per day would be returned to the Fox River, which is the City of Waukesha's current discharge location.

The City of Waukesha originally submitted its diversion application in May 2010. This updated application (in October 2013) was in response to the WDNR's request for additional information and a reorganized application to facilitate agency and public review.

The City of Waukesha submitted an updated application to the DNR on October 14, 2013. At the WDNR's request, the City of Waukesha held several public informational meetings in November on the revised application. The DNR also held a comment period on the revised application that closed on December 2, 2013.

In December 2013, the WDNR sent letters to the City of Waukesha asking the City to clarify the demand estimates provided in its application and to provide additional detail on the City's water conservation plan.

Most recently, the Wisconsin DNR sent a letter May 23, 2014, to the City of Waukesha asking the City to review its preferred wastewater discharge location in the Lake Michigan Basin.

III. PHASE 2 - RECOMMENDED ALTERNATIVE WATER SUPPLY

Upon completion of Phase 1 of this project, an alternative water supply was evaluated that would provide multiple water sources including riverbank inducement (RBI) shallow wells near the Fox River, other shallow wells, and the deep confined existing city wells with treatment to meet the radium standards. The following are recommendations for an alternative water supply and a summary of the research and analysis supporting these findings. These recommendations are somewhat limited in scope and development by the quick response time necessary to forward these recommendations to the DNR review process and the limited access to data available in the various reports and studies.

The recommendations include the following:

A. Identification of alternative water supply, if any, and research/analysis related to that alternative water supply
B. Identification of trends for both 35- and 40-year planning periods in the water production and consumption data for any alternative water supply
C. Analysis of water quality for alternative water supply
D. Assessment of alternative water supply's ability to meet state and federal drinking water standards for radium
E. Comparison of alternative water supply to Lake Michigan
F. Assessment of return flow water quality of alternative water supply
G. Identification of possible environmental/health concerns with alternative water supply.

A. Alternative Water Supply Description, Research, and Analysis

1. Introduction

An additional Waukesha water supply alternative considered in this report was a combination of the existing deep and shallow Waukesha wells augmented with expanded area of new shallow RBI wells. The new RBI wells are modeled as shallow aquifer wells placed close enough to the Fox River to induce part of the water they pump to flow to them through the riverbank. Due to their location near the Fox River, the existing Waukesha Wells 11 and 12 currently pump a part of their water production through induced flow from the Fox River. See Figure 1 for a location map of the existing wells 11 and 12, Fox River and other physical features. The addition of RBI wells to satisfy the future Waukesha water supply demands will reduce the significant aquifer drawdown effects of the alternatives described in the Application, and provide an alternative with similar costs but fewer environmental impacts.

The Deep Wells with Shallow RBI Wells Alternative, Alternative 1A, was initially evaluated for an average day demand of 10.1 mgd and maximum day of 16.7 mgd. Subsequently the report was

revised to include evaluation of Alternative 1B, with the same well water sources providing an average day demand of 8.5 mgd and maximum day of 14.1 mgd. Although the maximum day is stated lower for Alternative 1B, the alternative includes the same well sources as Alternative 1A, with capacity to meet the 16.7 maximum day demand if necessary. Alternative 1B is evaluated further in report Section III.H.

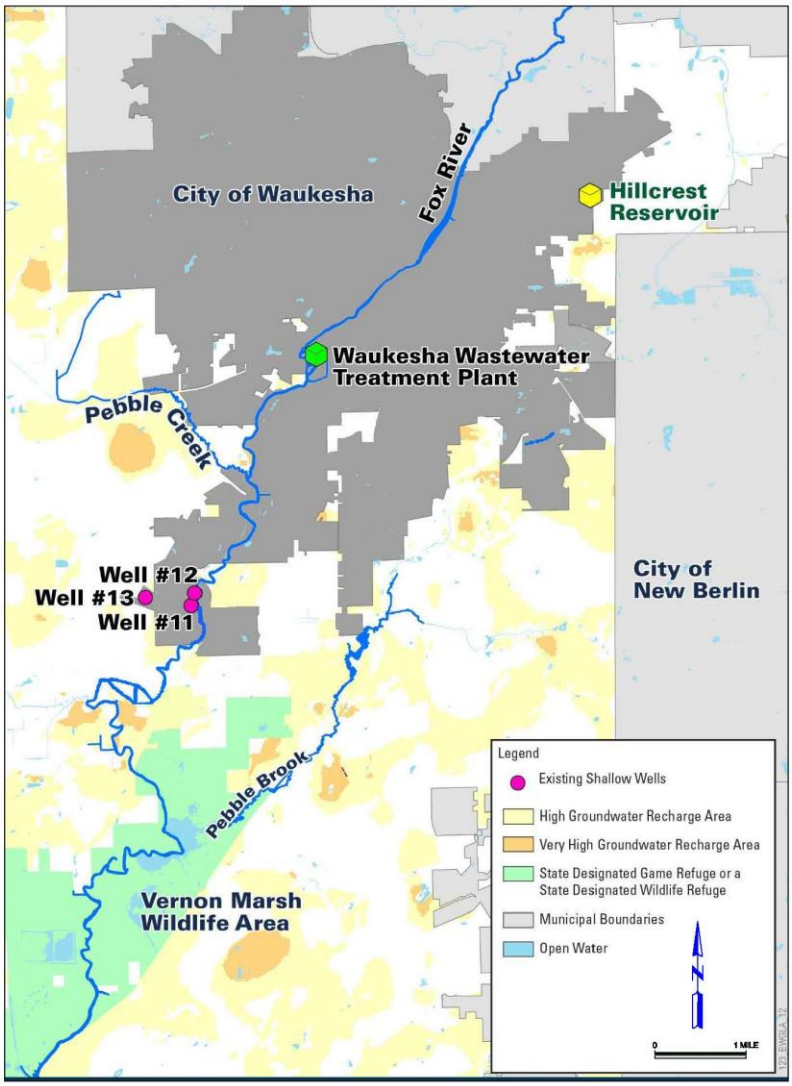


FIGURE 1: WAUKESHA LOCATION MAP

2. Riverbank Filtration Evaluation

The Phase 1 evaluation included a review of the USGS Report 2012–5108, a Groundwater/Surface-Water Flow Model for the Upper Fox River Basin and a review of comments by Douglas Cherkauer and Timothy Grundl, dated November 27, 2013, regarding the RBI shallow well modeling and the associated impact on the shallow ground water surface in the area. The USGS Fox River Model (FRM) for the RBI wells modeled along the river indicates much less impact than the Troy Bedrock Valley model (TBVM) used to model the shallow wells in the Waukesha diversion application (Application) due to the lower predicted drawdowns for the shallow wells. The Cherkauer document details several technical points that explain how the TBVM used in the Application has shortcomings in adequately modeling the groundwater withdrawal for the shallow wells and river alluvium wells considered in the Application.

The Cherkauer document also details how the FRM more accurately approximates the physical setting of the wells and surrounding aquifer, which predicts much less impact on the shallow ground water than the TBVM because of the flow contribution to the wells induced from the river. Existing Wells 11 and 12 have been shown to induce about 30% of their production water from the river. Simulation of RBI wells using the FRM greatly reduces shallow aquifer drawdown, in both depth and areal extent when compared to results from the TBVM presented in the Application.. The FRM predicts the shallow aquifer drawdown to be less than 25 feet, as compared to as much as 90 feet for the TBVM. An RBI water source alternative has less effect on Pebble Brook, Mill Creek, Mill Brook, and Vernon Marsh, which all flow into or hydraulically communicate with the Fox River.

FIGURE 2: WAUKESHA WELL 12 LOCATION NEAR THE FOX RIVER

Based on this information, there is merit in considering a new alternative, with a greater flow contribution from RBI wells along the Fox River, and without the shallow wells located away from

the river. Although the RBI wells show promise as a source, it should be noted that the interaction between aquifer and the Fox River is complex. There are few wells and little geological information for the complex shallow glacial deposits in the area near the river. Future on-site investigation including test drilling and geophysics will be required to properly site production wells along the river that are capable of the desired RBI water production.

The RBI wells influence on base flow is much less than the shallow wells modeled in the Application. The RBI wells are intercepting some groundwater that previously discharged to river and also inducing other water out of the river. In the setting under the FRM model, the RBI well flow is all returned to the river upstream at the WWTP, so the RBI wells impact on base flow is much less than wells which are either in another watershed (Pebble Brook, for example) or are upstream from the WWTP.

3. Potential Aquifer Production from RBI Wells

Consideration of a new multiple source alternative incorporating Fox River area RBI wells is recommended. See Figure 3 for the location of RBI wells considered to be included in the new alternative. The south wells in the FRM indicate more favorable aquifer conditions in that area, while the north well production was indicated to be significantly lower. The north area along the river is reported to have thinner glacial sediments which become finer grained, so the wells are less productive. While the production to the south is indicated to be better, the river area modeled in the FRM was north of the southern River Road crossing, and was not as far south as the shallow wells considered by the TBVM in the Application. There is little geological information and no modeling of the potential for RBI wells south of the southern River Road crossing.

The south FRM model wells are also away from contamination sites and will not result in new Fox River base flow reductions. All RBI wells that are located downstream from the WWTP discharge should cause no base flow reductions, because the WWTP would return the water to the river upstream of where they remove it. So the RBI wells downstream of the WWTP may cause a slight increase in base flow from the WWTP to the downstream end of the well field.

Some of the well locations modeled with the FRM showed good production, but will not be considered further for the multiple source RBI alternative. The FRM Wells 1, 2, and 4 have a combined 1.18 MGD capacity, but they are about 1.5-3.5 miles north of I-94 and the proposed WSSA. The modeled well locations are in Mitchell Park in Brookfield. The FRM Wells 10 and 11 were modeled at a 0.687 MGD total flow, and are located along the pond above the dam in downtown Waukesha (See Figure 4). There are some narrow parks along the river and a larger park with a baseball and volleyball field that may support a well field with about a 1.0 MGD capacity. However, commercial and industrial areas are nearby on both sides of the river and available well isolation distances are small for new well development along the river.

Well sites for the RBI alternative were chosen to include the relatively high concentration of coarse material well locations in the FRM model. All of the well locations in the FRM were simulated with a discharge set at 0.67 mgd at each well; but if modeled aquifer could not support that withdrawal, the model decreased that well withdrawal to the flow that could be pumped from the modeled

formation. However, if the aquifer at a well location could provide the requested 0.67 mgd, no effort was made to find out how much more could be pumped.

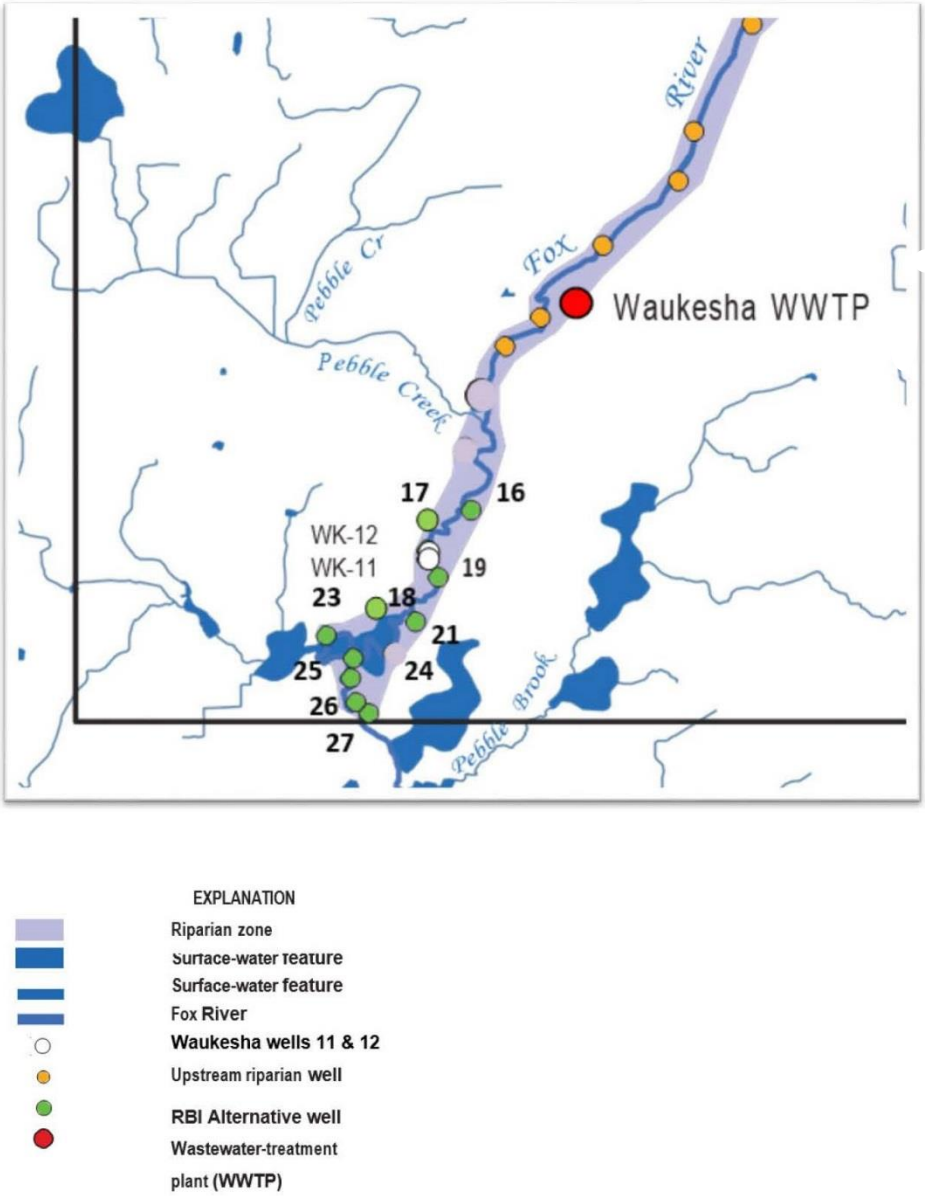


FIGURE 3: LOCATION OF RBI WELLS INCLUDED IN DEEP WELLS WITH RBI WELLS ALTERNATIVE, adapted from Development and Application of a Groundwater/Surface-Water Flow Model using MODFLOW-NWT for the Upper Fox River Basin, Wisconsin

Eight of the south ten FRM wells, 18-20 and 23-27 (See Figure 3), all produced the requested 0.667 mgd flow when modeled. Wells 16, 17, 21 and 22 produced 0.12, 0.23, 0.28 and 0.14 mgd, respectively. The well locations for eight of the FRM wells, 17, 20-21, and 23-27 were used as sources in the RBI Alternatives 1A and 1B. Two new wells were identified as wells 18 and 19, as shown highlighted in red in Figure 3. These 10 well locations are proposed as the RBI source in Alternatives 1A and 1B presented herein. The simulated well capacity of the eight modeled wells exceeded 4.0 mgd.

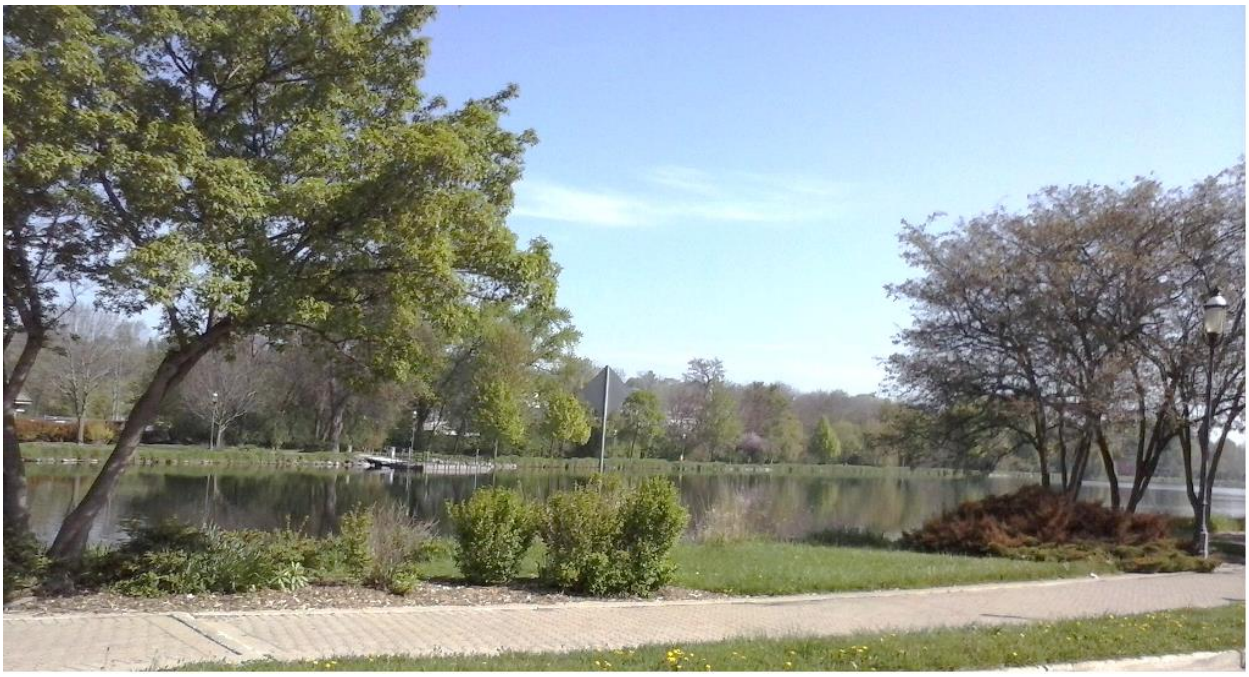


FIGURE 4: FOX RIVER ABOVE WAUKESHA DAM AT FRAME PARK

4. Multiple Source Alternative with RBI Wells

The new Deep Wells with Shallow RBI Wells Alternative would draw up to 10.0 million gallons per day (MGD) of ground water from the existing deep city wells, 4.8 MGD from 12 new RBI wells in the city and south of the city, and 1.9 MGD from existing Wells 11, 12, and 13. A map of the proposed RBI well locations for the Deep Wells with Shallow RBI Wells Alternative is shown in Figure 3, which was adapted from the report *Development and Application of a Groundwater/Surface-Water Flow Model using MODFLOW-NWT for the Upper Fox River Basin, Southeastern Wisconsin*, by D.T. Feinstein, M.N. Fienen, J.L. Kennedy, C.A. Buchwald, and M.M. Greenwood, prepared in collaboration with the University of Wisconsin–Milwaukee, Scientific Investigations Report 2012–5108, U.S. Department of the Interior, U.S. Geological Survey.

The water from all of the wells is proposed to be treated as described for the deep wells, shallow wells, and Wells 11, 12, and 13 in the Application. New water transmission mains would be constructed from the wells to the treatment plants, and from the treatment plants to the Hillcrest

Reservoir to blend the various water qualities produced by the plants. The details of water supply source, treatment and transmission facilities for the RBI Alternative are shown in Figure 5.

A location map of the facilities included with this RBI Alternative is shown in Figure 6, which was adapted from *Volume 2 of 5: City of Waukesha Water Supply Service Area Plan, October 2013*. The background recharge area, game refuge, municipal boundary, and open water information shown in Figure 5 was provided from that adapted map.

WATER SOURCE	ALTERNATIVE 1A		ALTERNATIVE 1B		SUPPLY FACILITIES	TREATMENT FACILITIES	TRANSMISSION FACILITIES
	AVG. DAY DEMAND 10.1 MGD	MAX. DAY DEMAND 16.7 MGD	AVG. DAY DEMAND 8.5 MGD	MAX. DAY DEMAND 14.1 MGD			
Deep confined aquifer	**6.2 mgd**	**10.3 mgd**	5.7 mgd	7.9 mgd	7 existing wells #3,5,6,7,8,9 ,10	3 new reverse osmosis treatment plants at wells 6, 8, and 10. Existing hydrous manganese oxide treatment at well 3.	5 miles of pipeline to Hillcrest Reservoir for blending, then pumped to distribution system.
Shallow aquifer (new RBI wells)	**2.5 mgd**	**4.4 mgd**	1.8 mgd	4.2 mgd	10 new wells and about 6 miles of connecting pipeline to the treatment plant.	1 new groundwater treatment plant for iron, manganese and arsenic removal.	1 new pump station at new water plant and about 10 miles of transmission pipe to Hillcrest Reservoir for blending, then pumped to distribution system with about 4 miles of piping improvements.
Shallow aquifer (existing wells)	**1.4 mgd**	**2.0 mgd**	1.0 mgd	2.0 mgd	3 existing wells #11,12,13	Existing groundwater treatment plant for iron and manganese removal for wells 11 and 12	About 1 mile of transmission pipe to Hillcrest Reservoir for blending, then pumped to distribution system

FIGURE 5: FACILITIES FOR DEEP CONFINED AND SHALLOW RBI AQUIFERS ALTERNATIVE

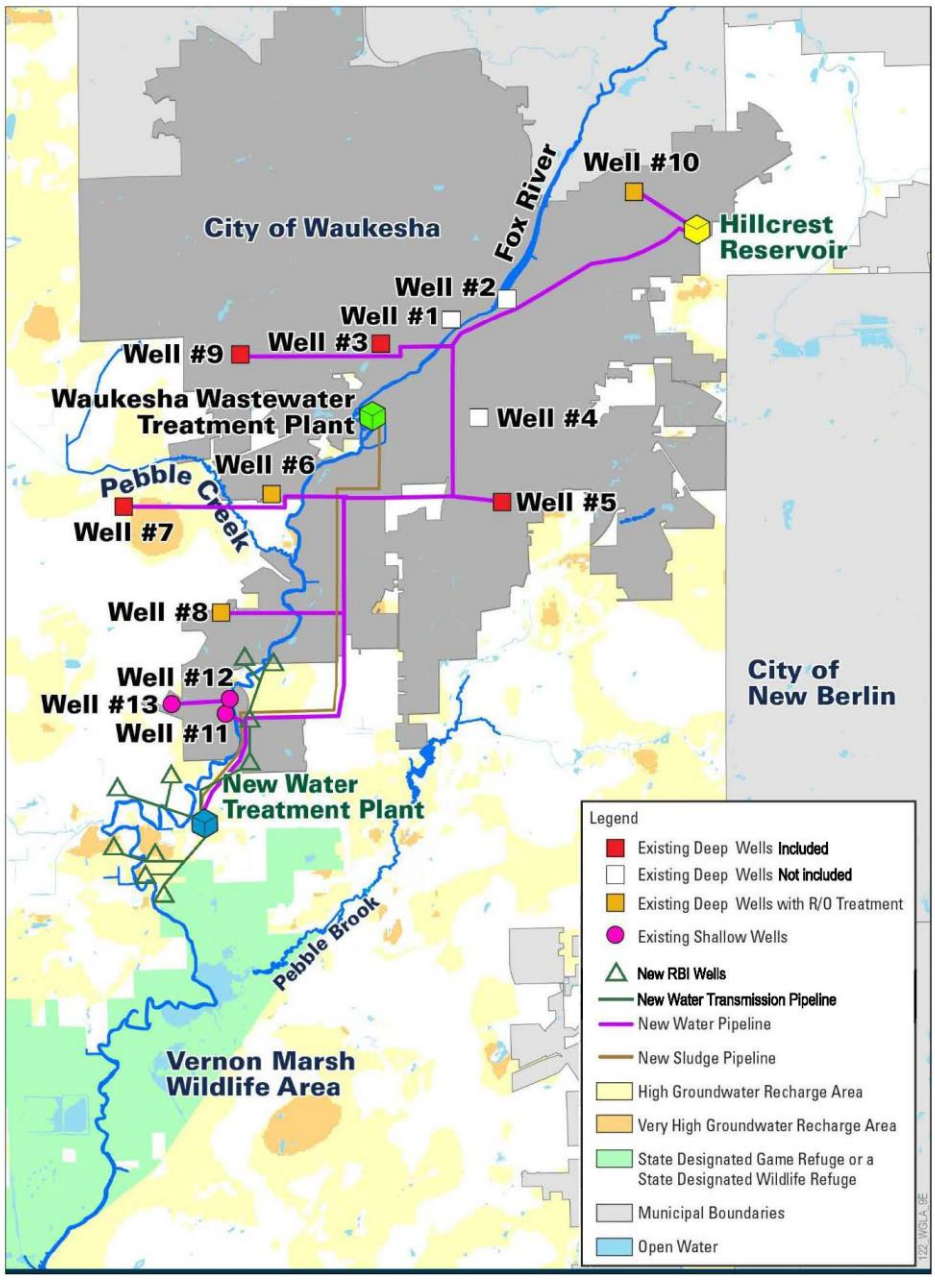


FIGURE 6: LOCATION MAP - PROPOSED DEEP WELLS ALTERNATIVE WITH RBI WELLS Adapted from Volume 2 of 5: City of Waukesha Water Supply Service Area Plan, October 2013

B. Planning Period Water Production and Consumption Data Trends

1. Recent Water Production Trends

Waukesha water production has changed over the last several years from all deep well production, to a shallow well contribution from Wells 11 and 12, and then to the current use of Wells 11, 12, and 13 with the deep wells. The reported production from the Application and the DNR High Capacity Well Records on their website also indicates Wells 3 and 10 were pumped more heavily starting in 2008. Wells 3, 8, and 10 are treated for radium and Wells 5, 6, and 9 are radium non-compliant wells. Well 2 is non-compliant for gross alpha and Well 7 is radium compliant, with only one sample result indicated over the radium standard in the last 5 years, according to the 2013 DNR Waukesha Water Supply Sanitary Survey. Use of the radium non-compliant wells has been reduced in accordance with the Wisconsin DNR stipulated order for system operation. The Waukesha average annual water production has remained fairly stable at 6.7 to 7.1 MGD for the years 2006 through 2012.

As a result of the recent reduced production from the deep confined aquifer, the deep aquifer static water level has increased. DNR records indicate a rise of about 30' to over 75' in the annual median static water levels for Wells 2-3, and 5-10. The records indicate the annual median static water levels were the lowest in the years 1996 through 2004, with various wells reaching their lows in various years. See Figure 7 for a summary of the Waukesha deep well water levels from 1983-2012, provided by Shaili Pfeiffer of the WDNR (obtained from Doug Cherkauer).

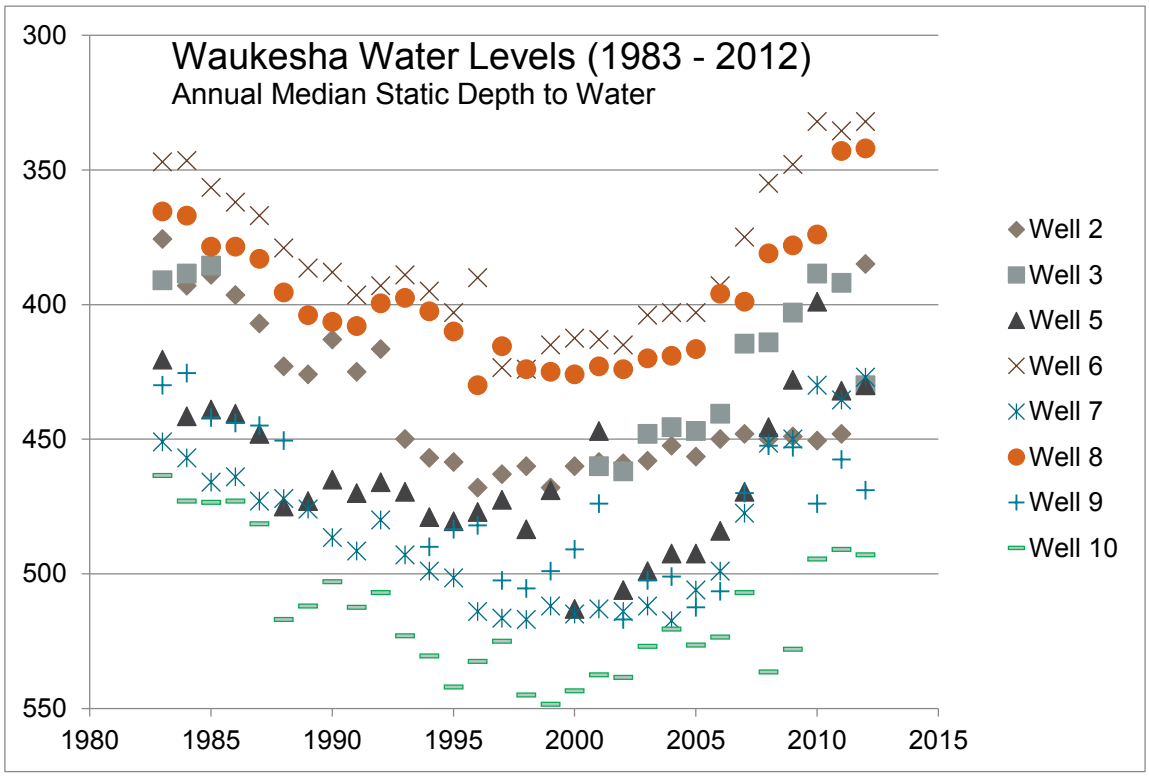


FIGURE 7: WAUKESHA WELL WATER LEVELS (1983 – 2012)
Source: Shaili Pfeiffer of the WDNR (obtained from Doug Cherkauer)

The Village of Sussex Deep Well #1 (DNR #BH424/ High Cap #88157) is an emergency standby well that is not regularly pumped, and serves as an ideal static water level (SWL) monitoring point in the deep confined aquifer. Sussex Well # 1 is located about nine miles north of downtown Waukesha. Doug Cherkauer emailed the following information regarding that well on 5-25-2014:

1972 at installation, SWL = 352'

1999 at rebuild, SWL = 479'

2014 current level SWL = 430'

The USGS has records for a deep well in the City of Waukesha that is located in the downtown area, near East Baxter Street between Buckley Street and Oak Street. The location is on the east side of river about 2 blocks above the dam. Figure 8 shows static water level measurements for that well, which indicate a 96-foot to 117-foot rise in the SWL from 1999 to the present date.

Date	SWL (depth below top of casing in feet)
January 1, 1932	122'
May 22, 1946	226.53'
December 15, 1981	387.0'
September 15, 1988	440'
January 15, 1996	479'
September 1, 1998	467'
October 1, 1999	478'
July 25, 2013	381.95'
December 4, 2013	362.62'
March 25, 2014	360.98'

+96' SWL rise

+117' SWL rise

FIGURE 8: USGS STATIC WATER LEVEL RECORDS FOR DEEP WAUKESHA WELL

General deep aquifer withdrawal information obtained in a May 28, 2014, phone conversation with Doug Cherkauer is that Menomonee Falls has reduced pumping from the deep confined aquifer and generally serves the area east of the surface water divide from a Lake Michigan source. New Berlin has changed its source from the deep confined aquifer to Lake Michigan, and Waukesha's water demands have reduced and shallow aquifer production has increased. He suspected Pewaukee's deep aquifer use may have increased slightly, and Sussex is growing but going to the shallow aquifer. The west Milwaukee County water supplies which formerly drew water from the deep confined aquifer have changed to a Lake Michigan source. Municipal users in western Milwaukee County have not been using deep wells for several decades, while industrial users have changed to the lake supply more recently.

2. Recent Water Demand Trends

The city has taken steps to reduce the water demand through conservation since 2006, as documented in the Application. The Application indicates the per capita water use has decreased steadily over the last 20 years, but future demands are based on historic per capita flow data. It is uncertain whether and/or how long the decreasing trend will continue. Comments and a detailed discussion that the demand projections should be consistent with historical trends and planned conservation methods are contained in "An Analysis of the City of Waukesha Diversion Application", by Jim Nicholas, dated February 2013. These demand concerns have merit in that the size, cost, and implementation measures for the facilities required to meet a higher than necessary flow demand are similarly larger in size and higher in cost and activity. The Application and the City's February 20, 2014, response and the AECOM 2-19-14 Technical Memorandum response to DNR questions indicate that industrial demands have declined but may increase with future development and increased industrial activity.

The Seasonal Water Use is shown in Exhibit 3-6 Application Water Conservation Plan Supplement, Page 3-8, which compares the monthly water demand for 2005 and 2009. Figure 7 shows a plot of monthly demand for years 2010, 2011, and 2012 added to a copy of Exhibit 3-6. This figure was adapted from the Water Conservation Plan Supplement Prepared in Conjunction with the Waukesha Application for Lake Michigan Water Supply, April 2011. The Application refers to the decrease in monthly flows from 2005 to 2009 to demonstrate the success of water conservation measures on reducing maximum monthly demands. Note that the 2010 - 2012 high months are near the 2005 high demand months, and the high demands demonstrate that significant peak water demand still occurs in the summer and should be planned for. Note the July 2012 peak month of 283 million gallons represents a 1.35 factor for the average day for this maximum month, when compared to the annual average daily demand. The maximum day in that maximum month would be expected to be somewhat higher than the 1.35 ratio. A sustained high demand for several consecutive days or weeks can be the critical maximum design for a water system. Although conservation may reduce the overall or average demand, conservation measures will not necessarily reduce peak events that are weather related and/or based on voluntary customer actions.

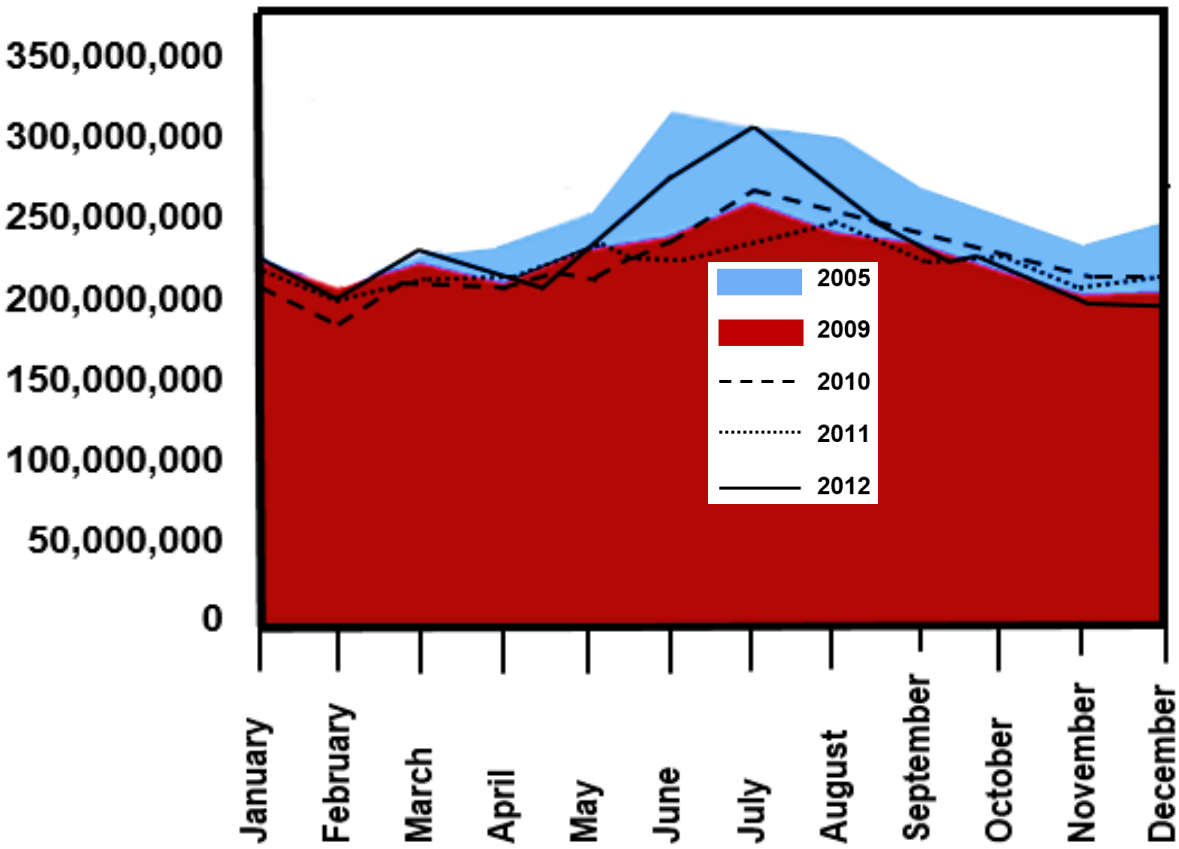


FIGURE 9: CITY OF WAUKESHA SEASONAL WATER USE
Source: City of Waukesha annual report to the Wisconsin Public Service Commission, 2009. Adapted from the Water Conservation Plan Supplement Prepared in Conjunction with the Waukesha Application for Lake Michigan Water Supply, April 2011

3. Water Supply Service Area

The water supply service area proposed in the Application includes the City of Waukesha and portions of outlying areas determined as likely to be developed in the planning period. A copy of the proposed WSSA map is shown in Figure 10. As this detailed projection has progressed through a planning process including the regional planning agency, this report will not comment on the WSSA. The Application WSSA will be used for the purposes of this evaluation.

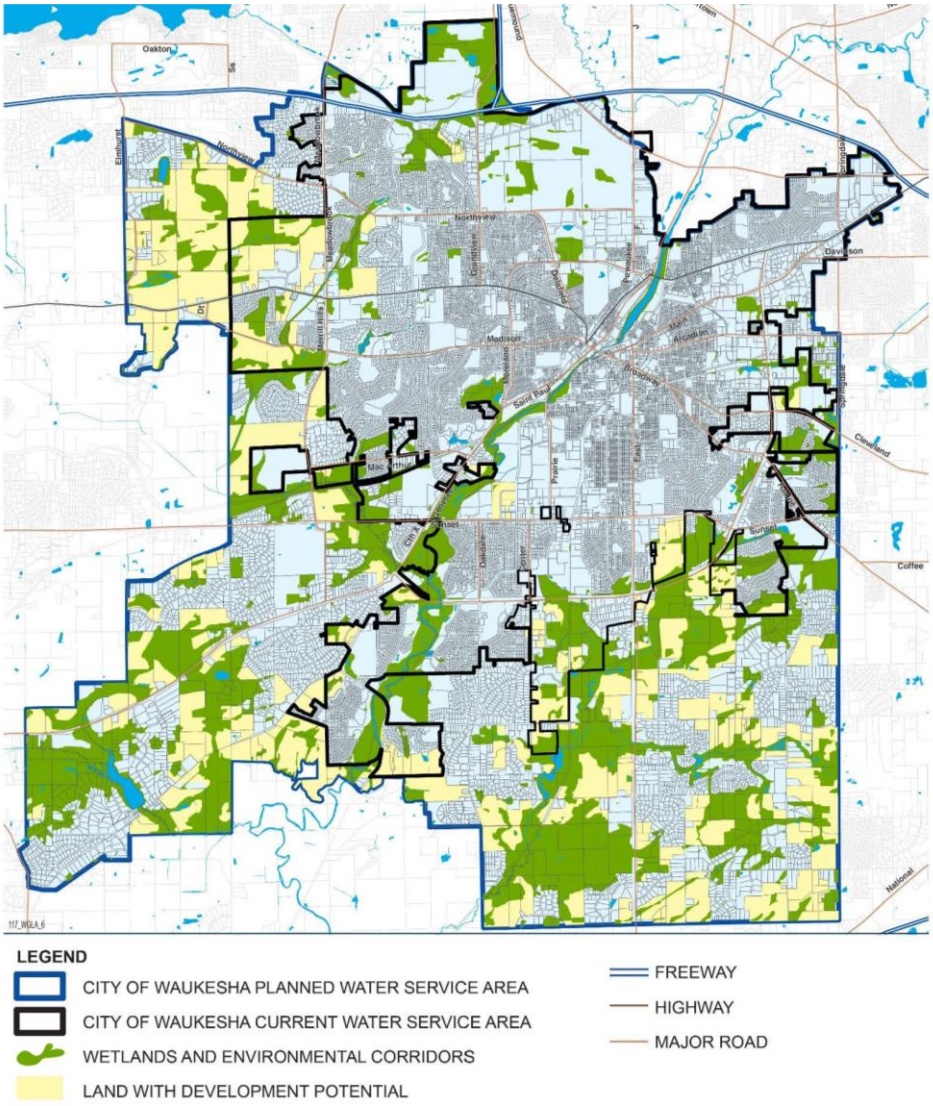


FIGURE 10: PROPOSED WAUKESHA WATER SUPPLY SERVICE AREA, adapted from Volume 2 of 5: City of Waukesha Water Supply Service Area Plan, October 2013

4. Projected Water Supply Demand

The water supply demand projections establish a range of water demand for the end of the planning period, with a projected average daily demand of 10.1 MGD and maximum daily demand of 16.7 MGD. Several comments and concerns have been expressed regarding the demand projections, with particular emphasis on the effects of water conservation efforts and the impact

future increases in both existing and new industrial activity. The Application future demand projections will be used as the basis for evaluation of additional water supply alternatives.

C. Water Quality Analysis of Alternative 1A Water Supply

1. Anticipated water quality (demand related)

The new Alternative of Deep Wells with Shallow RBI Wells would combine water from various sources including new shallow screened RBI wells, existing shallow wells, and the existing deep confined sandstone wells. The RBI wells would have their flow directed to a single treatment plant with iron, manganese, and arsenic removal. Wells 11, 12, and 13 would be treated for iron, manganese removal and disinfection. Three reverse osmosis (RO) treatment plants would be installed at the three largest existing deep wells to treat for total dissolved solids (TDS), radium, and gross alpha. The water from all of the sources would be directed through new transmission mains to the Hillcrest Reservoir for blending and to achieve a more uniform water quality for customers.

2. Discussion of potential future water quality issues

Potential future water quality issues identified in the Application include the possible presence of arsenic in shallow wells in the area south of the city. This arsenic is reported to be detected in a test well, and may or may not be present in the RBI wells near the Fox River. The deep wells will receive RO treatment in both the Application deep well alternatives and in the proposed Alternative 1A, so any future increases in TDS referred to in the Application should be treated by the RO plants. It should be an operational goal of the city to balance the production from the deep and shallow sources to minimize the level of treatment required and to maximize the blended finished water quality. . As the deep well RO plants are brought online with the Application alternatives and the proposed Alternative 1A, the blended water quality will improve by a reduction in hardness, which should result in less water softener use by Waukesha water supply customers.

D. Alternative 1A Water Supply Ability to Meet Radium Drinking Water Standards

1. Radium standards

The federal and state drinking water radium standard is 5 picoCuries per liter (pCi/L), regulated at the point of source water entry (POE) to the distribution system. The water must meet the standard before it enters the distribution system and before the first customer downstream of the each source. If the water system has more than one source contributing to a particular POE, the flow from those sources can be blended to meet the standard at the POE. Another type of blending is provided for the city as an interim acceptable deep well operation under the DNR stipulated order for compliance until the radium non-compliant wells are treated or replaced. This blending is a system-wide “worst-case” annual average of monthly radium sample results, weighted by using the highest well radium results for the wells in production for each month. This average must then comply with the 5 pCi/L standard. This weighted annual system averaging will end in 2018, under the current stipulation.

2. Radium in source water and compliance plan

Radium is present in all of the existing city confined deep aquifer wells. The radium levels vary somewhat in the wells. Some of the deep wells comply with the radium standard, some exceed the standard and are not routinely used, and some of the deep wells that exceed the standard have existing radium removal treatment. Production from some of the wells is being minimized specifically to comply with the DNR stipulation or to minimize the radium contribution to the weighted average compliance calculation.

According to the 2013 Waukesha Radium Report, for the year 2013, deep well monitoring analyses showed wells 5, 6, 7, and 9 exceeded the 5 pCi/L standard. Wells 3 and 10 receive HMO treatment, and Point of Entry (POE) monitoring for those wells showed they were in compliance with the radium standard. Deep Well 8 production is blended with flow from Well 11 and Well 12, and that blended POE was in compliance with the radium standard. The report further states Well 3 was used for 352 days; Well 5 for 123 days; Well 7 for 151 days; Wells 8, 11 and 12 for 363 days; Well 10 for 267 days; and Well 13 for 363 days. Well 6 and Well 9 were not used for water supply production in 2013.

For Alternative 1A, the city would comply with the radium standard by treating and blending the deep well water to a radium level below the standard prior to the system points of entry.

E. Alternative 1A Water Supply Costs

1. Estimated Capital Cost

The estimated capital cost for Alternative 1A is $176,287,000 as presented in Figure 11. This cost is estimated based on the estimated quantities of detailed cost items at the unit costs presented for Alternative 1 in Appendix E of the Application. The Alternative 1A costs were subtotaled and percentages were added for contractor's overhead and profit, contingencies, engineering, etc., in the same manner as for calculation of the Application costs. This cost is nearly $30 million or about 15% less than the Application estimated total project capital cost for the Alternative 2 – Lake Michigan Supply.

2. Estimated Present Worth Cost

The estimated total operating and maintenance cost for Alternative 1A is $6,821,000 per year, as presented in Figure 12. The associated Alternative 1A total present worth capital and O&M costs for 20 years is $254,918,000 and for 50 years is $283,341,000. These costs are based on the Alternative 1 Operating and Maintenance Cost in Appendix E of the Application. The Alternative 1A costs were estimated in the same manner as for the calculation of the other Application O&M costs. The Alternative 1A annual O&M cost is estimated to be $1.08 million less and the estimated 50-year Total Present Worth Cost is about 13% less than the Lake Michigan Supply Alternative.

The above O&M costs should be considered to be conservatively high, because they include $2,860,000 per year for home softening salt, equipment, and replacement costs for Waukesha water system customers. As the deep well RO plants are brought online with the proposed

Alternative 1A, the blended water quality will improve by a reduction in hardness, which should result in less water softener use by Waukesha water supply customers and a corresponding reduction in these softening-related costs. It should be noted that these are not utility costs, but they are voluntary customer costs, and do not impact the water rates necessary to pay for the alternative project costs. The softening costs are included in the Alternative 1A cost analysis because they were included in other Application groundwater alternatives including Alternative 1.

Shallow RBI Aquifer Well Field	Quantity	Unit Cost	Total
Well houses and pumps	10	$334,500	$3,345,000
Land, acres	10	$178,416	$1,784,000
Roads, ft	30,000	$27.90	$837,000
Interconnecting pipe, 8” to 16”, ft	30,000	$185	$5,550,000
Electrical (10% of well houses, pumps, land)	5,129,000	$10%	$513,000
			$12,029,000
Shallow RBI Aquifer Supply Pipeline to Waukesha			
11 mi of 24" pipe, mixed rural and urban, ft	58,080	$357	$20,735,000
			$20,735,000
Shallow RBI Aquifer Treatment Plant and Pump Station			
One groundwater treatment plant @ 6.7 mgd	6,700,000	$1.59	$10,653,000
Land	1	$2,230,000	$2,230,000
			$12,883,000
Deep Well Treatment Plant			
3 RO plants for Wells 6,8,10 @ 5.35 mgd	5,350,000	$4.57	$24,460,000
including land built in 2020			**$24,460,000**
Distribution System Improvements			
4.3 mi of 16", 24", and 30" pipes	22,500	$413	$9,289,000
5.1 mi of 16" pipe for blending, ft	26,928	$323	$8,698,000
			$17,987,000
Wastewater Forcemain			
5 mi of 6" forcemain, ft	26,400	$141	$3,722,000
		Subtotal	**$91,816,000**
3% markup for Bonds & Insurance			$2,754,000
5% markup for Mob/Demob			$4,591,000
8% markup for Contractors Overhead			$7,345,000
4% markup for Contractors profit			$3,673,000
		Subtotal	**$18,363,000**
25% Contingency			$27,545,000
		Subtotal Markups and Contingency	**$45,908,000**
		Total Project Construction Costs	**$137,724,000**
8% allowance for engineering and design			$11,018,000
12% allowance for permitting, legal and admin.			$16,527,000
8% allowance for engr services during construction			$11,018,000
		Subtotal Other Project Costs	**$38,563,000**
		Total Project Capital Cost	**$176,287,000**

FIGURE 11: ALTERNATIVE 1A DEEP AND SHALLOW RBI WELLS ALTERNATIVE CAPITAL COSTS

Source of Supply	Units	Quantity	Unit Cost	$/yr
Deep Well pumping/maintenance	$/1000 gal	2,190,000	$0.35	$766,500
Shallow Well Pumping/Maintenance	$/1000 gal	1,496,500	$0.14	$209,510
			Total	**$976,000**
Treatment/Pumping				
Deep Wells 6,8,10 starting in 2020	$/1000 gal	1,095,000	$0.61	$667,950
Shallow Wells	$/1000 gal	1,496,500	$1.09	$1,631,185
Residuals	$/1000 gal	164,068	$4	$656,270
			Total	**$2,955,000**
Home Softening				
Salt/Equipment/Replacement	$/person/yr	13,683	$209	$2,859,747
			Total	**$2,860,000**
Transmission				
Operation and Maintenance	$/lf/yr	144,430	$0.52	$75,103
			Total	**$75,000**
		Alternative 1A Total O&M ($/yr.)		**$6,866,000**
PRESENT WORTH OF O&M (6%, 20 yrs)	$79,150,000			
PRESENT WORTH OF O&M (6%, 50 yrs)	$107,760,000			
Total Present Worth (6%, 20 years)	$259,730,000			
Total Present Worth (6%, 50 years)	$288,340,000			

FIGURE 12: ALTERNATIVE 1A DEEP AND SHALLOW RBI WELLS ALTERNATIVE O&M COSTS

F. Comparison of Alternative 1A Deep Wells with RBI Augmentation to Lake Michigan Alternative

1. Environmental impact evaluation

With the Fox River Model and the RBI well alternative, the environmental impacts to private wells and wetlands is greatly reduced from the Application groundwater source options, to the point where the impacts should be considered as “moderate” when compared to the Lake Michigan Alternative. Private wells and wetlands will be affected by the ground water table drawdown of

the RBI shallow wells proposed in the new alternative, but with much less impact than the other shallow well alternatives presented in the Application. The Application Environmental Report calculates that there are more than 3,000 private wells in the 1 foot and greater drawdown area that could be affected and more than 3,000 wetland acres that would be affected by groundwater drawdown of 1 foot and greater for Alternative 1, based on the Troy Bedrock Valley Model. The Fox River Model, however, predicts a much smaller area will be affected by pumping from the shallow RBI wells, resulting in many fewer impacted private wells. An estimate from Application Exhibit 11-18, which shows the number of wells per section, and from Figure 40A USGS FRM document indicates that about 260 private wells would be affected in the 1 foot drawdown area and about 86 wells would be affected in the 5 foot drawdown contour, much less than the Application indicates. Figure 40A in the USGS FRM document also indicates the Shallow RBI Alternative would only affect about 600 acres at the 1 foot and greater drawdown and about 200 acres of wetlands in the 5 foot drawdown area. The Lake Michigan Alternative would not affect the private wells directly because there would be no well drawdown.

The return flow to the Fox River at the Waukesha WWTP under the RBI Alternative would mitigate the effects of the RBI well withdrawals on the river downstream of the WWTP. One of the major advantages of locating the RBI wells downstream from the location where water is returned is that there will only be minimal changes in base flow on the main channel - and those changes will be small increases between the WWTP and the well field. Table 1 of the Cherkauer-Grundl November 27, 2013, report indicates the Fox River Model predicts similar base flow reductions for local streams for an aquifer withdrawal over three times that modeled with the Troy Bedrock Valley Model. This information demonstrates that the base flow reductions with the RBI well alternative would not be as great as predicted for the shallow well alternatives in the Application and should be considered as “minor” when compared to the Lake Michigan source.

FIGURE 13: FOX RIVER LOOKING NORTH AT THE SOUTH RIVER ROAD CROSSING AND SOUTH END OF PROPOSED RBI WELLS

2. Long-term sustainability

The combination of shallow RBI wells, existing shallow wells, and the existing deep Waukesha wells results in an alternative with a variety of sources that can be operated to avoid maximum effects on any one aquifer source. The deep well water levels have continued to increase over the last 10-20 years, demonstrating the viability of the deep aquifer to satisfy the recent withdrawals.

3. Public Health Protection

The RBI Alternative would have three WWTPs, Waukesha, Brookfield, and Sussex discharging upstream of the shallow RBI wells along the Fox River. Although some of the well flow will be recycled from the river, it has been shown that only about 30% of the well production at Wells 11 and 12 is induced from the river. The Application concern about the potential for recycle flow concentrating contaminants is lessened by the wells only receiving a portion of their flow induced from the river. The wastewater discharge is also diluted by the stream flow after it is discharged. The larger percentage of flow to the well is expected from the aquifer away from the river, further reducing any contaminant concentrations received from the river.

The shallow RBI wells are more vulnerable to groundwater contamination than the deep wells, and careful well siting will be required to maximize isolation distances from existing and future potential contaminant sources. These wells are proposed to be treated before the water enters the distribution system. It should be noted the Lake Michigan source is also subject to contamination and treatment plant challenges, similar to the Application statements that the ground water alternatives are subject to potential source contamination.

If the deep groundwater levels are no longer decreasing, then the negative impacts stated in the Application of increasing radium and TDS levels, decreasing capacity, and decreased flow to surface water may not occur.

4. Capital and Present Worth Costs

The estimated total project capital cost for Alternative 1A - Deep and Shallow RBI Wells is $176,287,000 as detailed in Figure 11. This cost is nearly $30 million or about 15% less than the Application estimated total project capital cost for the Alternative 2 – Lake Michigan Supply. The Alternative 1A estimated Total Operation and Maintenance (O&M) cost is $6,821,000 per year, which is $1.08 million less than the Lake Michigan Supply. The Alternative 1A estimated 50-year Total Present Worth Cost is about $283 million, which is about 13% less than the Application estimate for a Lake Michigan Supply.

5. Feasibility

The feasibility of withdrawing the all of the above-described RBI well flow from the aquifer near the Fox River is not proven. The Fox River Model suggests that shallow RBI wells could be located in the shallow aquifer near the Fox River, but the exact geology that would support the location of the wells to withdraw the indicated groundwater flow remains to be identified. The

planning, testing, and development of a municipal RBI well field incorporating the 10 well sites required along the Fox River will require a significant future effort.

G. Water Quality Assessment of Alternative 1A Water Supply Return Flow

1. Return flow quantity and location

The new alternative would return all flow to the City of Waukesha wastewater treatment plant (WWTP), maintaining Fox River water flow for downstream RBI well recharge. This alternative would continue the existing return flow discharge to the Fox River and would not result in a reduced flow in the Fox River due to a transfer to another watershed as would result with the Lake Michigan Alternative. The existing condition of no direct recharge to the deep confined aquifer would continue.

H. Evaluation of Alternative 1B – Deep and Shallow RBI Wells for 8.5 mgd Average Day

1. Introduction

This section provides an evaluation of Alternative 1B, with the same well water sources as Alternative 1A providing an average day demand of 8.5 mgd and maximum day of 14.1 mgd. Although the maximum day is stated lower for Alternative 1B, the alternative includes the same well sources as Alternative 1A, with capacity to meet the 16.7 maximum day demand if necessary.

2. Water Sources

The water sources for Alternative 1B are identical to the wells included in Alternative 1A, as described in the sections above. The flow attributed to each group of well sources is shown in Figure 5 for the 8.5 mgd Alternative 1B. A location map of the facilities included with RBI Alternative 1B is shown in Figure 6. Alternative 1B uses the same wells at a lower production rate to meet the lower demands than Alternative 1A. With both alternatives, additional well capacity would be developed by the city as needed to meet increasing demands over time.

3. Water Quality and Treatment

Alternative 1B water quality is the same as Alternative 1A, described in Section III.C., and would combine water from various sources including new shallow screened RBI wells, existing shallow wells, and the existing deep confined sandstone wells. A single treatment plant for the RBI wells would remove iron, manganese, and arsenic. Wells 11, 12, and 13 would be treated for iron and manganese removal and disinfection. Three reverse osmosis (RO) treatment plants would be installed at the three largest existing deep wells to treat for total dissolved solids (TDS), radium, and gross alpha. The water from all of the sources would be directed through new transmission mains to the Hillcrest Reservoir for blending and to achieve a more uniform water quality for customers.

4. Radium Standards

The radium occurrence and well use to minimize radium levels for Alternative 1B would be the same as Alternative 1A, described in detail in Section III.D. For Alternative 1B, the city would comply with the radium standard by treating and blending the deep well water to a radium level below the standard prior to the system points of entry.

5. Costs

The estimated total project capital cost for Alternative 1B - Deep and Shallow RBI Wells is the same as Alternative 1A, $176,287,000 as detailed in Figure 11. The Alternative 1B estimated Total Operation and Maintenance (O&M) cost shown in Figure 14 is $6,207,000 per year. The Alternative 1B estimated 20-year Total Present Worth Cost is about $260 million, and the 50-year Total Present Worth Cost is about $273 million.

Source of Supply	Units	Quantity	Unit Cost	$/yr
Deep Well pumping/maintenance	$/1000 gal	2,080,500	$0.35	$728,000
Shallow Well Pumping/Maintenance	$/1000 gal	1,022,000	$0.14	$143,000
			Total	**$871,000**
Treatment/Pumping				
Deep Wells 6,8,10 starting in 2020	$/1000 gal	1,040,000	$0.61	$634,000
Shallow Wells	$/1000 gal	1,022,000	$1.09	$1,114,000
Residuals	$/1000 gal	164,068	$4	$656,000
			Total	**$2,404,000**
Home Softening				
Salt/Equipment/Replacement	$/person/yr	13,683	$209	$2,859,747
			Total	**$2,860,000**
Transmission				
Operation and Maintenance	$/lf/yr	137,510	$0.52	$72,000
			Total	**$72,000**
		Alternative 1B Total O&M ($/yr.)		**$6,207,000**
PRESENT WORTH OF O&M (6%, 20 yrs)	$71,553,000			
PRESENT WORTH OF O&M (6%, 50 yrs)	$97,417,000			
Total Present Worth (6%, 20 years)	$247,840,000			
Total Present Worth (6%, 50 years)	$273,704,000			

FIGURE 14: ALTERNATIVE 1B DEEP AND SHALLOW RBI WELLS ALTERNATIVE O&M COSTS

6. Comparison of Alternative 1B to Lake Michigan Alternative

a. Environmental impact evaluation

With the Alternative 1B RBI well alternative, the environmental impacts to private wells and wetlands is reduced from Alternative 1A evaluated in Section III.F.1., because of the lower flows for each of the wells in this alternative. The impacts of the Alternative 1B RBI well alternative should be considered as "minor" when compared to the Lake Michigan Alternative. Private wells and wetlands will be affected somewhat by the ground water table drawdown of the RBI shallow wells proposed in the new alternative. The Lake Michigan Alternative would not affect the private wells directly because there would be no well drawdown.

The return flow to the Fox River at the Waukesha WWTP under the RBI Alternative would mitigate the effects of the RBI well withdrawals on the river downstream of the WWTP. The base flow reductions with the RBI well alternative should be considered as "minor" when compared to the Lake Michigan source. The Lake Michigan Alternative would remove the existing return flow from the water system to the Fox River downstream of the WWTP.

b. Long-term Sustainability

The combination of shallow RBI wells, existing shallow wells, and the existing deep Waukesha wells results in an alternative with a variety of sources that can be operated to avoid maximum effects on any one aquifer source. The 8.5 mgd average day demand is a relatively minor increase from the current average day demand over the planning period. The construction of 10 new RBI wells to meet the demand over the planning period will allow Waukesha to pump all of the deep and shallow wells at a rate somewhat below the full rated capacity of each well. Maximum day flow for Alternative 1B can also be met without all of the deep and shallow wells operating all day, reducing the corresponding well drawdowns and increasing the long term sustainability of the alternative.

c. Public Health Protection

Although the RBI Alternative 1B would have WWTPs discharging upstream of the wells along the Fox River, the wells only receiving a portion of their flow induced from the river. The wastewater discharge is also diluted by the stream flow after it is discharged. The larger percentage of flow to the well is expected from the aquifer away from the river, further reducing any contaminant concentrations received from the river.

The shallow RBI wells are vulnerable to groundwater contamination, and careful well siting will be required to maximize isolation distances from existing and future potential contaminant sources.

These wells are proposed to be treated before the water enters the distribution system. The Lake Michigan source is also subject to contamination incidents and treatment plant challenges.

d. Capital and Present Worth Costs

The estimated total project capital cost for Alternative 1B - Deep and Shallow RBI Wells is $176,287,000 as detailed in Figure 11. This cost is nearly $30 million or about 15% less than the Application estimated total project capital cost for the Alternative 2 – Lake Michigan Supply. The Alternative 1B estimated Total Operation and Maintenance (O&M) cost shown in Figure 14 is $6,207,000 per year, which is $1.693 million per year, or 21%, less than the Lake Michigan Supply. The Alternative 1B estimated 50-year Total Present Worth Cost is about $273 million, which is about $58 million, or 17%, less than the Application estimate for a Lake Michigan Supply.

e. Feasibility

The feasibility of withdrawing the all of the above-described RBI well flow from the aquifer near the Fox River is not proven. The Fox River Model suggests that shallow RBI wells could be located in the shallow aquifer near the Fox River, but the exact geology that would support the location of the wells to withdraw the indicated groundwater flow remains to be identified. The planning, testing, and development of a municipal RBI well field incorporating the 10 well sites required along the Fox River will require a significant future effort.

f. Return Flow quantity and location

Alternative 1B would return all well flow to the City of Waukesha wastewater treatment plant (WWTP), maintaining Fox River water flow for downstream RBI well recharge. This alternative would continue the existing return flow discharge to the Fox River and would not result in a reduced flow in the Fox River due to a transfer to another watershed as would result with the Lake Michigan Alternative. The existing condition of no direct recharge to the deep confined aquifer would continue.

IV. CONCLUSION

Instead of insisting on diversion of water from Lake Michigan, the City of Waukesha should utilize the nearby available groundwater resources to develop a combination deep well and shallow RBI well groundwater source to meet the forecasted water supply demand for the proposed Water Supply Service Area. Deep well water level monitoring has demonstrated that the confined

aquifer deep well water levels have recovered somewhat from the low levels experienced 10-20 years ago. This deep well water level increase is partly a result of the City and other surrounding community water supplies reducing their groundwater demands, due to a combination of both City of Waukesha water conservation efforts and other communities abandoning the deep aquifer and drawing water instead from a new Lake Michigan source.

The Multiple Source RBI Alternatives 1A and 1B are proposed to include the existing deep aquifer city wells with expanded treatment for radium, total dissolved solids, and gross alpha, new shallow RBI wells along the Fox River in the southern part of the city and south of the city with treatment, and existing Wells 11, 12, and 13 with existing treatment. The water from the various well treatment plants would be pumped through new transmission mains to the Hillcrest Reservoir for blending and producing a more consistent water quality for customers.

Private wells and wetlands will be affected by the ground water table drawdown of the RBI shallow wells proposed in the new RBI Alternatives 1A and 1B, but will be affected much less than the other shallow well alternatives presented in the Application. The USGS Fox River Model for the RBI wells modeled along the river indicates much less impact than the Troy Bedrock Valley model (TBVM) used in to model the shallow wells in the Waukesha diversion application due to the lower predicted drawdowns for the RBI shallow wells. The return flow to the Fox River at the Waukesha WWTP under the RBI alternatives would eliminate the effects on the base flow downstream of the WWTP. The Lake Michigan Alternative would not affect the private wells directly because there would be no well drawdown, but the diversion of the Waukesha WWTP return flow to the Lake Michigan basin would lower the Fox River stream flow which may affect shallow wells and wetlands downstream.

The water table and wetland impact simulations for the RBI Alternatives 1A and 1B and those in the Waukesha Application have been estimated using different models with very different designs. Some part of the different responses may be due to the model design. It would be instructional to run the Waukesha Application shallow aquifer well designs on the FRM, and then use those results for a direct comparison of well field drawdown effects. Without such a parallel-run comparison, the differences between the drawdowns in the Application and those in the FRM are most likely primarily due to the locations of the wells. Wells designed for RBI in Alternatives 1A and 1B are located very close to the Fox River by design. The RBI wells induce a portion of their water from the river, which reduces the amount of groundwater drawn directly from the aquifer. This aquifer withdrawal reduction, in turn, reduces drawdowns and impacts on wetlands and the base flow of tributary streams.

In the Waukesha Application shallow well alternatives, many shallow wells are located within the watershed of Pebble Brook, in which there are also many private wells. Pumping from the proposed new Waukesha shallow aquifer wells under those alternatives then reduces water levels in private wells and base flow to Pebble Brook. Because Pebble Brook drains to and is a primary source of water for Vernon Marsh, the location of shallow wells in the Application also reduces water delivery to the Marsh, potentially causing undesired impacts.

V. ACKNOWLEDGED WORKS REFERENCED FOR PHASE 2 REPORT

Figure 1: Waukesha Location Map

Figure 2: Waukesha Well 12 Location Near the Fox River - Photo taken by Donald DeGrand

Figure 3: Location of RBI Wells Included in Deep Wells with RBI Wells Alternative, adapted from *Development and Application of a Groundwater/Surface-Water Flow Model using MODFLOW-NWT for the Upper Fox River Basin, Southeastern Wisconsin*, by D.T. Feinstein, M.N. Fienen, J.L. Kennedy, C.A. Buchwald, and M.M. Greenwood, prepared in collaboration with the University of Wisconsin–Milwaukee, Scientific Investigations Report 2012–5108, U.S. Department of the Interior, U.S. Geological Survey

Figure 4: Fox River above Waukesha dam at Frame Park - Photo taken by Donald DeGrand

Figure 5: Facilities for Deep Confined and Shallow RBI Aquifers Alternative

Figure 6: Location Map-Proposed Deep Wells Alternative with RBI Wells, Adapted from Volume 2 of 5: City of Waukesha Water Supply Service Area Plan, October 2013

Figure 7: Waukesha Well Water Levels (1983-2012), Source: Shaili Pfeiffer of the WDNR (obtained from Doug Cherkauer)

Figure 8: USGS Static Water Level Records for Deep Waukesha Well

Figure 9: City of Waukesha Seasonal Water Use, Source: City of Waukesha annual report to the Wisconsin Public Service Commission, 2009. Adapted from the Water Conservation Plan Supplement Prepared in Conjunction with the Waukesha Application for Lake Michigan Water Supply, April 2011.

Figure 10: Proposed Waukesha Water Supply Service Area, adapted from Volume 2 of 5: City of Waukesha Water Supply Service Area Plan, October 2013

Figure 11: Alternative 1A Deep and Shallow RBI Wells Alternative Capital Costs

Figure 12: Alternative 1A Deep and Shallow RBI Wells Alternative O & M Costs

Figure 13: Fox River Looking North at the South River Road Crossing and South End of Proposed RBI Wells

Figure 14: Alternative 1B Deep and Shallow RBI Wells Alternative O & M Costs

"An Analysis of the City of Waukesha Diversion Application", by Jim Nicholas, dated February 2013

APPENDIX A

PHASE 1 FINDINGS

PHASE 1 FINDINGS

The following is a list of our comments and questions specific to riverbank inducement and shallow well alternatives:

1) A shallow groundwater alternative incorporating riverbank inducement (RBI) will be evaluated further, in combination with other groundwater sources. We will further evaluate an alternative combination of shallow RBI wells, shallow wells, and deep confined wells, all in the Waukesha area.

2) The Troy Bedrock Valley Model was used to predict the shallow well aquifer hydraulic performance in the application. Technical reports state that the model has shortcomings in the way it predicts the wells' effects on surface water and wetland areas, resulting in an overstatement of the drawdown and associated environmental effects for the shallow well alternatives.

3) The recently-developed Upper Fox River Watershed Model is based on a different conceptual model that is reported to be more suited to predict the performance of the shallow aquifer.

4) The necessary geological information about the location and character of river bottom soil and near-river aquifer materials in the area along the Fox River is not readily available without further physical or geophysical investigations. This information would help predict and confirm the feasibility of RBI wells withdrawing the relatively large quantity of water to be induced from the river to meet Waukesha's demand. Specific well siting and the feasibility of sited wells to withdraw water from the aquifer cannot be evaluated with confidence without this geological information.

5) Fox Model information is available for the individual well capacities indicated available near the river, both upstream and downstream of the WWTP. The downstream wells with high production could be optimized for higher production in further evaluation.

6) Although the RBI wells modeled upstream of the WWTP did not produce as much water as downstream, there may be some of the well locations that would be favorable to further water supply alternative consideration.

7) Existing Waukesha Wells 11 and 12 are near the Fox River, and rated capacities are 300 gpm and 600 gpm, respectively. The wells are located close to the river and have been demonstrated to be receiving induced flow from the river. Nearby Well 13 is 750 gpm, but is much further away from the river, demonstrating the complex geology of the area. All are shallow wells.

8) A paper reviewed, *Plugging in Riverbank-Filtration Systems: Evaluating Yield-Limiting Factors* by Stephen A. Hubbs, P.E., Louisville Water Company, Louisville, Kentucky, regarding existing RBI riverbank plugging states that large capacity well fields take 3-5

years to “settle in” to a sustainable yield of about 50-75% of the initial capacity. The effects of some riverbank plugging should be included in considering this alternative.

9) Water viscosity is reported to play a role in a cyclical seasonal water temperature-related specific yield variation pattern for RBI wells.

10) River high flow event-associated riverbank scouring is reported to be significant in restoring capacity lost to RBI system riverbank plugging.

11) A paper reviewed, *Using Microscopic Particulate Analysis for Riverbank Filtration* by Jennifer L. Clancy, Ph.D., Clancy Environmental Consultants, Inc., St. Albans, Vermont, and William D. Gollnitz, Greater Cincinnati Water Works, Cincinnati, Ohio, on microscopic particulate analysis for RBI systems reports the systems evaluated had greater than a 2-log removal for Giardia and greater than 3 logs for Cryptosporidium.

12) The LT2 Enhanced Surface Water Treatment Rule is reported to allow a 3 log RBI treatment credit for Crypto.

13) The RBI system particulate removals were better than those in the conventional surface water plants evaluated.

14) With respect to the comments regarding the concentration of contaminants in a RBI alternative with return flow upstream, what percent of the Fox River stream flow does the WWTP discharge equal? What would be the expected contaminant dilution in the stream?

15) Which shallow test wells had arsenic detects? Were the results confirmed and what were the concentrations?

The following are general comments:

16) City and other information regarding the deep confined aquifer water levels in the last few years was obtained from USGS and the DNR.

17) Kenosha and Walworth increasing groundwater levels cited are not relevant to the deep confined aquifer at Waukesha, because of the distance from Waukesha and the effects of changes in deep well withdrawals in northern Illinois.

18) The maximum to average water supply demand ratio was 1.66 in 2005 and 1.62 in 2001. The Application demand analysis uses 1.68, which is close to these two recently experienced events, and will be used in this evaluation of a new alternative.

19) In Appendix E of the Application, Alternatives 1, 5, and 6 include $2.86 million per year and Alternative 4 includes $1.586 million per year for customer water softener salt/equipment/replacement. These costs should not be included in the Waukesha

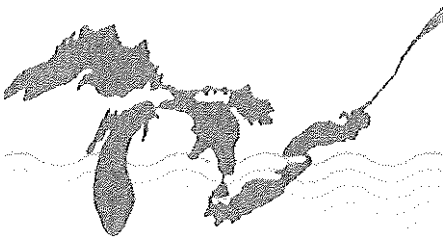
alternative present worth cost analysis. These are not utility costs and are voluntary customer costs. Including these costs in the present worth analysis increases these groundwater alternatives costs, but does not affect the Lake Michigan alternative.

20) Is the second of the three Alternative 4 Operation and Maintenance cost estimates in Appendix E actually for Alternative 2? There is no Alternative 2 O&M cost summary in the Appendix.

21) Alternative 3, Fox Alluvium and Shallow Aquifer, has no land cost associated with the lime softening treatment plant and pump station. Alternatives 1, 4, & 6 have $2.230M and Alternative 5 has $1.115M for treatment plant and pump station land costs.

22) The Alternative 5 land cost is $334,500 for each of 12 well sites, and Alternatives 1 & 4 have $178,416 for each of the 12 well site land costs. Why are these different?

23) The Alternative 6 cost estimate shows a $2.23M land cost for the shallow well water treatment plant, while the other alternatives show $557,500 for the WTP land.



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Wisconsin DNR DG/5
PO Box 7921
lvladison, \'(II 537077921
A ttn: Kassie Lang

WAUKESHA DIVERSION COMMENTS

The success of the Great Lakes Compact is critical to the livelihood of the millions of people that live in the Great Lakes region. The proposed Waukesha diversion represents a crucial first test for the via bility of the Great Lakes Compact. As the first proposed ustraddling county,, diversion, ho,v the \\lisconsin Departn1ent of Natural Resources ("WDNR") tackles the proposal will set important precedents for future diversion requests, both in Wisconsin, the seven other Great Lakes states and Canada. I write on behalf of the Great Lakes and St. Lawrence Cities Initiative (the "Cities Initiative") to express the comments of American and Canadian lvlayors on this issue and respectfully ask the WDNR to labor to set "good" precedent in acting on the Waukesha diversion application.

The Cities Initiative is a binational coalition of Mayors and other local officials that ,vorks actively ,,rith federal, state and provincial govern1nents to advance the protection and restoration of the Great Lakes and St. Lawrence River. \'(le represent over 100 American and Canadian cities of all sizes. \Xie count the Mayors of the Wisconsin cities of lvlilwaukee, Racine, Sheboygan, Ashland, Superior and Bayfield among our members.

The importance of this precedent: How the WDNR handles the proposed Waukesha diversion will be felt far beyond Waukesha County and far beyond Wisconsin. The proposed \Vaukesha diversion is the first diversion sought under the "straddling county" exception to the Great Lakes Compact's general blanket prohibition of diversions of Great Lakes waters to areas outside the Great Lakes basin. [1] The precedential value for Wisconsin alone is enormous: the state has seventeen counties that straddle the Great Lakes basin, with a combined population of 638,450 and area of 6,480 square miles.' All eyes are on the WDN R.

Comments on the proposed diversion: The Mayors would like to register several comments and concerns with the WDNR on the proposed diversion:

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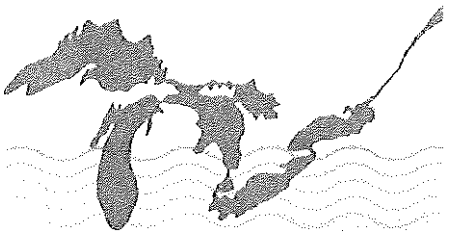
1 Don Behm, *Nnv IP'a11kesha Like Diversion Dot111Je11/s T'o11t Be11efi!s lo Great L-1kes,* 1\-IIL\VAUKEEJOURNAL-SENTINEL (Oct. 14, 2013), http:/ /\v\vw. jsonline.corn/ ne\vs/waukesha/ ne\v-,vaukesha-lake-diversion-documents-tout-benefits-to-great-lakes-b99 l 17997z 1-227617921.htn1l.

2 UNI\'. C)F ◥'IS.-i\-IIL\Vt\UKEE, *Q&A: IP'later Issues in IF'aHkesha,* http:/ /\V\V\V.ghvi. frcsh\vater.u\v1n.cdu/ Ollf\Vatcrs/ doctuncnts/\Y/aukcshaHandoutB\"X'eb.pdf Qast visited Nov. 13,2013).



Great Lakes a nd St. Lawrence (hies: Initiative
P.!Hance di;,s vlll;;,s d0s Grands Lacs- et clu S<1int-taur£nt

1.) The proposed new Waukesha service area and its western reach: The 1vfayors are concerned about the diversion of Great Lakes water to the far western reaches of Waukesha County, including to the Town of Genesee and Town of Delafield. The new Waukesha service area greatly expands the existing Waukesha service area and reaches much further from the Great Lakes basin. The spirit of the Great Lakes Compact and the straddling county exception is to minimize the distance of any diversion from the Great Lakes basin. By expanding the Waukesha se1vice area to the ,vestern edges of \ ?aukesha County, the proposed service area exacerbates existing concerns about the Waukesha diversion. The Cities Initiative asks that because of the remote nature of the diversion, the \'(II)NR apply a high level of scrutiny to Waukesha's application.

2.) The need for Great Lakes water: The Great Lakes Compact and Wisconsin implementing statutes require tha t any community applying for a diversion under the straddling county exception be "without adequate supplies of potable water." [3] The Cities Initiative asks that the WDNR scrutinize Waukesha's assertions that their current water supplies are inadequate. In particular, the Cities Initiative asks for a close examination of Waukesha's claim that the city's current deep aquifer groundwater is not sustainable. Waukesha rests much of its claim on "drastically declining water levels" in the deep aquifer. While it is true that the water table has dropped precipitously since 1960, USGS data shows that the deep aquifer water levels have been relatively stable since 1986.[4] \'(II)NR should consider the stabilization of deep aquifer water levels when evaluating Waukesha's claim that its existing wa ter source is inadequate. Stabilizing water levels could mitigate or negate \\?aukesha's concerns about i.) increasing radiun1 concen trations at deeper levels; ii.) increasing total dissolved solids contamination at greater depths; iii.) decreasing well capacity; and iv.) decreasing flo,v to surface ,vatcr._;

Furthennore, even if \\Vaukcsha adequa tely tnakes the case that the current service area shows a need for Great Lakes wa ter, WDN R should bear in mind that areas of the expanded service area *(e.g.,* Town of Genesee, Town of Delafield) have demonstrated no need for Great Lakes water and are currently served by existing adequate water supplies.

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[3] *!IS.* STAT. § 281.346(4)(e)(l)(a) (2012).

[4] J iif NICIIOLAS, AN ANALYSIS OF THE CITY OF \'(f,\LJKESI IA DIVERSION APPLICATION, 17 (2013) (citing USGS data therein).

[5] *Id.*

3.) \ 'aukesha's demand projections: The Great Lakes Compact and \Xlisconsin implementing statutes require that the "diversion shall be limited to quantities that are reasonable for the purposes for which it is proposed."" The Cities Initiative recognizes that demand forecasting is difficult and assumptions must be made. Nevertheless, we believe that \Vaukesha's forecast of 10.1 mgd is significantly higher than needed and requires careful scrutiny by \'(IDNR. The Cities Initiative requests that WDN R carefully test Waukesha's assumptions that result in the 10.1 mgd estimate including:

a. Industrial water use intensity: Is the assumption of 1,297 gallons/acre/day as the high case[7] for industrial water use intensity a fair assumption? This reflects water use intensity in 2000. Industrial water use intensity in Waukesha now hovers around 600 gallons/ acre/ day, with a 2008-2012 average of 642 gallons/acre/day.' Waukesha wishes to use the higher level for its projections.

   Waukesha claims that the recent levels are unnaturally low and reflect one- **titne influences.]'he city argues that '\vcak cconornic conditions occurring** after the terrorist attacks of September 11, 2001, and the start of the recession in 2008, which resulted in the loss of local industry, reduced **industrial \Vater use intensity."[9] Data belie this claim, ho\vever. IV1il,vaukec's** metropolitan area (including Waukesha) private industty output increased by 14.7% from 2001-2012.'" Furthermore, the number of industrial accounts in Waukesha's service area rose from 138 in 2000 to 147 in 2009." Accordingly, \VDNR should consider use of Waukesha's current, lower industrial water use intensity for modeling future demand. Water use intensity is dropping across all sectors: for example, from 1990-2010, Waukesha's water use decreased 21%, while its population increased 24%." There is no reason to believe that industrial use intensity did not follow a similar efficiency trend regardless of external economic factors.

"\',IJS. STAT. § 281.346(4)(£)(2) (2012).

[7] CITY OF \X[1]AUKESIf A, 1 CITY OF \XfALJKESIIA \?ATER DIVERSION \PPJJCAT!C)N 3-8 (2013).

[8] Ct'I'Y OJI\\[1]AUKESJ-IA, 2 CITY OF\X[1]AUKESIIA \\!ATER DIVERSION APPLICATIC)N App. C at 5 (2013).

·[1]*Id.* at 6-3.

w BUREAU OF ECON..ANALYSIS, REC;IONAL DAT,\ -GDP & PERSONAL INCOIE (2013).

[11] CITY Of \AUKES! IA, *u1pra* Note 8, at 5-2.

[12] CITY OF \\'AUKESIIA, *s11pra* Note 7, at 2-5.

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b. Residential, commercial and public use intensity: Waukesha proposes to model future demand using 2001-2012 average per capita use." However, recent efficiency measures implemented by Waukesha have brought 2012 levels belo\v their ten-year averages. [14] Overall, residential, comtncrCial and public \vatcr use intensity, tneasured in gallons per capita per day, have marched steadily downwards over the past decade. [15] \'(II)NR should consider modeling the continuation of this long-term trend, or at least using today's levels as the starting point for modeling future consumption.

c. Unaccounted-for water projections: Waukesha proposes to model future water demand projecting unaccounted-for water at 8% of total use, derived from Waukesha's 2008-2012 average."' The Cities Initia tive recognizes that this is less than the American Water Works Association target of 10%;[17] nevertheless, the 2008-2012 average is misleadingly high due to the presence of 201 l 's outlying data point at approximately 12% unaccounted-for water. [18] \'(II)NR should consider removal of the 2011 data point, resulting in a significantly lower calculation of approximately 7% unaccounted-for water. As \\la ukesha avers in discussing its conservation tncasures, "historically, [\v'aukesha] averages 4-8% unaccounted-for water."" As Waukesha promises to continue its vigilant monitoring of the system, it may be sensible to project demand using lower numbers for unaccounted-for wa ter than the 8% currently projected.

4.) Conservation and efficiency measures: The Great Lakes Compact and Wisconsin statutes require scrutiny of conservation a nd efficiency 111easures. 'fhe proposed diversion must be imple1nented so as to incorporate "environtnentally sound and econotnically feasible \Vater conservation measures"[20] to 1nini1nizc \Vatcr \v:i thdra\vals and consu1nptive use. Additionally, \"\?isconsin la\v requires that in the case of a straddling county diversion, Waukesha implement conservation and efficiency 1neasures that \vill result in 10°/o conserva tion and efficiency gains.[21] The Cities

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[11] *Id.* at 3-8.
1-l CITY *OF* \?AUKESHA, *JltjJrtl* Note 8, at App. C at 3.
[15] NICHOLAS, *11,pra* Note 4, at 29 (citing \\'aukesha application data therein).
!(, CITY *OF* \\'AUKESHA, *Jllj>ra* Note 7, at 3-8.
n*Id.*
[18] CnY OF VAUKESHA, *s1pra* Note 8, at .App. C at 5.
[19] CITY OF VAUKESI-IA, *s11prt1* Note 7, at 5-7.
2" WIS. STAT. § 281.346(6)(c) (2012).
[21] WIS. AmllN. CODE DEP'T OF NATURAL RES. § 852.05(3) (2012).

Initiative ret1uests that \\'DN R scrutinize \X'aukesha's proposed tneasurcs to ensure tha t the conservation and efficiency gains will result. To hit this target, Y(laukesha will need to find approximately 1 mgd in conservation savings.

1'he Cities I nitia tive recognizes Y\laukesha's positive history ,vith ,vater conservation initiatives, but close scrutiny is still due. Waukesha provides a list of important conservation progratns, including .itnplementing innovations in customer metering, limiting unaccounted-for water, restricting outdoor sprinkling, implementing conservation ,vater rates) expanding fixture rebate progratns and educating in the public schools." However, Waukesha makes no attempt to quantify the impact of the vast majority of these programs, other than to say they will collectively reach the 1 mgd conservation goal. The only programs where attempts are made to quantify gains are those involving fixrure rebates and the City Hall retrofit demonstration, which make up relatively insignificant pieces (less than 20%) of the overall projected savings in 2050.[21] Furthermore, even the programs that Waukesha has quantified warrant a careful look into the assumptions made. For example, Waukesha projects that approximately 63 mg in savings in 2050 will come from toilet replacements. Waukesha estimates savings of approximately fifteen thousand gallons per year for each toilet replacement." The Public Service Commission's Summary of 2010 Water U tility Conservation Reports shows that Waukesha only saved approxima tely eight thousand gallons per toilet replace1nent, and that none of the seven utilities surveyed showed savings of more than 12,047 gallons per toilet replacement.[25] Even assuming that fifteen thousand gallons per toilet can be saved, this means that 4,200 toilets will need to be replaced. From 2008-2011, only eighty eight toilets were replaced in \'(laukesha, with a $25 rebate.[21]. While rebates will increase from $25 to $100 under Waukesha's plan,[27] WDNR should be careful to pressure-test any assumptions made by Waukesha.

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[22] CITY OF ¥,\UKESHA, *Sffpra* Note 7, at *S-7*,

[23] CITY <JF \\1,\UKESI IA, 3 CITY OF \\1.AUKESHA \\I.ATER DIVERSION .1\PPLICATION .App. J (2013). Su111n1ing the projections for 2050 yields approxin1ately 70 mg in savings, or Jess than 0.2 mgd.

[24] *Id.* at 1-4.

[21] PUB. SERV. COMf'N OF \\TIS., SUf L\RY ()I' 2010 UTILITY \\I.ATER CONSERVATION REPORTS 6 tbl.2 (2010). *u,* NJCHOL.r\S, *supra* Note 4, at 29.

[27] But note that J\{adison, a city three ti1nes \\:/aukesha's size, sa,v all 2,500 of its available $100 year 2010 toilet rebates a,varded b}' ()ctobcr of that year. PUB. SERV. COL\I'N OF \\'IS., *s11prt1* Note 25, at 10. I t is possible, but the assun1ptions n1ust nevertheless be properly vetted.

5.) <u>Consideration of alternative sources</u>: The Great Lakes Compact and the Wisconsin statutory schetne require that for a diversion to be approved, there must be Hno reasona ble water supply alternative within the watershed in which the community is located, including conserva tion of existing ,vater supplies/'[28] and that \ ?aukesha has Hassessed other potential ,vatcr sources for cost-effectiveness and environn1ental effects."[29] The Cities Initia tive is concerned about the cursory or inappropriate exanUnation given to some alternatives, and the failure to consider others. Accordingly, the Cities Initiative urges WDNR to look closely at Waukesha's alternatives analysis.

\'(!])NR should satisfy itself that Waukesha was appropriate in making certain substan tive judgtnents in evaluating alternatives. For exa1nple, Lake Iichigan ,vatcr is declared to pose a "nllnor risk" in tern1s of public health,3° an assertion backed only on the grounds that "contamination is possible . . .but the large size, intake locations and high quality of Lake lvlichigan water makes this a rare occurrence."[31] This is a major reason that the Lake Michigan alternative is selected as preferred, but there is no substantive reason to believe that Lake Michigan is any more or less likely to face contamination than other water sources. Typically, aquifers are thought of as more protected water sources than open lake water, but the analysis of the aquifer alternatives gloss over this fact.[32] \'(!])NR should ensure that the same objective consideration is given to all alternatives.

Furthertnore, the Cities Initiative is concerned about the failure to discuss alternatives that minimize the use of Lake lvlichigan water. While Waukesha has proposed one approach that docs not take an "all or none" approach to using Lake Michigan wa ter (the Lake Michigan / shallow aquifer alternative), Waukesha does not explore other such "Lake-other" hybrids. The Cities I nitiative asks that \'(!])NR satisfy itself as to \'<!/aukesha,s reasons for not exploring, for exa111ple, a Lake lv ichigan / deep unconfined aquifer combination, which would rrurunuze " thdrawals from Lake Michigan while still assuring the city of a relia ble water source. 1\dditionally, considerations of surface ,vaters, including the Fox }liver (a

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''\(IJS. STAT. § 281.346(4)(e)(l)(d) (2012).
2,,WIS. STAT. §281.346(5m)(c) (2012).
30 CIT'i' OF\\'AUKESHA, *s1lpra* Note 7, at 4-18.
[31] *Id.* at 4-9.
[32] *See, e.g., id.* at 4-10 ("contaminants can pass quickly through sand and gravel aquifers").

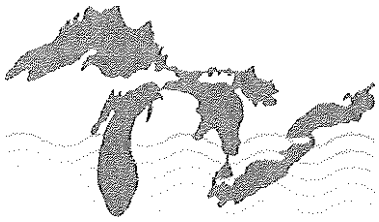
source of wa ter for 200,000-plus Illinois residents), are given short shrift." Proper consideration of alternatives to Great Lakes ,vatcr is at the very core of the Great Lakes Compact, and the Cities Initiative urges \ ;rDNR to carefully scrutinize Waukesha's compliance with the letter and the spirit of the law.

6.) Return flow considerations: The Great Lakes Compact and Wisconsin implementing statutes require the return of all diverted ,vater, less consun1ptive use, to the Great Lakes basin, and that inflows of water from outside the Great Lakes basin be minimized.[34] The Cities Initiative asks WDNR to carefully examine \'(laukesha's submission for compliance in this area. While Waukesha touts the positive effects of discharging treated wastewater effluent into the Root River," the Cities Initiative asks that WDN R carefully study the negative impacts that such discharges will have on the Root River. The Root River is prone to flooding, having recorded major floods io 2008 and 2010."' The addition of more water volume will only exacerbate the problem.

Additionally, as \X'aukesha recognizes, the Root River is already listed on the federal Clean Wa ter Act's Section 303(d) "Impaired \v'aters" list for pollutants such as total suspended solids, total phosphorous and dissolved oxygen." The Cities Initiative asks WDNR to carefully examine the consequences, both ecological and legal, of increasing discharges of pollutants to an already-impaired wa terway.

\le appreciate your revie,v of the above com1nents and your close cxan1ination of the Waukesha application. The scrutiny given this application will set an important precedent for future diversion applications under the Grea t Lakes Compact. Please reach out ,vith any questions that you tnight have about our concerns.

B FRIENDS OF THE Fox RIVER, STATE OF THE Fox RIVER REPORT 1 (2003), *available at* http:/ /prairierivers.or.g/\vp-contcnt /uploads/2007 /09/statcoffoxr.ivcr.2003.pd f.
"WIS. STAT. §281.346 (2012).
[35] *See, e.g.,* Behm, *supra* Note 1.
.I(, Don Behm, *IF'a1lkeshtl'.r Rool Rivtr IF'ater Plan: Bet/er FiJhi1lg or IJ7011e Flooding?,* 11IL\VAUKEE JOURNAI,-SENTINEL (Nov. 14, 2013), http:/ /v.'\vw.jsonline.con1/nc,vs/,vaukcsha/,vaukeshas-root-r.iver.-\vatcr-plan-bcttcr-fishing-or-,vorsc-flooding-b99140 l 48z 1-231752221.httnl.
.17 CITY OF \X'AUKESI IA, 4 CITY 0J,' \\'AUKES! !,\ \V,\TER DIVERSI()N APPLICATION § 3.2.7 (2013).



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Sincerely)

Keith P. Hobbs

lvlayor Keith Hobbs, Thunder Bay, Canada
Chair – Gt"cat Ilakes and St. La,vrencc Cities Initiative

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Ms. Shaili Pfeiffer
Wisconsin Department of Natural Resources
Via email: shaili.pfeiffer@wisconsin.gov

August 12, 2015

RE: *Issues pertaining to the water supply service area plan as proposed in the City of Waukesha's application for a diversion of Lake Michigan water under the Great Lakes Compact*

Dear Ms. Pfeiffer,

We are writing on behalf of the Compact Implementation Coalition with some clarifying questions that arose from a conversation that we had in July with Eric Ebersberger and Judy Ohm. We hope that we can come to a common understanding of the Department's intended procedure and how the approval process for the water supply service area (WSSA) plan should be structured to ensure compliance with the Great Lakes Compact.

With regard to the rulemaking for the process of water supply planning mandated under Wis. Stat. s. 281.348, it is our understanding that the department intends to abandon the draft rule NR 854, and approve the WSSA plan without the requisite rulemaking.

As described during our last conversation with Department staff, the approval of the WSSA plan would not take place until after the Regional Body review and the Council approves (or denies) the diversion application as a whole, and the Department anticipates that the Council may condition approval of the diversion on changes to the WSSA. With these basic process concepts in mind, we have a number of follow up questions that we request responses to from the Department:

1. The Department has stated that formal public hearings were held on the development and implementation of the WSSA plan. We are not aware of any such public hearings that were held or records of such by SEWRPC, City of Waukesha or the DNR and how they complied with specific criteria in Wis. Stat. §281.348, or the Great Lake Compact provisions governing a community without potable water supplies. Can you provide us with the specific dates and records of such formal public hearings on the WSSA Plan, including any formal documents that were issued such as a response to comments?

2. It is our understanding that individual households or parts of communities in Wisconsin have experienced or might experience bacterial contamination of water supplies requiring appropriate construction of well casings to prevent such contamination of their water supplies – what are the DNR's policies and requirements in those instances? How many of those communities have been required to seek municipal water supply service instead of implementing construction of well casings to prevent contamination? If these communities are required to hook up to a municipal supply, will they also be required to abandon or improve their existing wells? What is required in an instance where a community needs to hook up to the municipal supply, but cannot? Is there a policy in place for an interim solution?
3. DNR and Waukesha have both stated that a DNR official recommended that a portion of the Town of Genesee be included in the WSSA plan for public health reasons. We have not seen an official record of such a recommendation by the DNR, can you supply us with that formal recommendation and when it was issued? Has the Department considered other options for the Town of Genesee's water supply?
4. Have any homeowners, businesses or other entities within the Town of Genesee (4.4 sq. mile area recommended to be added to the WSSA plan) requested to hook up or in fact have any been hooked up to the City's water supply because of bacterial contamination in their wells? How many households have experienced well contamination or are on land that is unsuitable for septic, and where are they located?
5. Over the past several years, the Department, the City of Waukesha and SEWRPC have said that any WSSA plan must be coterminous with an approved sewer service area plan. However, it would appear that SEWRPC and the City of Waukesha's development and reliance on the WSSA plan of 2008 is in direct conflict with this mandate because the portion of the Town of Genesee included within the WSSA plan is not within the City's sewer service plan. Now, the Department has conditioned its approval of the WSSA plan on the addition of the Town of Genesee area to the sewer supply plan. What are the legal requirements for this type of post-hoc revision of the sewer service plan and what are the opportunities for the general public to be meaningfully involved in that process?

We are also very concerned to learn that the Department intends to respond to public comments only on the Department's draft EIS, and not on the Department's draft Technical Review. The Compact makes clear that States are required to provide for meaningful public participation when reviewing diversion applications. As part of that, States must "provide a record of decision" which includes both the public comments that were submitted during the process and the State's "responses." Great Lakes–St. Lawrence River Basin Water Resources Compact Art. 6, §6.2. Waukesha and DNR have made numerous technical and substantive changes to Waukesha's application since the Department's last public participation process in

2013. These changes demand another round of Department response to comments. Furthermore, it is disconcerting that for a decision of this magnitude the Department would depart from long-established principles of meaningful public participation. Accordingly, we strongly urge the Department to reconsider its plan to not respond to comments on the draft Technical Review.

We look forward to the Department's response to these questions and a continued dialogue about these important issues pertaining to Waukesha's application.

Sincerely,

Peter McAvoy, of Counsel

Elizabeth Wheeler, Clean Wisconsin

Clean Wisconsin ▪ Midwest Environmental Advocates
Milwaukee Riverkeeper ▪ River Alliance of Wisconsin
Sixteenth Street Community Health Center
Waukesha County Environmental Action League
Wisconsin Wildlife Federation

September 19, 2009

Mayor Larry Nelson
Waukesha City Hall
201 Delafield Street
Waukesha, WI 53188

Dear Mayor Nelson,

We wish to thank you for the opportunity we had to meet with you, Dan Duchniak and Bill McClenahan last Tuesday to discuss the outline we provided of continuing issues of concern relating to the City of Waukesha's prospective application for a diversion of Great Lakes water under the Great Lakes Compact and Wisconsin's Act 227.

As we explained, our primary interest remains the successful implementation of the Great Lakes Compact, and we recognize that the City of Waukesha's application for diversion will set an important precedent at both the state and regional level. Towards that end, we have sought over the course of the past six months' document exchange and last week's meeting to identify and bring to Waukesha's attention issues that, if left unaddressed, could form the basis for opposition to the City's prospective application. As set forth in the outline document, such issues include, but are not limited to:

- the need for a more comprehensive evaluation of Waukesha's water supply options and potential service area mindful of the Compact's "no reasonable alternative" provision;

- the need for a thorough, side-by-side analysis of potential return flow options to accompany the respective water supply options identified by Waukesha to date; and

- the value of Waukesha proactively committing to an Environmental Analysis protocol as a tried and true means of addressing both potential opposition and uncertain regulatory guidance given that any application for a diversion of this nature will comprise a major action under WEPA;

- the importance of providing a meaningful opportunity for the public and other stakeholders to be heard in the public participation process.

Again, we appreciate your interest in including us in this ongoing communication process and will be very interested in following the development of your application.

Best regards,

Jodi Habush Sinykin, Of Counsel
Midwest Environmental Advocates

On behalf of the following organizations:
Clean Wisconsin
Milwaukee Riverkeeper
River Alliance of Wisconsin
Sixteenth Street Community Health Center
Waukesha County Environmental Action League
Wisconsin Wildlife Federation

WAUKESHA COUNTY
ENVIRONMENTAL ACTION LEAGUE
Protecting Waukesha County's natural resources since 1978

March 26, 2010

Lori Sweet
Waukesha Water Utility
115 Delafield Street
Waukesha, WI 53188

RE: Comments on Waukesha's Draft Application for a Lake Michigan Water Supply

Dear Ms. Sweet,

Thank you for the opportunity to comment on the Lake Michigan Water Supply draft diversion application of January 2010.

The Waukesha County Environmental Action League (WEAL) is a 30+ year-old grassroots environmental organization whose mission it is to protect and preserve the natural resources of Waukesha County. WEAL's membership includes City residents as well as residents of the surrounding townships whose addresses have recently been included in the service area boundary as drawn by SEWRPC in December 2009. In addition to WEAL's organizational work on the water issue, and our individual efforts as citizens and taxpayers, WEAL also works in collaboration with a regional and statewide coalition of environmental groups called the Compact Implementation Coalition (CIC), a coalition formed to ensure that the Great Lakes Compact be implemented as intended.

As you know, WEAL has been keenly interested and closely involved with the water issues in the City of Waukesha and surrounding areas since their beginnings back in the 1980s when City of Waukesha water was tagged as exceeding maximum standards for radium by the Environmental Protection Agency (EPA).

In November 2008, the City of Waukesha and Waukesha Water Utility (WWU) officials called upon WEAL and other CIC member organizations to help them develop an application (and application process) that would be precedent-setting in its excellence, thoroughness and transparency--and use best available science and practices to support its case that Waukesha needs another water source.

The CIC response was seven pages of thoughtful, thorough questions, and expertise provided courtesy of attorneys, biologists, health providers, scientists, and activists, representing experts and average citizens of the SE Wisconsin and the state. These many questions were constructed to address both letter- and spirit-of-the-law standards established by the Great Lakes Compact, and to help the City meet its stated goal of setting a high standard (precedent) for what is expected to be the first Compact application for a diversion outside the Great Lakes basin. Though many questions were technical and detailed, we believe that answered in good faith, with an appropriate level of detail, and using science as the basis, these answers would, in total, lead to the making of a solid case for a diversion, a result we could and would endorse.

When responses to the CIC questions were finally received in June 2009, many answers were incomplete, vague or confusing, evaded the intent of the question or were not directed to the question asked.

In some cases, a response took issue with the wording of a question and focused on semantics while avoiding answering the question, referred to another document or inferred that the question should not have been asked. Arguments were unsupported by details. Conclusions were drawn that were not supportable from the scientific studies cited. Some responses contradicted others. Science and thoughtful analysis took a backseat to the sales pitch. Math sometimes did not add up. A typical response was that "we're still studying that" or "we'll get back to you." And no one ever did. There are numerous areas remaining where questions have yet to be answered adequately.

Another meeting was held on September 8, 2009 at which we were assured that questions would be answered and details provided once "additional studies were complete." In a follow-up letter to the City of Waukesha and Utility dated September 19, 2009, Attorney Jodi Habush-Sinykin of the CIC outlined several issues considered to be outstanding, including, but not limited to:

- the need for a more comprehensive evaluation of Waukesha's water supply options and potential service area mindful of the Compact's "no reasonable alternative" provision;

- the need for a thorough, side-by-side analysis of potential return flow options to accompany the respective water supply options identified by Waukesha to date;

- the value of Waukesha proactively committing to an Environmental Analysis protocol as a tried and true means of addressing both potential opposition and uncertain regulatory guidance given that any application for a diversion of this nature will comprise a major action under WEPA;

- the importance of providing a meaningful opportunity for the public and other stakeholders to be heard in the public participation process.

The first two bullet points remain unaddressed in the diversion application of January 2010.

At the (Great Lakes) regional review level, in order to establish the credibility needed for seven gubernatorial approvals, a successful diversion application will need to build a good case, cite or include base studies, and make reasoned arguments that are supported within the document. Other Great Lakes states, even those following Wisconsin issues, haven't been living and breathing a Waukesha diversion. The City of Waukesha and the WWU must begin at the beginning with this application, including a brief narrative of the EPA ruling on non-compliant radium levels and subsequent lawsuits. Without this, other states will wonder what led up to the WI DNR's consent decree of 2008, or perhaps assume erroneously that the compliance order was the originating event for the application. We understand that this may be unpleasant, but without context, the application will fail to establish the need for a new water source, if the case can be made.

In many respects, our concerns and comments have changed little since WEAL first formulated a series of questions for the City of Waukesha Common Council in February of 2006. We observe the following:

The City's draft application does not meet the Great Lakes Compact's diversion exception standard to exhaust all "reasonable water supply alternatives within [its own] basin . . . including conservation of existing water supplies" as a condition of making application for an exemption to the Compact's ban on diversions:

Many of the earlier (14) alternatives were dismissed as "too expensive," "too political," or "not implementable." The City will have to do better to describe just how costs were estimated and compared, what details were analyzed, and how that conclusion was drawn. It could be said, without too much of a stretch, that a Lake Michigan diversion option represents all of those things and more. Furthermore, in eliminating 12 of these alternatives, the City relies on a 2002 Water Supply Plan that is nearly a decade old. Has anything else changed in a decade? Costs certainly have increased. What assumptions are going into the numbers that lead the City to assert that a Lake Michigan diversion is the least costly option? No party can make that determination until the City releases cost breakdowns to the public.

WEAL remains skeptical about any alternative that was dismissed due to its being "too expensive" without being updated and reanalyzed. WEAL continues to call on the City to show its work in making projections and cost estimates (broken down, not in a single sum) in a side-by-side comparison of all options and combinations thereof.

The draft application does not adequately justify the need for the 18.5 mgpd that is being requested, an amount that is nearly three times the average daily amount now being used:

Page 2-1: 10.9 mgpd maximum day demand for projected service area
6.86 mgpd average daily use

Earlier estimates of requested amounts ranged from 20 – 24 mgpd. This fall, the amount was lowered to 18 mgpd. However, even with this adjustment, the application fails to establish a need for the 18.5 mgpd, even if "10.9 mgpd maximum day demand for projected service area" is used.

SEWRPC projects the City's water service area will expand significantly over the current boundary area. Also according to SEWRPC, large swaths of land (in the additional service area) are not buildable due to their designation as wetlands or environmental corridor.

Another large part of the land within the newly drawn boundary is already developed under township residential zoning of larger lots with private wells and septic systems. Residents in these subdivisions are unlikely to request annexation in light of higher taxes

and the already incurred costs of well and septic. In these developed sections are newer subdivisions with high percentages of unsold homes (even after years on the market), excess inventory of new construction, and an unstable economy - with a grim jobs outlook and tight credit availability - which may never recover to its previous level. Peak oil, rising gas and oil prices may make this type of suburban/rural living unattainable for many. Due to these factors, projections in population growth may never materialize.

According to SEWRPC, "only 15 % of the service area land is available for new future development." Much of this land is scattered to the south, west and east of current city boundaries and in the outermost extremes of the newly drawn service area. These far-flung areas would require enormous investments in infrastructure to bring city services to

this largely rural area. There are no guarantees that the land will be developed at all, or that it wouldn't become residential development with private wells and septic systems.

Water Conservation Lacks a Future Plan and Details About Implementation:

Page 2-5 lists "Water Conservation and Protection Plan Goals", and rates each idea on a "relative water savings benefit scale." However, a listing alone does not constitute an actual plan. We would expect that while making a case to the WIDNR and the Great Lakes Governors of the exceptionalism of this plan, an actual plan should include a description of each plan component and how it accomplishes or progresses toward each goal, a prioritization of components (in the plan) with start dates and target dates for goal completion, quantifiable and measurable standards of completion success, an analysis of already implemented components, an estimation of conservation impact, an annual conservation budget including actual funds expended for years 2006 - 2009 (and on what), and projections for 2010 and beyond for implementation of components yet to be launched.

On page 1-3, several water use decrease percentages were given, but lack of supporting detail raises more questions about how these amounts were derived and what impact conservation made on the decrease. For example, the 31% decrease between 1988 and 2008 is correlated with an 18 % increase in the population during the period, but no mention is made regarding loss of manufacturing capacity during the decade and what effect that those losses had on the 31%. Was any usage reduction attributable to conservation?

The 11% decrease between 2005 and 2008 does not factor in the two extremely wet summers of 2006 and 2007. As drought conditions were a factor in '05, and '06 and '07 exceeded average rainfall for summers, how can the 11% be attributed to conservation? The draft also fails to mention what year (and month) the sprinkling ban went into effect.

WEAL appreciated the City's commitment to proceed with a transparent, "high-bar" application under the Great Lakes Compact. However, we are disappointed in the resulting process. The openness and transparency promised early and repeated often did not materialize as requests for information and details were stymied, closed meetings were held at both the Water Utility and the Common Council, and, a number of questions have gone unanswered. Comments were not recorded nor made available to the public. And the following chronology will show how little time has been available for citizen input on the actual application.

Feb 23: Public comment (Committee of the Whole)
March 8: Public comment (Committee of the Whole)

March 18: Water Utility Commission votes to recommend diversion application to Common Council
March 26: Public comment period ends
April 8: Common Council votes on recommended diversion application from Water Utility Commission

If the Water Utility Commission were to fairly consider and weigh public comments, why is the close of public comments seven days AFTER the WWU Commission vote? And how can the Common Council vote on the WWU Commission recommendation if public comments were not all received and known by the Commission when it forwarded the diversion application?

Because this proposed diversion application will likely be the first under the recently approved Great Lakes Compact, its precedent-setting impact will be enormous on the legal tenets of the Compact. Because of its scale, the diversion will cost a significant amount and will forever alter the environment in two watersheds. For these reasons, its details should be well explained and well understood by all stakeholders, and all decisions carefully considered before an application is submitted.

In many of its iterations, the diversion application continues to insist that it seeks Lake Michigan water as the most "sustainable" source. WEAL challenges the City and County of Waukesha to become truly sustainable: to live within its own means, both water and financial. The City is not without water resources, as are many communities in the southwest. WEAL challenges the City to model true leadership by demonstration through practice and recognition that all resources are finite, that a Midwest city with reasonable resources, imagination and hard work, can learn to live and thrive within its means. The lesson to be taken from Peter Annin's book, Great Lakes Water Wars, is that seemingly vast, inexhaustible water resources can indeed be depleted, the Great Lakes and precious groundwater resources among them.

We appreciate your consideration of these comments.

Sincerely,

Steve Schmuki, President
Waukesha County Environmental Action League
schmuki@execpc.com

cc: Todd Ambs, Department of Natural Resources
Governor Jim Doyle

Mayor Larry Nelson, City of Waukesha
Mayor Tom Barrett, City of Milwaukee
Melissa Malott, Clean Wisconsin
Cheryl Nenn, Milwaukee Riverkeeper
Denny Caneff, River Alliance of Wisconsin
George Meyer, Wisconsin Wildlife Federation

Mr. Eric Ebersberger
Section Chief, Water Use
Wisconsin Department of Natural Resources
101 S. Webster St.
Madison, WI 53703

July 15, 2015

Dear Mr. Ebersberger,

Enclosed please find a copy of the report authored by the engineering firm, GZA GeoEnviromental, Inc., which presents a compelling non-diversion alternative to the diversion application currently advanced by the City of Waukesha under the Great Lakes Compact and pending final review.

You will recall that members of your Water Use Section met with GZA experts and members of our Coalition back on March 26 and June 17, 2015, to discuss the water supply alternatives available to the City of Waukesha. The meeting in March prompted our Coalition to issue a letter, dated April 28, 2015, the receipt of which you subsequently confirmed, which alerted you to our concern that Department staff appeared to be predicating their reasonable water supply alternatives analysis solely on the expanded water supply service area proposed by the City of Waukesha. We urged you to expand your analysis and to recalibrate your modeling work to take into account the water demands attributable to a smaller water supply service area, namely, Waukesha Water Utility's current water supply service area. We explained that Waukesha's application rests upon a faulty premise; namely, it is based upon an assumed expanded water supply service area that includes portions of four neighboring communities who have not implemented sufficient water conservation measures, demonstrated an inadequate supply of potable water, or agreed to use diversion water, even if they should need an alternative water supply sometime in the future. As you know, through our April 28 letter and numerous other conversations, we contend that each of those facts means that Waukesha's application fails to comport with the Great Lakes Compact.

In light of these prior communications, the enclosed GZA GeoEnvironmental, Inc. report should come as no surprise but, rather, serve as further admonishment against an incomplete review or premature approval of Waukesha's application at the state level. Indeed, the report's authors not only identify key aspects of Waukesha's application that call for greater Department inquiry and evaluation but they clearly detail a "No Diversion Solution," a reasonable water supply alternative, per Wisconsin's statutory definition of the term, relying upon the city's current water supply service area and existing infrastructure and groundwater wells. This new information, more clearly than ever, demonstrates that Waukesha *has* a reasonable water supply alternative to a diversion.

We thank you for your careful consideration of this report and, once more, for your ongoing commitment to the Great Lakes Compact. Should you wish to discuss our findings in greater detail we would welcome the opportunity to meet with you.

Very Truly Yours,

Jodi Habush Sinykin
Of Counsel, Midwest Environmental Advocates

On behalf of the Greater Compact Implementation Coalition:

Alliance for the Great Lakes
Clean Wisconsin
Midwest Environmental Advocates
Milwaukee Riverkeeper
National Wildlife Federation
Natural Resources Defense Council
River Alliance of Wisconsin
Waukesha County Environmental Action League
Wisconsin Wildlife Federation
Peter McAvoy, of counsel to the CIC

MEMORANDUM

Date: March 11, 2009

To: Secretary Matt Frank, Wisconsin Department of Natural Resources

From: The Great Lakes Compact Implementation Coalition
Clean Wisconsin
Midwest Environmental Advocates
Milwaukee Riverkeeper
River Alliance of Wisconsin
Sixteenth Street Community Health Center
Waukesha County Environmental Action League

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Our coalition appreciates the opportunity to meet with you to discuss some of the significant issues associated with implementing the Great Lakes Compact. To facilitate our discussion, we have outlined below the major topics we are interested in covering at Thursday's meeting.

One major topic is our recommendation calling for the Department to begin rulemaking for certain key provisions of the Compact. A second topic is the Department's letter to Waukesha in which it has apparently determined that Waukesha's creation of a new pipeline and discharge of wastewater into Underwood Creek would be considered an "existing" discharge.
A third topic is the Department's disposition of the New Berlin diversion application.

I. Background and Specific Issues of Focus for Rulemaking

In calling for rulemaking our coalition recognizes the staffing and time constraints the DNR is operating under, but it is imperative for the DNR to begin this process prior to responding to any precedent-setting applications for diversions and we look forward to working with the Department to put together forward thinking rules that implement the Great Lakes Compact. Our recommendation is also consistent with the Wisconsin Legislature's directive that rules be developed by the end of 2009 for specific provisions of the Compact.

It now appears that the City of Waukesha is not under immediate and significant time constraints in resolving its water supply issues due to their recently announced settlement with the Attorney General over the radium issue. However, if Waukesha or some other Wisconsin community seeks to advance a new application for a diversion in the near future the need for action on rules becomes all the more important.

In the absence of thoughtfully developed rules we are concerned that decisions made on any new diversion application will have significant, precedent-setting impacts and unintended consequences for other diversion requests. This would be most unfortunate as we begin the process to implement what is undeniably one of the most significant advances in state and regional water policy in decades.

In turn, making what may be perceived as "ad hoc" decisions on a diversion request here in Wisconsin, may cause unnecessary uncertainty, controversy and litigation between the other Great Lakes States and undermine the truly remarkable regional collaboration on getting the landmark Compact adopted just a few months ago.

While we understand that rulemaking will take some time, the principle areas of focus that would benefit from rules in the short term would address sections of Act 227 concerning certain diversion provisions. In particular, the following areas need the added clarity and specificity of rules:

1) The criteria that will be employed by the Department in determining when an application for a diversion is deemed "complete" and ready for public review and comment.

2) The public's notice and ability to comment on diversion applications at key points in the review and decision making process. For example:

    a. what requirements, if any, must communities follow in providing for public notice, comment, response to comments, and records of such in the development of diversion applications,

    b. when the Department determines an application is complete,

    c. when the Department sends an application for formal review by the other Great Lakes States,

    d. when comments are received back from individual states and the Regional Council and prior to Wisconsin making a decision on a diversion application or amendments to it.

3) Return flow requirements of the Compact, including:

    a. the process for determining consumptive use and acceptable "water loss" of diverted waters,

    b. the commingling of outside basin waters,

    c. whether use of excessively leaky pipes (I/I) is acceptable and appropriate public policy,

    d. the determination and documentation of economic and ecological impacts and costs of return flows to receiving waters,

    e. the parameters, if any, for allowing "disruptions" in return flows

4) Water conservation measures that must be employed and documented by communities seeking a diversion.

5) Guidance to regional planning agencies and communities on the elements required for water supply plans that are used to define the "area" to be served by a proposed diversion including alternatives that may be considered, economic and environmental impacts of each and connections with other local development and water quality plans.

II. Discharge to Underwood Creek Should be Considered a "New" Discharge in Compliance with the Clean Water Act and Common Sense.

In public presentations Waukesha has indicated that it will propose to return its flow to the Great Lakes Basin by creating a new point-source discharge to Underwood Creek. Although the Department has indicated that it will treat Waukesha's return flow as an existing discharge, we believe this conclusion is incorrect as it is inconsistent with state law and defies common sense.

The distinction is a critical one, because the Department's anti-degradation procedure contained in NR 207 is triggered only by new or expanding discharges to state waters. While we appreciate that the Department has committed to revising its anti-degradation procedure as part of its current triennial review of water quality standards, even under the existing procedure, the new discharge proposed by Waukesha to Underwood Creek would trigger regulatory requirements for Waukesha to evaluate alternatives to the new discharge, assess whether there will be a lowering of water quality in Underwood Creek, and demonstrate to the Department and the public that any significant lowering of water quality is justified by important economic or social development. Wis. Admin. Code § NR 207.04(1) and (2).

III. The New Berlin Diversion Application

How does the Department intend to address the application after the current comment period closes?