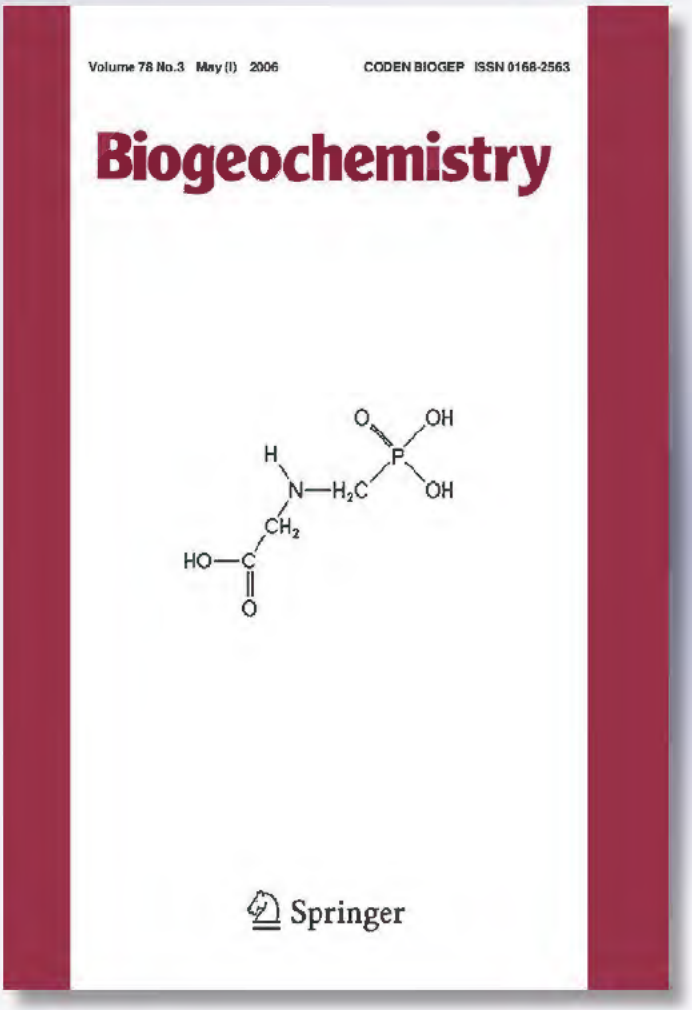
Effects of road salt deicers on sediment biogeochemistry

Seon-young Kim & Carla Koretsky

Biogeochemistry
An International Journal

ISSN 0168 2563

Biogeochemistry
DOI 10.1007/s10533 012 9728 x



Springer

Your article is protected by copyright and all rights are held exclusively by Springer Science+Business Media B.V.. This e-offprint is for personal use only and shall not be self-archived in electronic repositories. If you wish to self-archive your work, please use the accepted author's version for posting to your own website or your institution's repository. You may further deposit the accepted author's version on a funder's repository at a funder's request, provided it is not made publicly available until 12 months after publication.

Springer

Author's personal copy

Biogeochemistry
DOI 10.1007/s10533 012 9728 x

Effects of road salt deicers on sediment biogeochemistry

Seon-young Kim · Carla Koretsky

Received: 27 June 2011 / Accepted: 10 March 2012
© Springer Science+Business Media B.V. 2012

Abstract Road salt deicers, especially NaCl and $CaCl_2$, are increasingly applied to paved areas throughout the world. The goal of this study is to investigate the influence of high concentrations of these salts on wetland biogeochemistry. Sediment cores were collected in fall and spring from a freshwater wetland fringing an urban kettle lake (Asylum Lake, Kalamazoo, MI, USA), and incubated for 100 days in deionized water (control) or with treatments of 1 or 5 g/L $CaCl_2 \cdot 2H_2O$ or 5 g/L NaCl to simulate addition of road salt deciers. At monthly intervals, cores were sliced into three depths (0 5, 5 10, 10 15 cm) and pore waters extracted for analysis of pH, total alkalinity and dissolved Mn(II), Fe(II), PO_4^{-3}, NH_3, H_2S, SO_4^{-2}, Na, K, Mg, and Ca. Changes in solid phase geochemistry were assessed by measuring the percent organic matter and the distribution of Fe and Mn among four operationally defined sediment fractions (exchangeable, carbonate, reducible, oxidizable) in the control and treatment cores. Addition of NaCl, and especially $CaCl_2$, stimulated significant growth of microbial mats at the core sediment water interface and led to decreased pH and increased concentrations of Mn(II), Fe(II) and exchangeable cations (Ca, Mg, K, Na) in the sediment pore waters. This study demonstrates that the influx of road salt deciers is likely to have a significant impact on biogeochemical cycling in wetland sediments.

Keywords Road salt · Deicer · Redox · Wetland · Anaerobic · Sediment

Electronic supplementary material The online version of this article (doi:10.1007/s10533 012 9728 x) contains supplementary material, which is available to authorized users.

S. Kim · C. Koretsky (✉)
Department of Geosciences, Western Michigan University, Kalamazoo, MI, USA
e mail: carla.koretsky@wmich.edu

Present Address:
S. Kim
Wonju Regional Environmental Office, Ministry of Environment, Wonju, Korea
e mail: ecosun0@korea.kr

Introduction

Globally, the use of road salt deciers, typically NaCl and $CaCl_2$, has increased dramatically with urbanization and expansion of paved areas. For example, in the United States, ~164,000 tons of salt per year was used for deicing purposes in 1940 compared to >15,000,000 tons in the early 2000's (Salt Institute 2011). In Canada, an estimated 4,749,847 tons of NaCl was applied as a decier in 1997 1998 with levels of use in most provinces the same or increasing over the period from 1980 to 2000 (Environment Canada 2001). Road salt is also commonly used in Europe (e.g. Kjensmo 1997; Thunqvist 2003; Rodrigues et al. 2010; Galuszka et al. 2011) and Asia (e.g. Kayama et al. 2003; Kim et al. 2004).

Published online: 27 March 2012

Author's personal copy

Many adverse environmental impacts associated with road salt use have been reported. For example, investigators have demonstrated using both field and laboratory studies that road salt additions may result in decreased aquatic biodiversity (Tuchman et al. 1984; Bridgeman et al. 2000; Ramakrishna and Viraraghavan 2005), detrimental effects on amphibians (Sanzo and Hecnar 2006; Karraker et al. 2008) and changes in microbial community structure (Hale and Groffman 2006; Tiquia et al. 2007). Road salt additions also alter the chemistry and density structure of lakes, with important ecosystem consequences (e.g. Bubeck et al. 1971; Bubeck and Burton 1989; Kjensmo 1997; Bridgeman et al. 2000; Judd et al. 2005; Novotny et al. 2008; Koretsky et al. 2011), and there is increasing concern regarding the potential contamination of potable water supplies by deicers (e.g. Williams et al. 1999; Kaushal et al. 2005; Bester et al. 2006; Findlay and Kelly 2011).

Relatively little is known regarding changes in sediment biogeochemistry resulting from the enormous seasonal influx of NaCl, $CaCl_2$ and other deicing agents to wetland soils (e.g., Environment Canada 2001; Kelly et al. 2008). Both field and laboratory studies show that deicer additions may lead to increased concentrations of calcium, potassium and magnesium in wetland pore waters (e.g. Bauske and Goetz 1993; Norrstrom and Jacks 1998; Lofgren 2001; Norrstrom and Bergstedt 2001; Backstrom et al. 2004), and decreases in pore water pH (Lofgren 2001; Backstrom et al. 2004), presumably due to ion exchange processes. Backstrom et al. (2004) attributed seasonal decreases in the dissolved organic carbon concentrations of soil pore waters to the combined effects of coagulation and sorption of DOC resulting from decreases in pH and increases in dissolved Ca levels caused by influxes of road salt. Several studies have also suggested that addition of road salt deicers may increase trace metal mobility and bioavailability in soils and sediments. For example, increases in dissolved cadmium are attributed to release via ion exchange and to enhanced solubility due to the formation of aqueous cadmium-chloro complexes (Amrhein et al. 1992; Bauske and Goetz 1993; Lofgren 2001; Backstrom et al. 2004; Mayer et al. 2008; Nelson et al. 2009). Increases in dissolved Zn, Cu, Cr, Ni and Pb have also been documented in field and laboratory studies of soils and sediments impacted by road salt deicers (Amrhein et al. 1992; Bauske and Goetz 1993; Norrstrom and Jacks 1998; Lofgren 2001; Backstrom et al. 2004; Nelson et al. 2009). Considerably less is known regarding changes in organic matter degradation pathways or cycling of redox-sensitive elements such as manganese, iron and sulfur in wetlands impacted by deicers. Mayer et al. (2008) collected pore waters from Rouge River Pond bottom sediments (maximum water depth ~4 m) with large concentrations of Na (~2,000 ppm) and Cl (~3,000 ppm) at the sediment water interface due to road salt deicer runoff, and found elevated concentrations of Fe (up to 100 ppm) and Mn (up to 4 ppm) in the upper 40 cm of the sediments, suggesting that road salt could influence redox processes in wetland sediments and soils.

The objective of this study is to investigate changes in sediment pore water and solid phase geochemistry, especially major (Na, Ca, Mg, K) and redox-sensitive (Fe, Mn, S) elements, resulting from the application of NaCl and $CaCl_2$ deicers to wetland sediments. Sediments cores were incubated in deionized water, NaCl or $CaCl_2$ solutions to mimic the effect of runoff with high levels of road salt deicers. The evolution of the pore water chemistry (pH, total alkalinity, Fe(II), Mn(II), sulfate, sulfide, phosphate, ammonia, calcium, magnesium, potassium, and sodium) was monitored as a function of deicer and incubation time. Changes in solid phase organic matter content were measured using loss-on-ignition, and a sequential extraction scheme was used to assess changes in solid-phase metal-association with four operationally defined fractions (readily exchangeable metals, carbonate, reducible and oxidizable). These measurements were intended to provide insights into changes in sediment geochemistry resulting from the widespread application of NaCl and $CaCl_2$ deicers.

Methods

Experiments were conducted using sediments from a fringe wetland on the west side of Asylum Lake, a ~19.8 ha kettle lake located in Kalamazoo, MI. The lake is surrounded by light residential development together with forests and meadows in a nature preserve. The wetland sediments have been influenced by both surface water runoff and groundwater input contaminated by road salt, primarily originating from US-131, located to the west of the lake (Fig. 1). Sauck

Author's personal copy

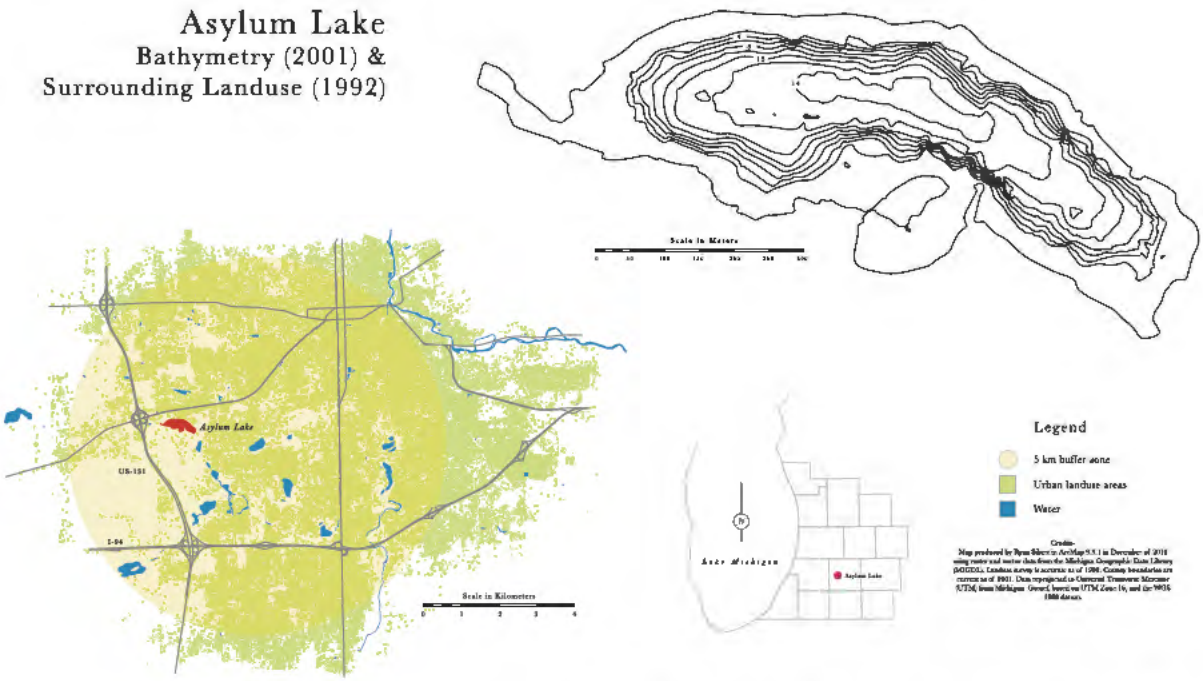


Fig. 1 Maps of study site showing urban land use in 5 km buffer zone and bathymetric map of Asylum Lake (based on data collected by Western Michigan University Facilities Management, personal communication)

and Barcelona (1992) measured dissolved Na and Cl concentrations of up to 248 and 480 mg/L, respectively, in shallow ground waters to the west of Asylum Lake and east of US-131 in June 1992. Sodium and Cl levels were nearly two orders of magnitude lower in ground waters located just to the west (up gradient) of US-131 (Sauck and Barcelona 1992). Koretsky et al. (2011) reported ~90 mg/L Na and ~160 mg/L Cl in Asylum Lake surface waters increasing to >100 mg/L Na and >200 mg/L Cl in lake bottom waters (~16 m depth) collected in July 2010. Prior studies demonstrated that sediment pore waters from the south shore of Asylum Lake were strongly redox-stratified with both iron- and sulfate-reduction suggested to be important organic matter degradation pathways (Koretsky et al. 2006).

In this study, sediments were collected in fall 2009 and spring 2010 using cylindrical PVC cores (diameter 5 cm, length 15 cm). The experiments were replicated in spring and fall because microbial community structure in wetland sediments often shows strong seasonal variations (e.g., Koretsky et al. 2003, 2005, 2006). Thirty cores were collected in fall and 39 were collected in spring. In each season, three cores were used to measure the initial conditions. The remaining cores were incubated in sets of nine, with each set placed in a vat containing deionized water (control), 5 g/L NaCl (0.086 M NaCl = 2.0 mg/L Na = 3.0 mg/L Cl), 5 g/L $CaCl_2 \cdot 2H_2O$ (0.034 M $CaCl_2$ = 1.4 mg/L Ca = 2.4 mg/L Cl) or 1 g/L $CaCl_2 \cdot 2H_2O$ (0.0068 M $CaCl_2$ = 0.27 mg/L Ca = 0.48 mg/L Cl).

The concentrations of salt used in the incubations were based on reported levels of NaCl in surface waters and soils in areas of road salt deicer application. Environment Canada (2001) reports up to 5 g/L NaCl in urban lakes and ponds, up to 4 g/L NaCl in ponds and wetlands and >18 mg/L NaCl in road runoff impacted by deicers. High levels of chloride have also been reported in roadside soils in Sweden (>1.74 g/L Cl; Backstrom et al. 2004) and in the upper portion of retention pond sediments in Michigan (>3 g/L Cl; Mayer et al. 2008). Ohne (1990) found up to 9.1 g/L Na and 13.5 g/L Cl in wetland surface waters adjacent to salt storage facilities in Maine. Fall cores were incubated in 5 g/L NaCl or 5 g/L $CaCl_2 \cdot 2H_2O$. Because a large effect on the pore water biogeochemistry was observed with the $CaCl_2$ treatment, spring

Author's personal copy

cores were also incubated in a lower concentration of $CaCl_2$ (1 g/L $CaCl_2 \cdot 2H_2O$).

Water levels were maintained at 8 cm above the sediment water interface by adding small quantities of deionized water to each vat periodically as needed. Every 30 days, for 3 months, three cores were sacrificed from each treatment vat and sliced into three vertical subsections (0 5, 5 10, 10 15 cm depths) in a Coy anaerobic chamber (~95 % N_2 and 5 % H_2 atmosphere). Pore waters were removed from each depth interval using suction under N_2 followed by syringe-filtration (0.45 µm). Redox-sensitive species (total alkalinity, ammonia, sulfide, ferrous iron) and pH were measured immediately. UV Vis spectrophotometric methods were using to measure total alkalinity (bromophenol blue; Sarazin et al. 1998), ammonium (indophenol blue, Grasshoff et al. 1982), phosphate (molybdate blue; Greenberg et al. 1992), sulfide (methylene blue; Grasshoff et al. 1982), sulfate (barium gelatin turbidity, Tabatabai 1974), and ferrous iron (ferrozine, Stookey 1970). Samples analyzed by ICP-OES for major elements (Ca, Na, Mg, K) were preserved in trace-metal grade nitric acid and were spiked with internal standards (1,000 ppb Y) prior to analysis. ICP-OES measurements were made with matrix-matched calibration standards (DI, NaCl or $CaCl_2$).

To assess the organic carbon content of the soils, loss-on-ignition was measured. Sediments were first air dried to constant weight, sieved (2 mm) and then ~5 g subsamples were weighed and heated at 550 °C for 5 h and reweighed (Heiri et al. 2001). A sequential extraction scheme (Tessier et al. 1979, 1982, 1996) was used to assess Fe and Mn associations with four operationally defined fractions (readily exchangeable, carbonates, reducible and oxidizable). Approximately 1 2 g of fresh sediment (weighed exactly) was extracted using the reactants and procedures shown in Table 1. After addition of each extractant, the slurry was centrifuged and the supernatant removed, syringe-filtered, and preserved for ICP-OES analyses with trace metal grade nitric acid. The remaining sediment was washed by adding deionized water to the wet sediment, mixing the slurry by hand, centrifuging and discarding the supernatant, after which the next extracting agent was added. The filtered, acidified supernatants were spiked with internal standards (1,000 ppb Y) and analyzed for total Fe and Mn using ICP-OES with matrix-matched calibration standards.

Speciation calculations were completed with the software JCHESS (Van der Lee and De Windt 2000) to calculate saturation indices for a suite of carbonates including calcite ($CaCO_3$), dolomite ($CaMg(CO_3)_2$) and rhodrochrosite ($MnCO_3$). The default thermodynamic database (based on the EQ3 database) was used for the calculations, together with the entire suite of data measured for the pore waters as a function of treatment and time. For these calculations, the measured total alkalinity was assumed to be equal to the total dissolved carbonate (e.g. Koretsky et al. 2007).

All statistical analyses were performed using PASW statistics software (version 18.0, SPSS Inc., Chicago, IL). Comparisons of treatments (i.e., control, 5 g/L NaCl and 1 g/L $CaCl_2 \cdot 2H_2O$ or 5 g/L $CaCl_2 \cdot 2H_2O$) were performed by one-way ANOVA at each sampling time. Repeated measures ANOVA was employed to analyze for treatment and time effects on measurements.

Results

Pore waters

Average concentrations of dissolved solutes from three replicate cores extracted at three depths (0 5, 5 10, 10 15 cm) as a function of incubation time are shown in Fig. 2. The full suite of depth-dependent data is available in the supplementary data. pH remains

Table 1 Sequential extraction methodology adapted from Tessier et al. (1979, 1982)

Target fraction	Reagent	Time	Temperature
Exchangeble	8 mL 1 M $MgCl_2$ adjusted to pH 7.0	1 h	Room temp
Carbonate	8 mL 1 M sodium acetate, adjusted to pH 5.0 with acetic acid	5 h	Room temp
Reducible	20 mL 0.04 M hydroxyl amine HCl in 25 % (v/v) acetic acid	6 h	95 °C
Oxidizable	3 mL 0.02 M HNO_3 and 5 mL 30 % H_2O_2 (adjusted to pH 2)	2 h	95 °C
	5 mL 3.2 N ammonium acetate in 20 % (v/v) HNO_3, + DI to total volume of 20 mL	30 min	Room Temp

Author's personal copy

relatively constant with time at ~7.5 8 in both the spring and fall controls, declining with time in all treatment cores (Fig. 2a; Table 2). pH values are similar in the fall and spring treatments, with values declining to pH ~ 7 by 100 days in cores amended with 5 g/L NaCl or 1 g/L $CaCl_2 \cdot 2H_2O$ and to ~6 6.5 in cores amended with 5 g/L $CaCl_2 \cdot 2H_2O$ (Fig. 2a; Table 3). Alkalinity levels are greater in the initial cores collected in spring (~8.5 mM) compared to those from fall (~2.5 mM; Fig. 2b; $F = 27.2$, $P < 0.01$). In fall, alkalinity increases with time in all cores, except for a low value in the control core at 100 days. In contrast, in spring, alkalinity generally decreases with time in all cores. Alkalinity levels tend to be greatest in the cores incubated in 5 g/L NaCl and lowest in the control cores and those incubated with 1 g/L $CaCl_2 \cdot 2H_2O$ (Fig. 2b; Tables 2, 3).

Dissolved Mn(II) concentrations are very low (~50 μM) in the control core pore waters, changing little with incubation time (Fig. 2c; Table 2). In contrast, Mn(II) levels increase with time in all of the treatment cores. The most dramatic changes occur in cores treated with 5 g/L $CaCl_2 \cdot 2H_2O$; in these, dissolved Mn(II) concentrations increase about tenfold, reaching ~600 μM after 100 days of incubation. Mn(II) levels also increase in the 5 g/L NaCl and 1 g/L $CaCl_2 \cdot 2H_2O$ treatment cores, although more slowly, reaching ~200 μM after 100 days (Fig. 2c; Table 3).

Like dissolved Mn(II), dissolved Fe(II) concentrations are low (<1 μM) throughout the incubations of the control cores, while concentrations increase dramatically with time in the 5 g/L $CaCl_2 \cdot 2H_2O$ treatments, reaching up to 1,980 μM Fe(II) after 100 days (Fig. 2d; Table 2). Dissolved Fe(II) concentrations also increase with time in the 5 g/L NaCl and 1 g/L $CaCl_2 \cdot 2H_2O$ treatments, but more slowly than dissolved Mn(II), with maximum dissolved Fe(II) concentrations of ~15 110 μM after 100 days of incubation (Fig. 2d; Table 2).

Dissolved sulfate and sulfide were measured on the fall cores only. Sulfate concentrations decrease precipitously with time in both the control and the treatment cores from initial levels of ~250 to <50 μM after 100 days of incubation (Fig. 2e). Sulfide concentrations increase with time, from an initial concentration of <20 μM, reaching levels as high as ~65 μM after 65 days (Fig. 2f).

Phosphate concentrations are close to detection limits in the initial fall cores (Fig. 2g), increasing with time in the control and treatment cores. The largest accumulation of phosphate occurs in the 5 g/L $CaCl_2 \cdot 2H_2O$ treatments, reaching ~35 μM at 100 days, with the lowest accumulation of phosphate in the control cores. Phosphate concentrations were not measured in spring. Average ammonia concentrations as a function of time and treatment are quite variable (Fig. 2h; Table 2), although depth-averaging of the data obscures some trends. Depth-dependent data (see supplementary materials) reveal that more ammonia typically accumulates with time in the deeper sections of 1 g/L $CaCl_2 \cdot 2H_2O$ cores ($P < 0.05$). Initial levels of ammonia are greater in spring (~100 μM) compared to fall (near detection limits). In fall, ammonia levels increase with time in all cores, except that a low value is observed in the control at 100 days. In spring, ammonia levels increase more rapidly with time in the deeper sections of the 5 g/L NaCl or $CaCl_2 \cdot 2H_2O$ cores (supplementary material; Table 2), with increased ammonia levels occurring at 100 days in the deeper portions of the control and 1 g/L $CaCl_2 \cdot 2H_2O$ cores (Fig. 2h).

Solid phase

Organic matter concentrations calculated from loss-on-ignition (Heiri et al. 2001) are greatest in the upper 5 cm of the core, decreasing with depth for all treatments (Fig. 3). No significant differences in percent organic matter are observed between the treatments and controls, nor does organic matter percentage change significantly with time (Table 2). Due to these small changes in bulk organic matter, analyses were not completed for the sediments from the spring incubations.

A sequential extraction technique was used to assess partitioning of Fe and Mn among four operationally defined sediment fractions: exchangeables, carbonates, reducibles and oxidizables (Tessier et al. 1979, 1982, 1996). Few consistent trends emerge with respect to the average concentrations of Fe or Mn extracted with the exchangeable, carbonate or reducible fractions as a function of time or treatment (Fig. 4; Table 2). In the fall cores, the quantity of oxidizable-associated Fe and Mn increases as a function of time in all cores, including the controls (Fig. 4g, h).

Most of the Fe is extracted in the upper portion of the cores and is associated with the reducible and oxidizable fractions (Fig. 5a f). After 100 days of incubation, the quantity of reducible- and oxidizable-associated Fe in the fall cores is somewhat lower

Author's personal copy

in the treatments compared to the control cores (Fig. 5a c). However, in spring, the levels of both reducible- and oxidizable-associated Fe are significantly greater in the upper portion of the treated cores compared to the control (Fig. 5d f). As for Fe, few consistent trends in extractable Mn are observed as a function of either treatment or incubation time (Fig. 5g l). In contrast to Fe, Mn is much more evenly distributed among the four fractions and among the three depths of the core (Fig. 5g l). Most of the Mn is typically extracted with the carbonate and reducible fractions of the sediment. After 100 days of incubation, carbonate- and reducible-associated Mn is somewhat greater in the upper 0 5 cm of the NaCl treatments compared to the controls, but few other differences between controls and treatments are apparent.

Discussion

Stimulation of anaerobic respiration

The reductive dissolution of Mn(IV) and Fe(III) oxides results in accumulation of dissolved Mn and Fe in suboxic pore waters (e.g. Davison 1993). Mn(IV) and Fe(III) reduction is often microbially mediated and coupled to oxidation of organic matter, but can also occur chemically or microbially via reaction with more reduced solutes, such as ferrous iron (for Mn(IV) reduction) or sulfide (e.g., Burdige and Nealson 1986; Burdige 1993; Yao and Millero 1996; Boudreau 1999). Mn(IV) is a more energetically favorable electron acceptor compared to Fe(III), therefore, Fe(II) typically accumulates after readily reducible Mn(IV) is exhausted.

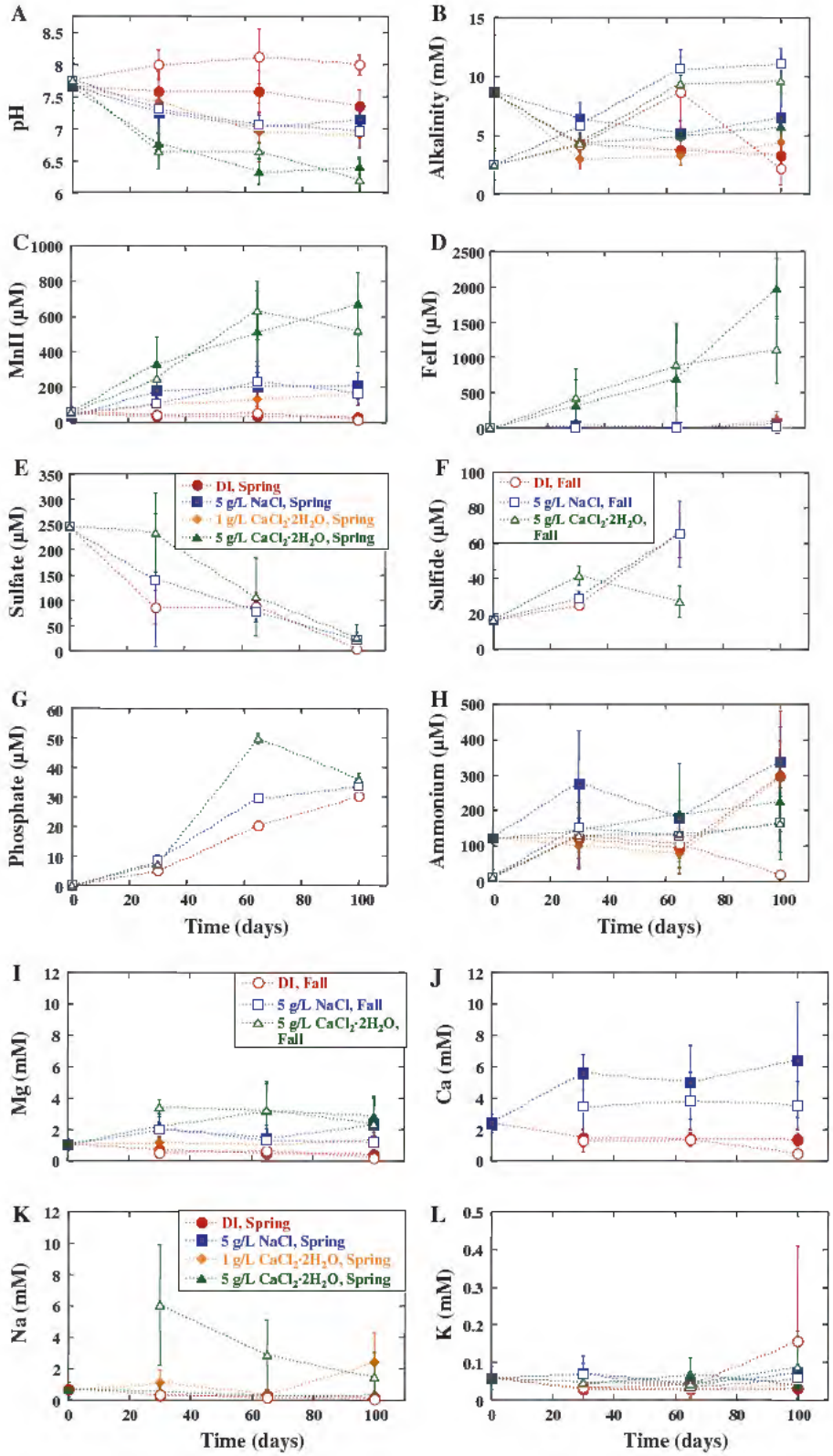
Dissolved Mn(II) and Fe(II) increased significantly with time in cores treated with NaCl, and especially in cores amended with 5 g/L $CaCl_2{\cdot}2H_2O$, but not in the control cores (Fig. 2c, d; Table 3). Mn(II) production rates were ~5.5, 1.3 1.6 and 1.1 μM/day after 100 days of incubation in the 5 g/L $CaCl_2{\cdot}2H_2O$, 5 g/L NaCl and 1 g/L $CaCl_2{\cdot}2H_2O$ experiments, respectively. Dissolved Fe(II) accumulated more slowly: ~15, 0.34 and 1.0 μM/day after 100 days of incubation in the 5 g/L $CaCl_2{\cdot}2H_2O$, 5 g/L NaCl and 1 g/L $CaCl_2{\cdot}2H_2O$ experiments, respectively. The significant accumulation of Mn(II), followed by Fe(II), in the treated cores suggests that the addition of NaCl or $CaCl_2$ stimulates anaerobic respiration with consequent reductive dissolution of Fe(III) and Mn(IV) oxides.

Fig. 2 Average **a** pH, **b** alkalinity, **c** dissolved Mn(II), **d** dissolved Fe(II), **e** sulfate, **f** sulfide, **g** phosphate, **h** ammonia, **i** magnesium, **j** calcium, **k** sodium and **l** potassium as a function of time and treatment. *Error bars* indicate standard deviations of measurements completed at three depths (0 5, 5 10, 10 15 cm) on triplicate cores. Na was not measured in cores with added Na, and Ca was not measured in cores with added Ca and sulfide was not measured for 100 days incubation

The rates of Mn(II) production observed here are similar to those measured by Thomsen et al. (2004) in anoxic incubations of sediments from the bottom of Lake Michigan (~3 μM/day in 1 2 cm portion of sediment core incubated for 20 days). Thomsen et al. (2004) also measured production of ΣCO_2, Fe^{+2}, NH_4^+ and sulfate reduction rates. With these data, they demonstrated that although a significant quantity of dissolved Mn(II) accumulated, most of it was produced by reoxidation of more reduced solutes, with relatively little contributing to organic matter mineralization. This may also be the case for incubations in this study, particularly given that significant ferrous iron production occurred in spring and fall (up to 15 μM/day), whereas Fe(II) production rates reported by Thomsen et al. (2004) were generally quite low. Sulfate consumption rates in the fall cores from this study are lower (~2.5 μM/day) compared to those reported by Thomsen et al. (2004), but without sulfate reduction rates and ΣCO_2 data, the contributions of each anaerobic respiration pathway to organic matter mineralization cannot be determined. Nonetheless, the large accumulation of Fe(II) and Mn(II), especially in the 5 g/L $CaCl_2{\cdot}2H_2O$ treatments, suggests that anaerobic respiration is stimulated by the addition of the deicing salts.

Primary productivity was not measured in this study. However, visual evidence of enhanced primary productivity was apparent at the top of cores incubated in NaCl or $CaCl_2$. Thick, orange-red fungal or microbial mats developed at the top of these cores, but not on control cores incubated in DI water (Fig. 3). Furthermore, the mats were thicker, brighter and formed more quickly on the cores incubated in 5 g/L $CaCl_2{\cdot}2H_2O$ compared to those incubated in 5 g/L NaCl. Thus, we hypothesize that degradation of the organic matter produced in these mats resulted in the significant accumulation of dissolved Mn(II) and

Author's personal copy



Author's personal copy

Table 2 The *F* statistic and degree of freedom for the treatment and time effects and their interactions on measurements as results of repeated measures ANOVAs

GLM repeated measures				
Measurements	Season	Treatment	Time	Treatment × Time
pH	Fall	*F* 319.7 (*df* 2)***	*F* 36.3 (*df* 3)***	*F* 23.7 (*df* 6)***
	Spring	*F* 16.9 (*df* 3)*****	*F* 21.8 (*df* 3)***	*F* 2.2 (*df* 9)
Alkalinity	Fall	*F* 1.2 (*df* 2)	*F* 1.18 (*df* 3)	*F* 78.3 (*df* 6)***
	Spring	*F* 9.0 (*df* 3)**	*F* 28.7 (*df* 3)***	*F* 1.5 (*df* 9)
Dissolved Mn(II)	Fall	*F* 43.8 (*df* 2)***	*F* 20.0 (*df* 3)***	*F* 10.4 (*df* 6)***
	Spring	*F* 100.5 (*df* 3)***	*F* 20.1 (*df* 3)***	*F* 22.5 (*df* 9)***
Dissolved Fe(II)	Fall	*F* 43.8 (*df* 2)***	*F* 20.0 (*df* 3)***	*F* 10.4 (*df* 6)***
	Spring	*F* 100.5 (*df* 3)***	*F* 20.1 (*df* 3)***	*F* 22.5 (*df* 9)***
Ammonium	Fall	*F* 1.6 (*df* 2)	*F* 6.8 (*df* 3)**	*F* 1.0 (*df* 6)
	Spring	*F* 1.9 (*df* 3)	*F* 7.6 (*df* 3)**	*F* 0.7 (*df* 9)
Organic matter content	Fall	NA	NA	NA
	Spring	*F* 0.4 (*df* 3)	*F* 2.8 (*df* 2)	*F* 0.5 (*df* 6)
Exchangeable Fe	Fall	*F* 3.2 (*df* 2)	*F* 4.9 (*df* 3)*	*F* 5.6 (*df* 6)**
	Spring	*F* 1.2 (*df* 3)	*F* 0.8 (*df* 3)	*F* 0.9 (*df* 9)
Exchangeable Mn	Fall	*F* 1.1 (*df* 2)	*F* 4.0 (*df* 3)*	*F* 0.4 (*df* 6)
	Spring	*F* 1.1 (*df* 3)	*F* 4.5 (*df* 3)*	*F* 1.1 (*df* 9)
Carbonate Fe	Fall	*F* 1.3 (*df* 2)	*F* 4.6 (*df* 3)*	*F* 2.8 (*df* 6)*
	Spring	*F* 0.9 (*df* 3)	*F* 2.0 (*df* 3)	*F* 1.4 (*df* 9)
Carbonate Mn	Fall	*F* 2.6 (*df* 2)	*F* 4.9 (*df* 3)*	*F* 0.3 (*df* 6)
	Spring	*F* 0.02 (*df* 3)	*F* 2.5 (*df* 3)	*F* 0.3 (*df* 9)
Reducible Fe	Fall	*F* 0.8 (*df* 2)	*F* 3.6 (*df* 3)*	*F* 2.2 (*df* 6)
	Spring	*F* 0.2 (*df* 3)	*F* 0.8 (*df* 3)	*F* 0.6 (*df* 9)
Reducible Mn	Fall	*F* 1.5 (*df* 2)	*F* 2.4 (*df* 3)	*F* 0.7 (*df* 6)
	Spring	*F* 0.6 (*df* 3)	*F* 0.1 (*df* 3)	*F* 0.5 (*df* 9)
Oxidizable Fe	Fall	*F* 1.1 (*df* 2)	*F* 2.3 (*df* 3)	*F* 0.9 (*df* 6)
	Spring	*F* 0.01 (*df* 3)	*F* 1.2 (*df* 3)	*F* 0.8 (*df* 9)
Oxidizable Mn	Fall	*F* 1.6 (*df* 2)	*F* 0.7 (*df* 3)	*F* 1.0 (*df* 6)
	Spring	*F* 2.5 (*df* 3)	*F* 1.8 (*df* 3)	*F* 1.6 (*df* 9)

Asterisks indicate statistically significant differences (*$P \leq 0.05$, **$P \leq 0.01$, and ***$P \leq 0.001$)

Fe(II) which was particularly apparent in the 5 g/L $CaCl_2 \cdot 2H_2O$ treatments.

Anaerobic respiration should result not only in increased levels of Mn(IV) and Fe(II), but also in mineralization of nitrogen and phosphorous. The similar release of phosphate in treated and control cores (Fig. 2g) is somewhat surprising. Possibly, trends in phosphate concentrations released by organic matter mineralization are obscured by multiple geochemical processes occurring in the cores; phosphate levels are also effected by adsorption on Fe(III) oxides or clays, precipitation of sparingly soluble P-bearing aluminosilicates and by uptake of phosphate by biota (Jahnke 1992). Thus, enhanced release of phosphorous in the treatment cores relative to the controls due to increased organic matter mineralization might be difficult to detect based on pore water data alone. Ammonia can be contributed to the pore waters via ammonification. The more rapid increase of ammonia at depth in the spring trials for the 5 g/L NaCl and $CaCl_2 \cdot 2H_2O$ cores (supplementary data) is consistent with more rapid onset and greater magnitude of anaerobic respiration in these treatments. However, no significant differences in total ammonia accumulation

Author's personal copy

Table 3 The *F* statistic and degree of freedom for the treatment effects on measurements as results of One way ANOVAs

One way ANOVA							
Measurement	Season	Incubation days					
		30		60		100	
pH	Fall (*df* 2)	*F*	42.8***	*F*	55.0***	*F*	254.6***
	Spring (*df* 3)	*F*	14.6**	*F*	14.5**	*F*	20.0***
Alkalinity	Fall (*df* 2)	*F*	1.2	*F*	1.2	*F*	78.3***
	Spring (*df* 3)	*F*	6.8*	*F*	3.9	*F*	16.6**
Dissolved Mn(II)	Fall (*df* 2)	*F*	42.4***	*F*	65.1***	*F*	11.2**
	Spring (*df* 3)	*F*	33.4***	*F*	77.3***	*F*	51.2***
Dissolved Fe(II)	Fall (*df* 2)	*F*	12368.6***	*F*	9.5*	*F*	14.3**
	Spring (*df* 3)	*F*	12.2**	*F*	17.8**	*F*	80.9***
Ammonium	Fall (*df* 2)	*F*	0.1	*F*	0.2	*F*	3.3
	Spring (*df* 3)	*F*	2. 8	*F*	0.9	*F*	0.5
Mg	Fall (*df* 2)	*F*	20.3**	*F*	20.9**	*F*	3.8
	Spring (*df* 3)	*F*	30.0***	*F*	10.8**	*F*	11.1**
K	Fall (*df* 2)	*F*	0.7	*F*	0.1	*F*	0.4
	Spring (*df* 3)	*F*	4.7*	*F*	1.4	*F*	1.2
Na	Fall (*df* 1)	*F*	4.2	*F*	8.7*	*F*	1.4
	Spring (*df* 2)	*F*	3.6	*F*	0.3	*F*	3.6
Ca	Fall (*df* 1)	*F*	5.5	*F*	8.6*	*F*	13.9*
	Spring (*df* 1)	*F*	57.2**	*F*	188.9***	*F*	13.8*

Asterisks indicate statistically significant differences (*$P \leq 0.05$, **$P \leq 0.01$, and ***$P \leq 0.001$)

are observed between the two treatments and little difference is apparent between the control and treatments in fall (Fig. 2h; Table 3). As for phosphorous, nitrogen mineralization may be masked by other processes, including uptake or release of ammonia by clay minerals and oxidation of ammonia by less reduced solutes.

Respiration processes also influence pore water pH (e.g. Van Cappellen and Wang 1996; Boudreau 1999). Aerobic respiration produces acidity, according to:

$$CH_2O + O_2 = CO_2 + H_2O = H^+_{(aq)} + HCO_{3\ (aq)} \quad (1)$$

where "CH_2O" represents organic matter; conversely, anaerobic respiration consumes acidity. Pore water pH is also affected by chemical reactions: acidity is produced both by the oxidation of reduced solutes by oxygen and also by precipitation of carbonates, via,

$$Ca^{+2}_{(aq)} + HCO_{3(aq)} = CaCO_{3(s)} + H^+_{(aq)} \quad (2)$$

Thermodynamic speciation calculations (see Methods) indicate that calcite, dolomite and rhodochrosite are all supersaturated in both the NaCl and the $CaCl_2$ treatments. The significant decrease in pH in these treatments (Fig. 2a) is consistent with carbonate precipitation. Acidity may also have been contributed by photosynthetic production of oxygen in the mats, which was subsequently consumed in the suboxic underlying sediments together with ion exchange processes (see below).

Solid phase geochemistry can also be examined to evaluate organic matter mineralization pathways. For example, increased organic matter productivity might be reflected in greater quantities of organic matter, especially in the upper portion of the cores. However, solid-phase organic matter does not change significantly with time or treatment (Fig. 3; Table 2). This may be because loss-on-ignition is a bulk technique that cannot distinguish pools of organic matter (e.g. labile vs. refractory). Furthermore, in these organic-rich sediments, relatively small changes in organic matter content occurring over the course of the incubation experiment may be indistinguishable from the high background levels of organic carbon in the

Author's personal copy

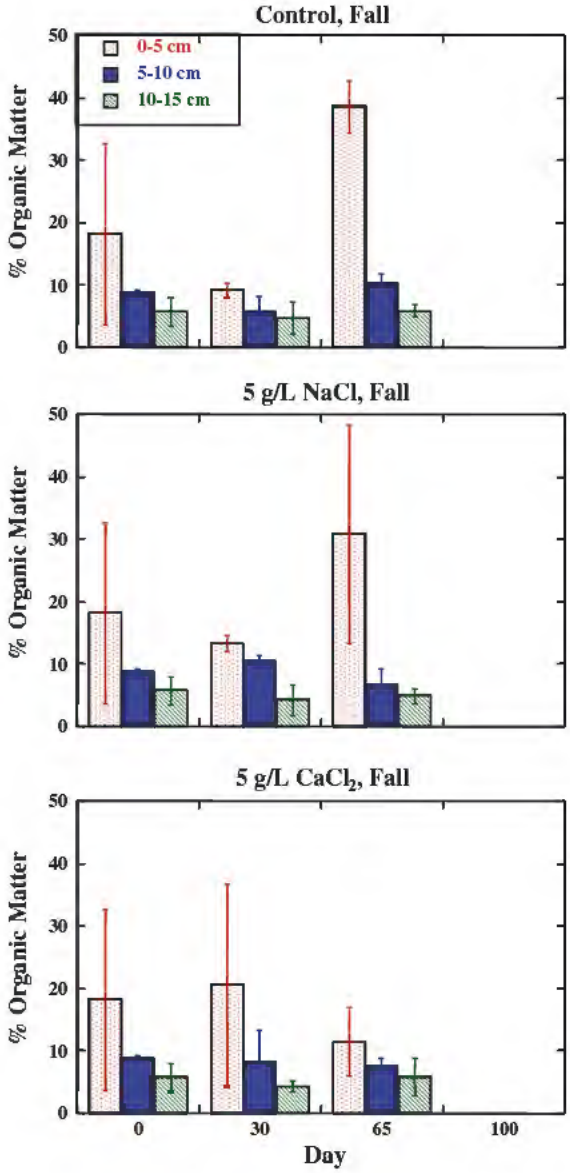


Fig. 3 Average and standard deviations of percent organic matter in triplicate cores as a function of depth and time for fall a control, b 5 g/L NaCl, and c 5 g/L $CaCl_2 \cdot 2H_2O$

initial sediment cores. Thus, changes in the labile fraction of the organic matter produced by enhanced primary production may not be detectable using the loss-on-ignition technique.

Reductive dissolution of Fe(III) and Mn(IV) oxides should reduce the level of Fe and Mn associated with operationally defined reducible fractions of the sediment and increase the levels associated with other operationally defined fractions, particularly carbonate- or oxidizable-phases. However, these pools do not change significantly with time (Fig. 4e, f; Table 2). Previous studies have shown that some Fe oxides may be only impartially removed by the Tessier sequential extraction step targeting the reducible fraction, and that this step may also partially remove Fe associated with Fe monosulfides (e.g. Filgueiras et al. 2002; Koretsky et al. 2006). Sediment preservation, especially drying or freeze-drying, can also mobilize metals, changing their distribution among various fractions (e.g., Rapin et al. 1986; Kersten and Forstner 1986; Hjorth 2004). Although other studies have shown that sequential extraction data, when used to compare similar sediments, and particularly when examined in conjunction with detailed pore water data, may yield useful insights into sediment geochemistry (e.g. Koretsky et al. 2006, 2007), the lack of correspondence observed here between increased dissolved Fe(II) and Mn(II) and Fe and Mn distribution among the extracted fractions (Figs. 2c, d, 5) is likely due to the inherent limitations of these operationally defined techniques.

Ion exchange

Addition of 5 g/L $CaCl_2 \cdot 2H_2O$ stimulates fungal or microbial mat growth and subsequent accumulation of reduced Fe(II) and Mn(II) in the core pore waters (Figs. 2c, d, 6). Calcium is a critical macronutrient for higher plants (e.g. Likens et al. 1998), but it is not essential for the growth of many microorganisms (Madigan et al. 2003). Furthermore, addition of 5 g/L NaCl also enhanced microbial mat formation and anaerobic respiration in treated cores, albeit to a lesser degree than the $CaCl_2$. Thus, while addition of the macronutrient Ca may be partially responsible for the observed mat growth, another mechanism must also be at work. One such process might be the release of key nutrients (e.g. Mg, K, NH_4^+, trace nutrients) from organic matter and clays via ion exchange processes.

Previous studies have demonstrated that NaCl or $CaCl_2$ additions to soils and sediments stimulate ion exchange, releasing both major and trace cations to pore waters. For example, Norrstrom and Bergstedt (2001) used column studies to demonstrate that Na^+ displaces Ca, K and Mg from cation exchange sites in soils collected from several sites in Sweden. Similarly,

Author's personal copy

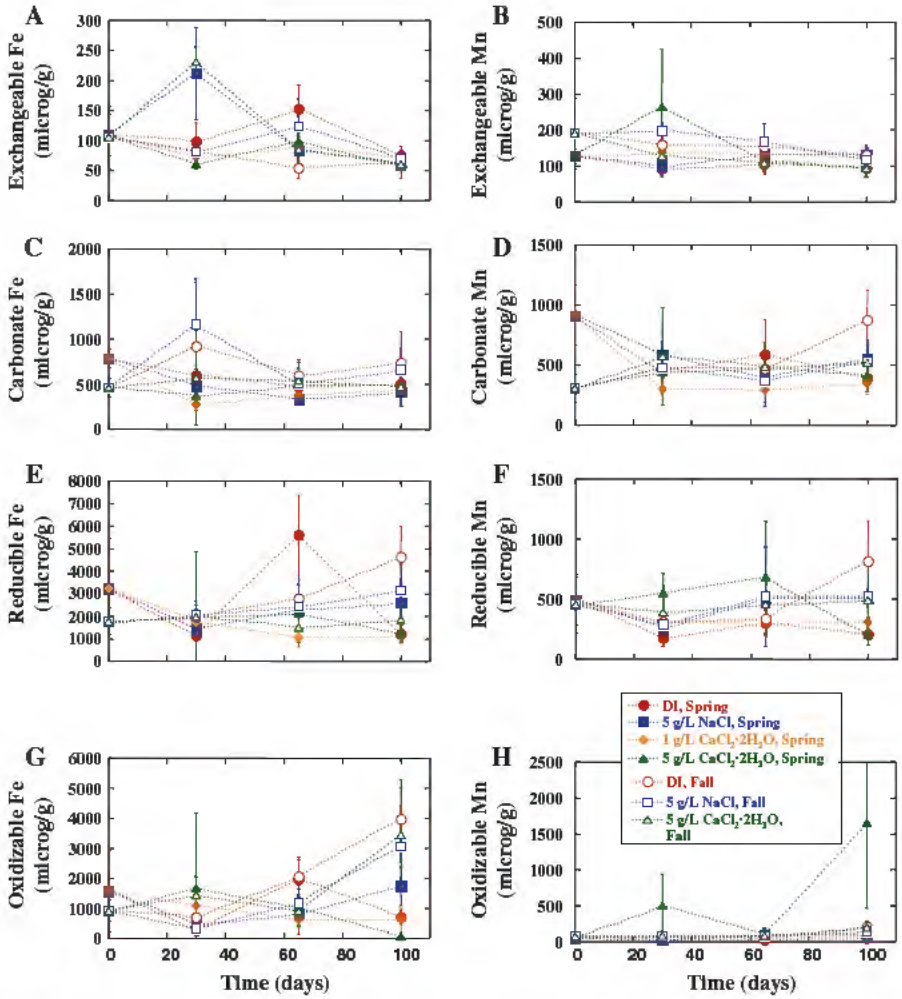


Fig. 4 Concentrations of **a** Fe or **b** Mn extracted with the exchangeable fraction, **c** Fe or **d** Mn extracted with the carbonate fraction, **e** Fe or **f** Mn extracted with the reducible fraction and **g** Fe or **h** Mn extracted with the oxidizable fraction of the cores as a function of time and treatment. *Error bars* indicate standard deviations of measurements completed at three depths (0–5, 5–10, 10–15 cm) on triplicate cores

Lofgren (2001) showed that NaCl additions mobilize Zn, Cd, Ca and Mg in streams and soils of a forested catchment. Backstrom et al. (2004) observed increased Cd, Zn and Ca levels, and decreased pH, in soils near a road treated with NaCl. They attributed these changes to ion exchange processes, together with the formation of Cd-chloro aqueous complexes. Amrhein et al. (1992) used leaching experiments to demonstrate that NaCl mobilizes Cr, Pb, Ni, Fe and Cu, which they attributed to the combined effects of increased dispersion of organic matter, together with ligand and ion exchange processes. Nelson et al. (2009) similarly found that infiltration of soils with NaCl or $MgCl_2$ mobilizes Pb, Cu and Cd through a combination of organic matter dispersion, ion exchange and the formation of aqueous metal-chloro complexes. Bauske and Goetz (1993) used a combination of field studies and laboratory leaching experiments with NaCl and $CaCl_2$ to demonstrate the potential mobilization of Zn and Cd via ion exchange and the formation of aqueous metal-chloro complexes.

In this study, incubation in either NaCl or $CaCl_2$ resulted in increased levels of dissolved Mg, K, Na

Author's personal copy

(for Ca additions) and Ca (for sodium additions) compared to controls and decreased pH (Fig. 2i l; Table 3), consistent with findings from prior studies. The equivalent positive charge added to the core pore waters in this study varies between 18 mM for the 1 g/L $CaCl_2 \cdot 2H_2O$ treatments and 86 mM for the 5 g/L NaCl treatments, with an intermediate equivalent charge (68 mM) for treatments with 5 g/L $CaCl_2 \cdot 2H_2O$. Thus, ion exchange should result in the greatest release of cations in the 5 g/L NaCl treatments, with the least release in the 1 g/L $CaCl_2 \cdot 2H_2O$ experiments. This trend is confirmed by the experimental data: with respect to the major elements, additions of the three solutions liberated similar proportions of positive charge relative to the added equivalents of charge. The sum of the charge equivalents associated with K + Mg + Ca (for sodium additions) + Na (for calcium additions) is approximately 14, 13 and 3 for the 5 g/L NaCl, 5 g/L $CaCl_2 \cdot 2H_2O$ and 1 g/L $CaCl_2 \cdot 2H_2O$ experiments, respectively, which is equivalent to 16, 19 and 22 % of the total positive charge added with the NaCl or $CaCl_2$.

Ion exchange reactions are non-specific; addition of NaCl and $CaCl_2$ will release NH_4^+ and trace nutrients to the soil solutions, in addition to major ions. Enhanced nutrient release could promote the observed mat formation and subsequent accumulation of anaerobic respiration products [dissolved Fe(II) and Mn(II)] in the treatment experiments. The quantities of the nutrients, like the major ions, released by each treatment should be directly related to the added equivalent charge. Thus, the 5 g/L NaCl addition would be expected to release the largest quantities of nutrients and stimulate the greatest amount of productivity. However, this is not the case. Instead, there is a greater mat growth and more production of Mn(II) and Fe(II) in the 5 g/L $CaCl_2 \cdot 2H_2O$ compared to the 5 g/L NaCl experiments in spite of the higher charge equivalents added with the NaCl treatments (86 mM compared to 68 mM). Thus, ion exchange processes alone cannot fully explain the incubation data. The mechanism for the apparent stimulation of productivity and increased Mn(IV) and Fe(III) reduction must involve at least some Ca-specific effects. Determining this mechanism will require further study, but possibilities include direct stimulation of mat growth (i.e. Ca behaving as a limiting nutrient) or mineral precipitation effects (e.g. enhanced calcite precipitation).

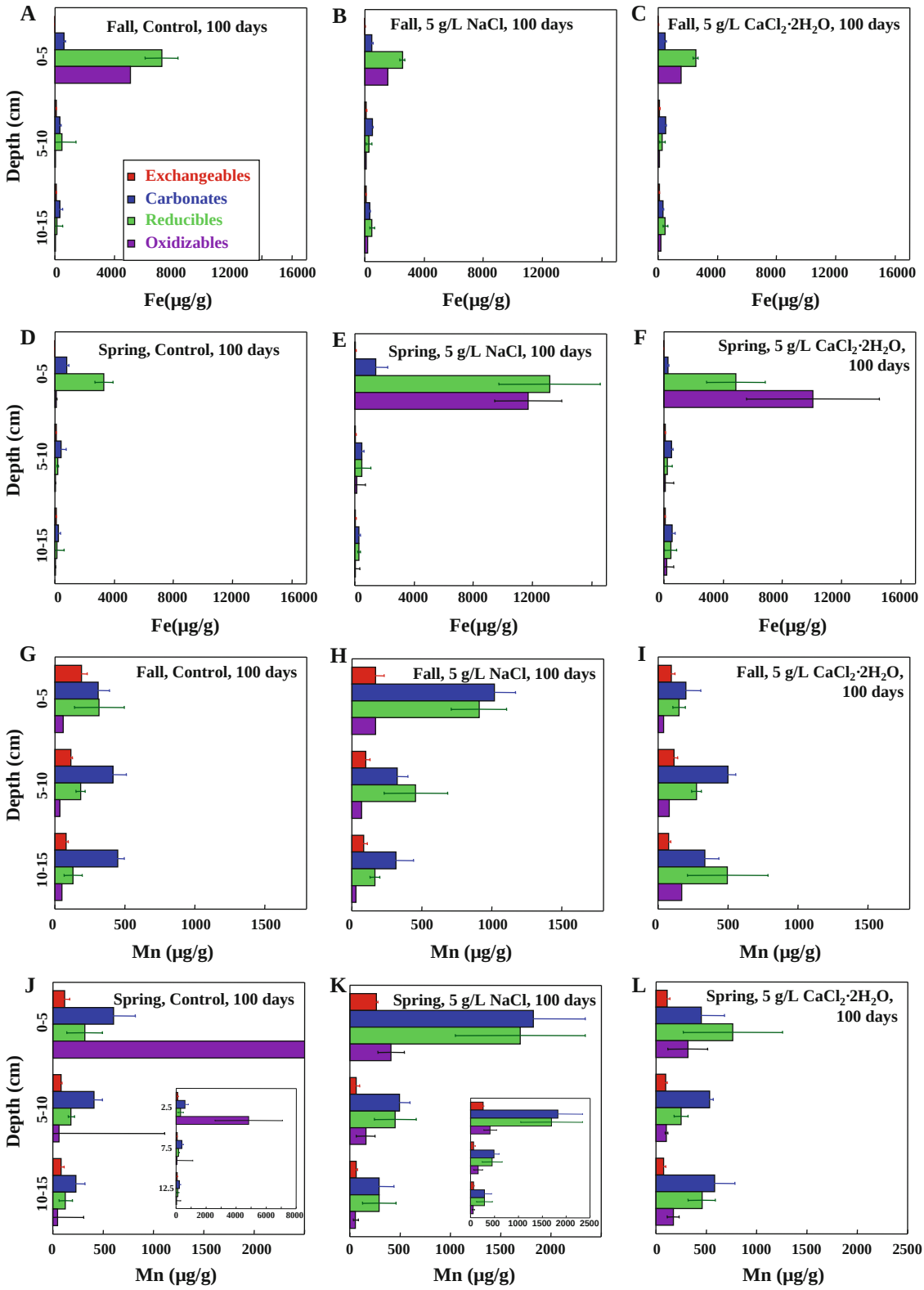
Fig. 5 Average Fe and Mn concentrations extracted with the exchangeable, carbonate, reducible and oxidizable fractions as a function depth at the termination of the experiments (100 days), for **a** Fe in fall control, **b** Fe in fall 5 g/L NaCl, **c** Fe in fall 5 g/L $CaCl_2 \cdot 2H_2O$, **d** Fe in spring control, **e** Fe in spring 5 g/L NaCl, **f** Fe in 5 g/L $CaCl_2 \cdot 2H_2O$, **g** Mn in fall control, **h** Mn in fall 5 g/L NaCl, **i** Mn in fall 5 g/L $CaCl_2 \cdot 2H_2O$, **j** Mn in spring control, **k** Mn in spring 5 g/L NaCl, and **l** Mn in 5 g/L $CaCl_2 \cdot 2H_2O$. *Error bars* indicate standard deviations of measurements completed on triplicate cores

Conclusions

Addition of the two commonly used road salt deicers, NaCl and $CaCl_2$, to wetland sediments results in significant biogeochemical changes. The salt additions, particularly $CaCl_2$, stimulate growth of a microbial or fungal mat, and enhanced production of dissolved Mn(II) and Fe(II). Pore water pH decreases dramatically, likely due to a combination of carbonate precipitation, oxidation and ion exchange reactions. Supply of Ca from $CaCl_2$, together with the addition of macro- and micronutrients to pore waters via ion exchange reactions, is hypothesized to stimulate increased primary productivity and anaerobic respiration. However, further study is required to determine the mechanism of this stimulation and to quantify primary productivity and organic matter mineralization pathways.

The use of road salt deicer is widespread and continues to increase in much of Asia, North America and northern Europe. This study demonstrates that additions of NaCl and $CaCl_2$ to wetland sediments may greatly influence sediment biogeochemistry, even in the absence of macrofauna and macrophytes. Prior work has focused mostly on enhancement of ion exchange reactions, organic matter dispersion and aqueous complexation as mechanisms to enhance trace metal levels. Another potentially important mechanism is release of metals from reductively dissolving Mn(IV) and Fe(III) oxides. The apparent stimulation of anaerobic respiration observed in this study could have important consequences for trace metal cycling. Trace element bioavailability and mobility is closely related to metal speciation (e.g. Allen et al. 1980; Campbell 1995). Reduction of Mn(IV) and Fe(III) oxides is expected to release adsorbed trace metals into solution, potentially enhancing their bioavailability and mobility. Such processes could be quite important, particularly in road side sediments, which not only receive the

Author's personal copy



Author's personal copy

Fig. 6 Photographs of cores incubated in **a** DI water, **b** 5 g/L NaCl and **c** 5 g/L $CaCl_2 \cdot 2H_2O$ after 60 days of incubation in fall

highest road salt loadings, but which often have a legacy of Pb contamination from leaded gasoline and which may have high levels of other trace metals, such as Cu, Zn, Cd and Cu (e.g., Amrhein et al. 1992; Nelson et al. 2009). Changes in trace metal speciation resulting from road salt deicers have largely been attributed to ion exchange, organic matter dispersion and aqueous complexation reactions (Amrhein et al. 1992; Bauske and Goetz 1993; Norrstrom and Jacks 1998; Lofgren 2001; Backstrom et al. 2004; Nelson et al. 2009). This study suggests that the onset of suboxic conditions with reduction of Fe(III) and Mn(IV) oxides may also be a significant factor. Future investigations should consider this pathway, together with changes in redox and microbial community structure that may result from road salt influx to wetland soils and sediments.

Acknowledgments This work was supported by the National Research Foundation of Korea (NRF 2009 352 C00145), the National Science Foundation (NSF EAR 038435) and the Yonsei University Research Fund of 2010. Ryan Sibert is thanked for providing maps of the study site.

References

Allen HE, Hall RH, Brisbin TD (1980) Metal speciation. Effects on aquatic toxicity. Environ Sci Technol 14:441 443

Amrhein C, Strong JE, Mosher PA (1992) Effect of deicing salts on metal and organic matter mobilization in roadside soils. Environ Sci Technol 26:703 709

Backstrom M, Karlsson S, Backman L, Folkeson L, Lind B (2004) Mobilisation of heavy metals by deicing salts in a roadside environment. Water Res 38:720 732

Bauske B, Goetz D (1993) Effects of deicing salts on heavy metal mobility. Acta Hydrochim Hydrobiol 21:38 42

Bester ML, Frind EO, Molson JW, Rudolph DL (2006) Numerical investigation of road salt impact on an urban wellfield. Ground Water 44:165 175

Boudreau BP (1999) Metals and models: diagenetic modeling in freshwater lacustrine sediments. J Paleolimnol 22:227 251

Bridgeman TB, Wallace CD, Carter GS, Carvajal R, Schiersari LC, Aslam S, Cloyd E, Elder D, Field A, Schulz KL, Yurista PM, Kling GW (2000) A limnological survey of Third Sister Lake, Michigan with historical comparisons. J Lake Reserv Manag 16:253 267

Bubeck RC, Burton RS (1989) Changes in chloride concen trations, mixing patterns, and stratification characteristics of Irondequoit Bay, Monroe Country, New York, after decreased use of road deicing salts, 1974 1984. Water Resources Investigation Report 87 4223. USGS, Reston

Bubeck RC, Diment WH, Deck BL, Baldwin AL, Lipton SD (1971) Runoff of deicing salt: effect on Irondequoit Bay Rochester, New York. Science 172:1128 1132

Burdige DJ (1993) The biogeochemistry of manganese and iron reduction in marine sediments. Earth Sci Rev 35:249 284

Burdige DJ, Nealson KH (1986) Chemical and microbiological studies of sulfide mediated manganese reduction. Geomi crobiol J 4:361 387

Campbell PGC (1995) Interactions between trace metals and aquatic organisms: a critique of the free ion activity model. In: Tessier A, Turner DR (eds) Metal speciation and bio availability in aquatic systems. Wiley, New York

Davison W (1993) Iron and manganese in lakes. Earth Sci Rev 34:119 163

Environment Canada (2001) Priority substances list assessment report: road salts. Minister of Public Works and Govern ment Services, Ottawa

Filgueiras AV, Lavilla I, Bendicho C (2002) Chemical sequential extraction for metal partitioning in environ mental solid samples. J Environ Monit 4:823 857

Findlay SEG, Kelly VR (2011) Emerging indirect and long term road salt effects on ecosystems. Ann N Y Acad Sci 1223:58 68

Author's personal copy

Galuszka A, Migazewki ZM, Podlaski R, Dolegowska S, Michalik A (2011) The influence of chloride deicers on mineral nutrition and the health status of roadside trees in the city of Kielce, Poland. Environ Monit Assess 176: 451 464

Grasshoff K, Ehrhardt M, Kremling K (eds) (1982) Methods of seawater analysis. Verlag Chemie, Weinheim, p 419

Greenberg AE, Clesceri LS, Eaton AD (eds) (1992) Standard methods for the examination of water and wastewater. American Public Health Association, Washington, DC

Hale RL, Groffman PM (2006) Chloride effects on nitrogen dynamics in forested and suburban stream debris dams. J Environ Qual 35:2425 2432

Heiri O, Lotter AF, Lemcke G (2001) Loss on ignition as a method for estimating organic and carbonate content in sediments: reproducibility and comparability of results. J Paleolimnol 25:101 110

Hjorth T (2004) Effects of freeze drying on partitioning patterns of major elements and trace metals in lake sediments. Anal Chim Acta 526:95 102

Jahnke RA (1992) The phosphorous cycle. In: Butcher SS, Charlson RJ, Orians GH, Wolfe GV (eds) Global biogeo chemical cycles. Academic Press, New York, pp 301 315

Judd KE, Adams HE, Bosch NS, Kostrezewski JM, Scott CE, Schultz BM, Wang DH, Kling GW (2005) A case history: effects of mixing regime on nutrient dynamics and community structure in Third Sister Lake, Michigan during late winter and early spring 2003. Lake Reserv Manag 21:316 329

Karraker NE, Gibbs JP, Vonesh JR (2008) Impacts of road deicing salt on the demography of vernal pool breeding amphibians. Ecol Appl 18:724 734

Kaushal SS, Groffman PM, Likens GE, Belt KT, Stack WP, Kelly VR, Band LE, Fisher GT (2005) Increased salini zation of fresh water in the northeastern United States. Proc Natl Acad Sci USA 102:13517 13520

Kayama M, Quoreshi AM, Kitaoka S, Kitahashi Y, Sakamoto Y, Maruyama Y, Kitao M, Koike T (2003) Effects of deicing salt on the vitality and health of two spruce species, *Picea abies* Karst, and *Picea glehni* masters planted along road sides in northern Japan. Environ Pollut 124:127 137

Kelly VR, Lovett GM, Weathers KC, Findlay SEG, Strayer DL, Burns DJ, Likens GE (2008) Long term sodium chloride retention in a rural watershed: legacy effects of road salt on streamwater concentration. Environ Sci Technol 42:410 415

Kersten M, Forstner U (1986) Chemical fractionation of heavy metals in anoxic estuarine and coastal sediments. Water Sci Technol 18:121 130

Kim K, Rajmohan N, Kim HJ, Hwang G S, Cho MJ (2004) Assessment of groundwater chemistry in a coastal region (Kunsan, Korea) having complex contaminant sources: a stochiometric approach. Environ Geol 46:763 774

Kjensmo J (1997) The influence of road salts on the salinity and the meromictic stability of Lake Svinsjoen, southeastern Norway. Hydrobiologia 347:151 158

Koretsky CM, Moore C, Lowe K, Meile C, DiChristina TJ, Van Cappellen P (2003) Seasonal oscillations of microbial iron and sulfate reduction in saltmarsh sediments (Sapelo Island, GA, USA). Biogeochemistry 64:179 203

Koretsky CM, Moore C, DiChristina TJ, Van Cappellen P, Meile C, Lowe KL, Violler E, Kostka JE (2005) Salt marsh pore water geochemistry does not correlate with microbial community structure. Estuar Coast Shelf Sci 62:233 251

Koretsky CM, Haas JR, Miller D, Ndenga NNT (2006) Seasonal variations in pore water and sediment geochemistry of littoral lake sediments (Asylum Lake, MI, USA). Geochem Trans 7:11

Koretsky CM, Haveman M, Beuving L, Cuellar A, Shattuck T, Wagner M (2007) Spatial variation of redox and trace metal geochemistry in a minerotrophic fen. Biogeochem istry 86:33 62

Koretsky CM, MacLeod A, Sibert R, Snyder C (2011) Redox stratification and salinization of three kettle lakes in southwest Michigan, USA. Water Air Soil Pollut. doi: 10.1007/s11270 011 0954 y

Likens GE, Driscoll CT, Buso DC, Siccama TG, Johnson CE, Lovett GM, Fahey TJ, Reiners WA, Ryan DF, Martin CW, Bailey SW (1998) The biogeochemistry of calcium at Hubbard Brook. Biogeochemistry 41:89 173

Lofgren S (2001) The chemical effects of deicing salt on soil and stream water of five catchments in southeast Sweden. Water Air Soil Pollut 130:863 868

Madigan MT, Martinko JM, Parker J (2003) Brock. Biology of microorganisms, 10th edn. Prentice Hall, Upper Saddle River

Mayer T, Rochfort Q, Borgmann U, Snodgrass W (2008) Geochemistry and toxicity of sediment porewater in a salt impacted urban stormwater detention pond. Environ Pollut 156:143 151

Nelson SS, Yonge DR, Barber ME (2009) Effects of road salts on heavy metal mobility in two eastern Washington soils. J Environ Eng 135:505 510

Norrstrom AC, Bergstedt E (2001) The impact of road de icing salts (NaCl) on colloid dispersion and base cation pools in roadside soils. Water Air Soil Pollut 127:281 299

Norrstrom AC, Jacks G (1998) Concentration and fractionation of heavy metals in roadside soils receiving de icing salts. Sci Total Environ 218:161 174

Novotny EV, Murphy D, Stefan HG (2008) Increase of urban lake salinity by road deicing salt. Sci Total Environ 406:131 144

Ohne T (1990) Levels of total cyanide and NaCl in surface waters adjacent to road salt storage facilities. Environ Pollut 67:123 132

Ramakrishna DM, Viraraghavan T (2005) Environmental impact of chemical deicers a review. Water Air Soil Pollut 166:49 63

Rapin F, Tessier A, Campbell PGC, Carignan R (1986) Potential artifacts in the determination of metal partitioning in sed iments by a sequential extraction procedure. Environ Sci Technol 20:836 840

Rodrigues PMSM, Rodrigues RMM, Costa BHF, Martins AALT, da Silva JCGE (2010) Multivariate analysis of the water quality variation in the Serra da Estrela (Portugal) Natural Park as a consequence of road deicing with salt. Chemom Intell Lab Syst 102:130 135

Salt Institute (2011) http://www.saltinstitute.org/Production industry/Facts figures/U.S. salt production sales. Accessed 1 June 2011

Sanzo D, Hecnar SJ (2006) Effects of road de icing salt (NaCl) on larval wood frogs (*Rana sylvatica*). Environ Pollut 140:247 256

Author's personal copy

Sarazin G, Michard G, Prevot F (1998) A rapid and accurate spectroscopic method for alkalinity measurements in sea water samples. Water Res 33:290 294

Sauck WA, Barcelona MJ (1992) Final Project Report. Long term hydrogeological research and education test site, KCHE 51 611851. Institute for Water Sciences, Western Michigan University, Kalamazoo

Stookey LL (1970) Ferrozine a new spectrophotometric reagent. Anal Chem 42:779 781

Tessier A, Campbell PGC, Bisson M (1979) Sequential extraction procedure for the speciation of particulate trace metals. Anal Chem 51:844 851

Tessier A, Campbell PGC, Bisson M (1982) Particulate trace metal speciation in stream sediments and relationships with grain size: implications for geochemical exploration. J Geochem Explor 16:77 104

Tessier A, Fortin D, Belzile N, DeVitre RR, Leppard GG (1996) Metal sorption to diagenetic iron and manganese oxyhy droxides and associated organic matter: narrowing the gap between field and laboratory measurements. Geochim Cosmochim Acta 60:387 404

Thomsen U, Thamdrup B, Stahl DA, Canfield DE (2004) Pathways of organic carbon oxidation in a deep lacustrine sediment, Lake Michigan. Limnol Oceanogr 49:2046 2057

Thunqvist EL (2003) Increased chloride concentration in a lake due to deicing salt application. Water Sci Technol 48:51 59

Tiquia SM, Davis D, Hadid H, Ksparian S, Ismail M, Sahly R, Shim J, Singh S, Murray KS (2007) Halophilic and halo tolerant bacteria from river waters and shallow ground water along the Rouge River of southeastern Michigan. Environ Technol 28:297 307

Tuchman ML, Stoermer EF, Carney HJ (1984) Effects of increased salinity on the diatom assemblage in Fonda Lake, Michigan. Hydrobiologia 109:179 188

Van Cappellen P, Wang Y (1996) Cycling of iron and manga nese in surface sediments: a general theory for the coupled transport and reaction of carbon, oxygen, nitrogen, sulfur, iron, and manganese. Am J Sci 296:197 243

Van Der Lee J, De Windt L (2000) CHESS tutorial and cook book. User's guide Nr. LHM/RD/99/05 Fontainebleau. CIG Ecole des Mines de Paris, Fontainebleau

Williams DD, Williams NE, Cao Y (1999) Road salt contami nation of groundwater in a major metropolitan area and development of a biological index to monitor its impact. Water Res 34:127 138

Yao W, Millero FJ (1996) Oxidation of hydrogen sulfide by hydrous Fe(III) oxides in seawater. Mar Chem 52:1 16

From:	Barbara Spring
To:	mi-waterstrategy
Subject:	Lets keep the Great Lakes water in the watershed
Date:	Sunday, July 19, 2015 5:02:38 PM

Water bottling companies should not be allowed to ship Great Lakes water out of the watershed bottle by bottle.

It is time to phase out nuclear power plants in the Great Lakes watershed and on their shores.

Oil pipelines under the Great Lakes should be closed and no new ones built.

Barbara Spring, author of *The Dynamic Great Lakes.*
http://bjspring.wordpress.com
http://barbara-spring.blogspot.com
http://spring4it.blogspot.com/

From: Ken Kuszpit
To: mi-waterstrategy
Subject: Lets use less water for making electricity
Date: Sunday, August 23, 2015 8:29:54 AM

The USGS says that 5% of the water we use in Michigan is to make ekectricity. If you go to wind and solar energy (which use no water) we can reduce this amount.

We need to encourage aquaculture. At today's fish prices I have to believe that there is a tremendous potentilal for profit in this industry.

24TH DISTRICT
STATE CAPITOL
P.O. BOX 30014
LANSING, MI 48909-7514
PHONE: (517) 373-0113
FAX: (517) 373-5912
E-MAIL: anthonyforlini@house.mi.gov

MICHIGAN HOUSE OF REPRESENTATIVES

ANTHONY G. FORLINI

STATE REPRESENTATIVE

COMMITTEES:
FINANCIAL SERVICES, **CHAIR**
FAMILIES, CHILDREN, AND SENIORS
NATURAL RESOURCES
TOURISM AND OUTDOOR RECREATION

John Allan
Director
Office of the Great Lakes
P.O. Box 30473
Lansing, MI, 48909

Director Allan,

I'd like to commend you for the work you have put in on your "Sustaining Michigan's Water Heritage" report regarding the plan for managing Michigan's water in the future. I agree that we need a long term plan and I believe that focusing on Michigan's recreational harbors, creating more access for the public to Michigan's coastlines, reducing phosphorus in lake basins, and expanding beach monitoring are all laudable goals.

However, as a state we need to focus more on what is causing the problem rather than just the effects we see in our ecosystem. I live in Harrison Township; a waterfront community on Lake St. Clair. I've lived here for decades and I have seen sewage being dumped into the lake for many years. The infrastructure of southeast Michigan is in desperate need of an upgrade as it was not meant to handle our current population. Much of the infrastructure here dates back to the mid-19th century. This problem is exacerbated when large to medium storms roll through the area dropping large amounts of rain causing even more untreated overflow of water and sewage from the sewer system straight into the lake.

What makes matters worse is that the communities "upstream" from the lake and river will dump excess sewage into the drainage system with very little fines. That is the core of the problem in southeast Michigan. It is cheaper for communities to pollute, than to treat the sewage they dump in our backyard. They have no incentive to become good actors when we let them pollute for next to nothing. Clean up efforts are expensive, but they have become a normal way of life on the lakefront.

I'd like to offer you a solution to this problem that I hope you will consider. The communities "upstream" should pay five times the cost of properly treating their sewage. The money then would be used for the cleanup of their neighbors on the lake whenever they dump in excess into the drains. These dollars should not be passed through a state agency to be considered as a revenue for funding other projects. This money should go straight to the lakefront communities to assist them in their cleanup efforts.

This tragedy has become the norm for years, allowing efforts to fix this disaster to become lackluster and even ignored. The report says that "water defines Michigan," well if we don't do something soon, sewage will define Michigan. I look forward to hearing from you on my proposal.

Anthony G. Forlini
State Representative
24th House District

From: Joseph B. Barrett
To: mi-waterstrategy
Subject: Lower Great Lakes biggest threat
Date: Tuesday, June 09, 2015 12:25:59 PM

Please google Joe Barrett ice boom. The lower Great Lakes cannot heal until the natural conveyor is restored. These scientists are treating the symptoms and not the cause. Thx, JBB
Joseph B. Barrett

From:	Casey Steffee
To:	mi-waterstrategy
Subject:	MAC Comments on Water Strategy
Date:	Thursday, August 27, 2015 11:28:42 AM
Attachments:	image001.png MAC Comments on Water Strategy.docx

---

Good Morning!

Attached are the comments from the Michigan Association of Counties. If you have any questions, feel free to let me know.

Thank you,

Casey Steffee
Governmental Affairs Assistant
Michigan Association of Counties
517.372.5374 (office)
steffee@micounties.org

935 N. Washington Ave.
Lansing, MI 48906
www.micounties.org
517-372-5374 (p) 517-482-4599 (f)

MAC
MICHIGAN ASSOCIATION OF COUNTIES
935 N. Washington Avenue
Lansing, MI 48906
517-372-5374 Fax 517-482-4599
www.micounties.org
Timothy K. McGuire, Executive Director

August 27, 2015

Michigan Department of Environmental Quality
525 West Allegan Street
P.O. Box 30473
Lansing, MI 48909-7973

To whom it may concern,

Michigan's waterways are crucial to the state's economy, job development and quality of life. Within that context, the Michigan Association of Counties (MAC) supports the proposed water strategy developed by the Michigan Department of Environmental Quality (DEQ). Several of the goals and implementation plans coincide with our internal policy positions for maintaining and improving Michigan's environment, including prevention of invasive species infestation, incorporation of environmental topics in education curriculums and development of a plan for the proper closure of wells.

While this is the case, it is critical for DEQ and the State of Michigan to fully fund any mandated activities related to implementation of the strategy. County governments are responsible for providing a multitude of other services that consume substantial shares of their budgets. An example of our concern is the recommendation for local public health departments to focus on their role as manager of county beaches. Establishing a sustainable funding source in order to carry out increased monitoring is necessary for this strategy to succeed.

MAC's members, the 83 counties of Michigan, stand ready to assist the State of Michigan in preserving and properly managing Michigan's natural assets, including its waters. With sound and responsible funding, Michigan's counties can be a major player in executing a strategy to advance this goal.

Thank you,

Casey Steffee
Governmental Affairs Analyst
Michigan Association of Counties

From:	Christine Kosmowski
To:	mi-waterstrategy
Cc:	rzilke@berriencounty.org; Anne Hendrix; "Stacy L. Hissong (SHissong@fsbrlaw.com)"; bosworth@micounties.org; Brian Jonckheere; Evan Pratt (pratte@ewashtenaw.org); Kogge, Stuart
Subject:	MACDC Water Strategy Comments
Date:	Friday, August 28, 2015 3:14:02 PM
Attachments:	MACDC Water Strategy Comments_final.pdf

To Whom It May Concern

The Michigan Association of County Drain Commissioners (MACDC) is composed of Drain/Water Resources Commissioners, engineering and environmental consultants, and contractors. As an organization we are dedicated to the protection of the health, safety, and welfare of Michigan's citizens, their lands and environmental quality, and to the protection and restoration of Michigan's water resources. We seek to accomplish these goals by promoting professional development, continuing education, and encouraging member involvement.

As Drain / Water Resources Commissioners, we are responsible for the management of water resources and storm water systems extensively throughout the State of Michigan. As managers of infrastructure which transports so much of our inland surface and ground water, we have a vested interest in the future management of those resources. Therefore, we appreciate and support the effort to develop a cohesive, long-term water strategy for the state in recognition of its abundant and precious water resources. We hope to be strong supporters and partners of the strategy and the effort to protect our state's valuable water resources.

Below are summary comments specific to Michigan's Drain Code of 1956 and attached are a compilation of comments pertaining to the goals in the document.

1. We would appreciate the opportunity to be on the stakeholder panel noted in Goal 8, Recommendation #3 from Table 2, concerning review of the Drain Code and other land use regulation/legislation, as MACDC members have a working knowledge of concerns, issues, and potential solutions.

2. On a related note, there may also be opportunities to improve the local impact on water quality from drainage infrastructure by forming another stakeholder group to evaluate legislative limitations of the Drain Code and other relevant legislation as well as solutions related to funding the solutions for water issues.

3. MACDC could help with generating a better inventory of County Drains at the statewide level.

4. MACDC could help with the water enterprise budget as shown in Figure 2 and related text. MACDC could help provide a better assessment of "Big Picture" costs/estimates of annual O/M costs --- historic and then projected. The former would require us to assemble a multi-year history of the total amount assessed in those years from members.

5. Public Engagement/Awareness -- MACDC advocates for a state-led effort at the highest level regarding the value of our water resources to residents in the state. We offer our assistance

with this aspect of the water strategy, as well.

Thank you for the effort to develop this document and we appreciate the opportunity to submit comments. We look forward to working with the Office of the Great Lakes on the implementation of *Sustaining Michigan's Water Heritage; A Strategy for the Next Generation*.

Sincerely,

Roger Zilke
2015-2016 MACDC President

August 28, 2015

Office of the Great Lakes
DEQ
P.O. Box 30473-7973
Lansing, Michigan 48909

To Whom It May Concern:

The Michigan Association of County Drain Commissioners (MACDC) is composed of Drain/Water Resources Commissioners, engineering and environmental consultants, and contractors. As an organization we are dedicated to the protection of the health, safety, and welfare of Michigan's citizens, their lands and environmental quality, and to the protection and restoration of Michigan's water resources. We seek to accomplish these goals by promoting professional development, continuing education, and encouraging member involvement.

As Drain / Water Resources Commissioners, we are responsible for the management of water resources and storm water systems extensively throughout the State of Michigan. As managers of infrastructure which transports so much of our inland surface and ground water, we have a vested interest in the future management of those resources. Therefore, we appreciate and support the effort to develop a cohesive, long-term water strategy for the state in recognition of its abundant and precious water resources. We hope to be strong supporters and partners of the strategy and the effort to protect our state's valuable water resources.

Below are summary comments specific to Michigan's Drain Code of 1956 and attached are a compilation of comments pertaining to the goals in the document.

1. We would appreciate the opportunity to be on the stakeholder panel noted in Goal 8, Recommendation #3 from Table 2, concerning review of the Drain Code and other land use regulation/legislation, as MACDC members have a working knowledge of concerns, issues, and potential solutions.

2. On a related note, there may also be opportunities to improve the local impact on water quality from drainage infrastructure by forming another stakeholder group to evaluate legislative limitations of the Drain Code and other relevant legislation as well as solutions related to funding the solutions for water issues.

3. MACDC could help with generating a better inventory of County Drains at the statewide level.

4. MACDC could help with the water enterprise budget as shown in Figure 2 and related text. MACDC could help provide a better assessment of "Big Picture" costs/estimates of annual O/M costs --- historic and then projected. The former would require us to assemble a multi-year history of the total amount assessed in those years from members.

5. Public Engagement/Awareness -- MACDC advocates for a state-led effort at the highest level regarding the value of our water resources to residents in the state. We offer our assistance with this aspect of the water strategy, as well.

Thank you for the effort to develop this document and we appreciate the opportunity to submit comments. We look forward to working with the Office of the Great Lakes on the implementation of *Sustaining Michigan's Water Heritage; A Strategy for the Next Generation*.

Sincerely,

Roger Zilke
2015-2016 MACDC President

Cc: Stacy Hissong, MACDC General Council
File

MACDC Water Strategy Comments

August 28, 2015

We appreciate the state's efforts in developing a cohesive water strategy for the state in recognition of its abundant and precious water resources. As managers of infrastructure which transports so much of our inland surface and ground water, we have a vested interest in the future management of those resources. We hope to be strong supporters and partners of the effort to protect our state's valuable water resources.

Please accept the following comments in the discussion of the water strategy.

PRELUDE:

The introduction is a key portion of the strategy that needs to be able to catch the reader's attention and convince them to read the rest of the document. We hope the following comments will help to round out that important piece of the water strategy.

1. **Detail the process.** We think the readers would be interested to know how the process was started, all of the work that was put into soliciting input around the state, and the diversity of the stakeholders involved. We feel that this lends tremendous credibility to the process and should be celebrated whenever possible.
2. **Don't forget our groundwater resources**. The water strategy lists some impressive statistics on our surface water assets. The addition of our impressive stats on groundwater would be a great addition to the discussions.
3. **Provide all of the suggested recommendations**. Since many other recommendations were made by participants at the listening sessions, it would be interesting to see all of them, as well as a discussion as to how the 22 key priorities were selected.

Goal 1

1. **Don't forget our inland lakes.** Reduction of nutrients in any of our great lakes will fundamentally require changes to what is happening on land. We feel that it starts with our individual actions on land and that this needs to be one of the central underpinnings of achieving this goal. Current watershed protection initiatives focus on our lands with denser populations, but still miss enormous areas of the state which have tremendous impact on lake nutrients.
2. **Tracking water use and withdrawals.** Our ability to ensure aquatic ecosystem health and function will necessitate our ability to understand how our withdrawals are impacting those resources. Expanding the ability of the current water withdrawal tool would significantly improve that ability to monitor water budgets and determine which activities pose impediments to maintaining a healthy system.
3. **Couple land-use with water knowledge.** Historically, our efforts at protecting aquatic ecosystems have focused on mitigating impacts after they occur. Whether through legislative action, or other mechanisms, coupling resource protection at the pre-planning stages of land-use zoning and policy, is a far more efficient and effective means of achieving that goal.

Goal 2

1. **Make them measurable.** Nothing breeds success better than success. Having achievable goals allows participants to gauge their progress in achieving their objectives and allows them to celebrate their successes. It's ok to have simple discrete goals that are readily attainable. They're less intimidating and they motivate people to set new and more ambitious standards!
2. **Education, education, education.** Education should be a central theme in all of the goals, because it will take a strong effort in this arena to build consensus on the issues, demonstrate successes, and instill transparency that will promote trust in the program. Education should go beyond the citizenry to local units of government, and interest groups.
3. **Protect the source.** While all groundwater must be protected, alignment of DEQ review and oversight rules so that source water areas are cross-checked with planned activities with potential impacts to these areas is crucial. Evaluation of oil exploration and other potential high-impact projects in terms of potential impacts to sensitive areas such as source water zones should be incorporated into state permitting reviews.

Goal 3

1. **Incentives work.** Creating opportunity, incentivizing progress, and rewarding successes are all crucial strategies in fulfilling any major project or initiative. Incentives should be a major tool to be utilized in the effort to meet our goals.
2. **Provide the tools.** To the extent which local and state government can leverage tools to protect local resources and create these strategic assets will be key in the success of this goal. This may require legislative changes at the state level to provide local units with discretionary authority on local decisions. In many cases, local units have their hands tied with regard to key decisions impacting water resources. These bonds must be removed.
3. **Funding tools.** While not a popular topic, the extent to which these initiatives can be leveraged through direct funding, incentives, or community initiatives will be necessary to achieve our goals. Cleanup of contaminated sites, for example, will require dedicated funding as well as legal support by the state. A dedicated section of the AG's office, for example, may be prudent in marshaling many cleanup sites through to actionable projects.

Goal 4

1. **Asset management.** Asset management is a priority system which utilizes a risk and impact assessment to develop an efficient management plan. Use of this strategy will help identify the greatest risks to the resource and protect them accordingly. The sustainability of these resources will depend to a great degree on the extent to which we can properly identify these risk/impact relationships and focus on the greatest priority items.

Goal 5

1. **Mesh and meld policies.** From a statewide sanitary code to building and development codes which reward water-based technology and innovation, a system of clear and consistent policies will help with compliance in achieving efficiency targets within the state. Adapting a flexible system by which water-based innovation can be more easily adapted within the state should be a key component in achieving this goal. Too often, the introduction of new water-based innovation is stymied by inflexible rules and regulations. Creating flexibility in regulations while still protecting the resource is a difficult yet necessary endeavor.

Goal 6

1. **Enable stormwater utilities.** Resource protection is best done at the local level and providing the tools for citizens and local units of government to protect their local resources is critical. As the "forgotten utility," stormwater receives little of the benefits afforded many of the "conventional" utilities such as wastewater and drinking water. Recognizing the need to properly managing these assets like other utilities will be a key step in protecting water infrastructure. This concept ties into one of our prior comments on the ability of communities to fund conservation efforts.

Goal 7

1. **What gets measured gets managed.** Measurement is a key component of any adaptive management process. It provides justification to measures that work and helps eliminate those that don't. We like the mention of a decision framework and suggest that measurement and monitoring also be utilized to legitimize the most efficient best management practices. This means of ground truthing will help to promote these efficiencies and aid in attainment of our goal areas.

Goal 8

1. **Provide the legal tools.** As mentioned in previous goals, local units need the flexibility and authority to actively protect water resources and promote conservation. Consistency in regulation, flexibility in decision making, and funding tools make this a difficult yet crucial component in the implementation of the overall water strategy.
2. **Get on the same page.** Water protection and property protection statutes often work at cross purposes, due in large part to incongruent statutes and administrative policies. Revising statutes so that governmental organizations can work cooperatively instead of at loggerheads, will be essential in eliminating the inefficiencies of the existing system.
3. **Michigan's Drain Code of 1956.**
   - We would appreciate the opportunity to be on the stakeholder panel noted in Goal 8, Recommendation #3 from Table 2, concerning review of the Drain Code and other land use regulation/legislation, as MACDC members have a working knowledge of concerns, issues, and potential solutions.
   - On a related note, there may also be opportunities to improve the local impact on water quality from drainage infrastructure by forming another stakeholder group to evaluate legislative limitations of the Drain Code and other relevant legislation as well as solutions related to funding the solutions for water issues.
   - MACDC could help with generating a better inventory of County Drains at the statewide level.
   - MACDC could help with the water enterprise budget as shown in Figure 2 and related text. MACDC could help provide a better assessment of "Big Picture" costs/estimates of annual O/M costs --- historic and then projected. The former would require us to assemble a multi-year history of the total amount assessed in those years from members.

Goal 9

1. **Include all stewards……and educate!** The list of stewards goes well beyond just communities and individuals. They include non-profits, chambers, businesses large and small, rotaries, and the list goes on. Education lies at the key to this, but leveraging the resources of so many groups that may not historically been considered partners in resource protection is crucial. In many cases, the market economy is recognizing the importance of resource protection and has embraced it more strongly than the public

sector. Inclusion of the private sector should be a strong focus of the strategy and associated educational efforts. MACDC advocates for a state-led effort at the highest level regarding the value of our water resources to residents in the state. We offer our assistance with this aspect of the water strategy, as well.

From: gv624vm@gmail.com
To: mi-waterstrategy
Date: Thursday, August 27, 2015 6:52:55 PM

This action to begin taxing water that comes from private wells is unconstitutional. The state does not own to the center of the earth. Putting this tax onto peoples property tax bills without any vote is wrong. Where does it stop. How soon will we be taxed for breathing the air over our property. This is bad and should be scrapped. The DEQ is powerm hungry and needs to be reigned in by the legislature. this smacks of AGENDA 21.

Sent from Windows Mail

DETROIT/WAYNE COUNTY PORT AUTHORITY

Comments

SUSTAINING MICHIGAN'S WATER HERITAGE

I would like to commend the Governor for developing a Comprehensive Water Strategy for the State of Michigan. This is definitely a step in the right direction. Regarding the section titled "Create Vibrant Waterfronts" I believe greater emphasis is needed on the role of commercial port and maritime operations to State's economy and the steps needed to ensure its future healthe.

The map used in this section show the tremendous number of commercial marine operations throughout the State, if not the largest number of such operations per state than clearly one of the largest. Access to low cost, efficient water transportation is one of the key factors in the growth of the State. Water transportation plays a key role in the mining, steel making and auto manufacturing sectors. Today, the maritime industry in the State is responsible for 26,800 jobs, $3.8 billion in business impact and $180 million in state and local tax revenues. Waterborne transportation is also the most energy efficient and environmentally friendly way to move cargo to domestic and international market. Air emissions from the rail mode is 1.4 time greater than marine and trucks produce 7.5 time the emission as marine. Regarding energy consumption, rail and trucks use 2.2 and 10 times respectively as much energy as the marine mode.

Marine transportation can play a critical role in the State's economic revitalization and environmental stewardship of the Great Lakes. But the investment is needed not only in dredging and port infrastructure but in highway and rail access to port facilities. The recent collapse of a dock along the Rouge River between the Cities of Detroit and River Rouge, which has closed the Federal navigation channel for several weeks and impacted the operation of AK Steel, Marathon Petroleum, St. Mary's Cement and other terminal along with thousands of jobs, demonstrates the dire need for port infrastructure investment. There is additional investment needed in land side port access by both truck and rail to port facilities. The State can and must become more engaged in these issues along with empowering port interest to make the necessary improvements.

In addition, greater utilization of the water transportation we can reduce emissions that eventually make their way into the Lakes, reduce energy consumption, and reduce the wear and tear on our highway system. With the appropriate investment in the marine sector, the State can make Michigan's business more competitive through efficient, clean and safe water transportation.

The maritime interests of the State would be happy to in detail the infrastructure needs of the industry. We applaud the effort to date and look forward to working with you to make this strategy a success. Please direct any questions to John Loftus, Executive Director, Detroit/Wayne County Port Authority (313) 259-5091.

DETROIT/WAYNE COUNTY PORT AUTHORITY

Comments

SUSTAINING MICHIGAN'S WATER HERITAGE

I would like to commend the Governor for developing a Comprehensive Water Strategy for the State of Michigan. This is definitely a step in the right direction. Regarding the section titled "Create Vibrant Waterfronts" I believe greater emphasis is needed on the role of commercial port and maritime operations to State's economy and the steps needed to ensure its future healthe.

The map used in this section show the tremendous number of commercial marine operations throughout the State, if not the largest number of such operations per state than clearly one of the largest. Access to low cost, efficient water transportation is one of the key factors in the growth of the State. Water transportation plays a key role in the mining, steel making and auto manufacturing sectors. Today, the maritime industry in the State is responsible for 26,800 jobs, $3.8 billion in business impact and $180 million in state and local tax revenues. Waterborne transportation is also the most energy efficient and environmentally friendly way to move cargo to domestic and international market. Air emissions from the rail mode is 1.4 time greater than marine and trucks produce 7.5 time the emission as marine. Regarding energy consumption, rail and trucks use 2.2 and 10 times respectively as much energy as the marine mode.

Marine transportation can play a critical role in the State's economic revitalization and environmental stewardship of the Great Lakes. But the investment is needed not only in dredging and port infrastructure but in highway and rail access to port facilities. The recent collapse of a dock along the Rouge River between the Cities of Detroit and River Rouge, which has closed the Federal navigation channel for several weeks and impacted the operation of AK Steel, Marathon Petroleum, St. Mary's Cement and other terminal along with thousands of jobs, demonstrates the dire need for port infrastructure investment. There is additional investment needed in land side port access by both truck and rail to port facilities. The State can and must become more engaged in these issues along with empowering port interest to make the necessary improvements.

In addition, greater utilization of the water transportation we can reduce emissions that eventually make their way into the Lakes, reduce energy consumption, and reduce the wear and tear on our highway system. With the appropriate investment in the marine sector, the State can make Michigan's business more competitive through efficient, clean and safe water transportation.

The maritime interests of the State would be happy to in detail the infrastructure needs of the industry. We applaud the effort to date and look forward to working with you to make this strategy a success. Please direct any questions to John Loftus, Executive Director, Detroit/Wayne County Port Authority (313) 259-5091.

From:	Sean Hammond
To:	mi-waterstrategy
Subject:	MEC Water Strategy Comments
Date:	Friday, August 28, 2015 12:52:23 PM
Attachments:	MEC Water Strategy Comments.docx

Please find attached Michigan Environmental Council's comments on the draft Water Strategy.

Thank you,
Sean Hammond

--

Sean Hammond| Deputy Policy Director
Michigan Environmental Council
602 West Ionia St.
Lansing, MI 48933-1015
517-487-9539 **Fax 517-487-9541**
Direct: 517-999-0422
Cell: 517-282-0685
www.environmentalcouncil.org
Sign up for our E-Newsletter!

August 28, 2015

Office of the Great Lakes, DEQ
P.O. Box 30473-7973
Lansing, Michigan 48909
Fax: 517-335-4053
Email: Mi-waterstrategy@michigan.gov

The Michigan Environmental Council, a coalition of more than 65 member-based organizations across the state, has reviewed the draft document, "Sustaining Michigan's Water Heritage: A Strategy for the Next Generation," created by the Office of the Great Lakes (OGL) at the Michigan Department of Environmental Quality. We want to commend OGL for the hard work and dedication necessary to draft such an impressive catalog of risks and proposed actions on behalf of Michigan's waters.

As a member of the OGL's voluntary "Water Cabinet," MEC is familiar with the document and appreciative of the opportunity to consult with OGL at several intervals over that last several years as the draft strategy was compiled and revised. As the OGL plans official delivery of the report to Gov. Snyder, and develops media strategies and outreach plans for promotion and adoption, MEC offers the following comments. We offer these as suggestions that we feel would help OGL further refine and strengthen the impressive document, elevate its status, and increase the likelihood of implementation by lawmakers, water stakeholders and advocates and the public.

Areas of Support and Commitment

In an era of unprecedented freshwater uncertainty (such as Western-state droughts and climate change), the development of a comprehensive and far-reaching strategy and vision articulating the value and role of Michigan's precious water resources is a great thing. We applaud the Governor for asking for the strategy, and thank Jon Allan and the team at OGL for pulling it together.

We find the draft document to be an impressive catalog of the complex actions, interactions and interdependencies of Michigan's hydrology, economy and water-based identity. It offers a solid accounting of the many specific water-related challenges, opportunities and options facing the state today, and in decades ahead. From aquatic invasive species and harmful algae blooms to groundwater withdrawals and stormwater runoff, the document offers a sobering and insightful picture of the road ahead.

With so much information packed into the report, however, MEC would like to highlight a few noteworthy recommendations that we feel are worth noting as "clear wins" in the

strategy. MEC is pleased these are included, and we offer our support and commitment to helping with implementation:

- **Goal 1, Rec 13: "**Refine and improve the water withdrawal assessment process to ensure sustainable use of water resources and that high priority is given to incorporating existing and new data and models to better represent local and regional water resources and surface water/groundwater interactions." By next year, the strategy says the state should have "a list of priority Water Use Advisory Council recommendations and an implementation plan." MEC and our partner and member organizations have long been engaged in the Water Withdrawal Assessment Tool process, and are eager to resume work to bring needed improvements and wider use of an improved tool.
- **Goal 2, Rec 8 and Goal 7, Rec, 3:** "Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites" and "Develop a long-term sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies." MEC has long been interested in the funding issues around legacy issues and monitoring, and are eager to assist in any workgroups or data-gathering activities to move this set of issues forward. As noted below, we believe that this process should begin immediately. For example, one idea that might be considered is the creation of a "use restriction fee" assessed on responsible parties when groundwater contamination issues necessitate the establishment of groundwater use restrictions. MEC would be happy to engage in research on this or other similar proposals for improved funding for legacy issues.

Suggestions for Stronger Recommendations

Of course, the essence of any useful strategy is prioritization. With this in mind, we at MEC believe there are a few issues that might warrant greater consideration or a more aggressive timeline for action than the strategy currently contemplates. These have to do with longstanding challenges where a course of action is clear and the state can get started today, even while many of the strategy's more visionary and far-reaching recommendations are being digested and researched.

- **Septics.** The strategy rightly calls on the legislature to "Establish inspection requirements for residential on-site wastewater systems" and "develop and implement a uniform statewide sanitary code" (Goal 2, Recs. 5 and 6) But an implementation date of 2020 is far too slow. As noted in the strategy, Michigan is the only state without a statewide requirement for septic inspections, and with more than half of new residential construction taking place using septic systems, it is common sense and overdue policy the current legislature could and should pass during this legislative session.
- **Long-term Funding.** We applaud the call to "Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies" (Goal 7, Rec. 3). Again, the

strategy's target date of 2018 maybe too slow, as funding for key water quality monitoring programs either has expired or will run out in 2017. Now is the time to elevate these critical needs with clear strategies for funding and prioritizing the actions needed monitor contamination concerns and ensure the health and restoration of aquatic ecosystems.

- **Nutrient pollution.** While developing a strategy for preventing Harmful Algal Blooms (HABs) is critical (Goal 1, Rec. 4), we also know that agricultural runoff and sewer overflows represent a major source of nutrient overload to the Great Lakes system, and are linked to algal blooms. We would ask that a recommendation be added to Goal 1 addressing specifically agricultural practices known to unduly burden waterways with such nutrients (such as winter/frozen soil application of manure, plowing and planting of vegetative buffers around waterways, etc.).
- **Aquatic invasives and net-pen aquaculture.** Goal 1 of Chapter 1 recommends that Michigan should "prevent the introduction of new aquatic invasive species." However, page 34 later states: "Aquaculture is another area that could thrive based on Michigan's plentiful water supply and high water quality. . . . [I]ndustry and the state should continue to support closed-loop or recirculating systems." In light of clear risks, and given the goal of not introducing new aquatic invasives, MEC would request this statement be amended with the following: "while simultaneously ensuring that open-water, net-pen aquaculture is not permitted in the Great Lakes or its connecting waterways, due to the high risk associated with the potential for pollution, escapement of new aquatic invasive species, heavy nutrient loading, and other known risks associated with large-scale fish farming operations in open, freshwater environments." Similarly, we would ask that "aquaculture technology and related opportunities" be removed as an implementation metric from Goal 5, Rec. 1 unless targeted specifically to closed-loop, recirculating systems located on land.
- **Water affordability.** MEC applauds the inclusion of a recommendation focused on water affordability (Goal 6, Rec. 3). However, as pointed out during public comments at the Detroit hearing on the water strategy, there are likely more concrete actions that can be recommended to address immediate concerns about water shutoffs and accessibility of clean water to the most vulnerable. Several examples of best practices were included during public comments that should be evaluated for inclusion. In addition, language on Page 37 ("While water as a resource may be free, there are costs associated with managing Michigan's water resources to ensure that water is of high quality and available for human uses") should be reexamined. For those who cannot afford to pay for access to clean water, it likely matters little whether the barrier is the cost of the water or the cost of the infrastructure to deliver it.
- **Watershed approaches.** Watershed-level governance needs to be more explicitly empowered. This could be a new recommendation within governance (Goal 8, Rec. 3), but should also pull in authorities such as green infrastructure planning efforts at a larger, landscape scale (Goal 1, Rec. 14), regional economic strategies (Goal 3, Rec. 1) and regulation of land use (Goal 1, Rec. 9). This suggestion

reflects both the capacity of watershed-based organizations to do this work and also the need for a more proactive approach to managing the landscape level opportunities to protect watersheds and groundwater recharge before it is degraded. I.e., "Holistic watershed-based approaches that slow the movement of water across the landscape, increase infiltration capacity, reduce erosion, sediment, nutrient flow and wastewater discharges, and increase aquifer recharge are needed for long-term preservation on Michigan's hydrology" (pg. 10).

- **Harbor Town program.** While the creation of a program to help market recreational harbor towns is laudable (Goal 4, Rec 4), there are also similar fledgling initiatives within the DNR to create new programs to celebrate "Pure Michigan Trails," water trails and "Pure Michigan Trail Towns." MEC recommends combining all these initiatives into a single overarching program that highlights the best examples of Michigan communities linking to their recreational assets, as recommended by the Blue Ribbon Panel on Parks and Outdoor Recreation: "The state should develop a 'Pure Michigan Places' program based on the Trail Town® program pioneered in Pennsylvania and designed to operate like the Michigan Main Street program, which provides technical assistance and financial resources to communities that make physical and programmatic connections to nearby state and regional recreation facilities."

Finally, we also think it's worth noting that, from a strategic perspective, precautionary actions that protect existing functional aquatic ecosystems should probably take precedent over more innovative or even risky propositions for economic development. We support innovations in technology and want to see thriving business development and research around water conservation. However, we believe it's better to focus on tackling the biggest challenges apparent now and taking a preventive approach to potential new sources of risk to the Great Lakes system, such as net-pen aquaculture, increased Great Lakes shipping, marketing of our abundant water to businesses that use a lot of it—all of which the water strategy touts as economic development opportunities.

Suggested Language and Structure Tweaks

Lastly, there are few areas MEC believes that small tweaks in language could strengthen the document and improve it:

- The subset of priority recommendations in Table 1 should be more clearly cross-referenced to their parallel recommendations in Table 2. For example, the recommendation number from Table 2 could be included in Table 1, and where possible the actual wording of the language could be identical to reduce potential for confusion. It would also be worth considering pulling the "implementation metric" and "lead actor" categories into Table 1, and more explicitly tying each "measure of success" to a specific recommendation. This would make it easier to understand the connections between the recommendations and their outcomes ("measures of success") and likely timeline ("implementation metric"). As an example, we were not able to discern from these charts what specific

recommendations are being proposed to achieve the 40 percent reduction in phosphorous in Western Lake Erie (Goal 1), and the timeline for revisiting this measurement).

- Page 1: "The Strategy recognizes the core values identified with water are four-fold: economic, environmental, social, and cultural. All are equally important." We feel the phrase "All are equally important" should be removed. On the very next page, another statement contradicts this assertion: "[W]ithout a healthy environment, human uses are diminished and fish and wildlife perish." While we recognize the interdependency of these four areas, it is clear that they are not in actuality equal: environmental health is foundational to the other three; e.g., without an environment, there can exist neither economy nor society nor culture. The inverse is not true.
- Page 3: "Federal, state, tribal and local regulation and restoration programs have made substantial progress in addressing this legacy [of contamination]. This network of programs and actions has been instrumental in reaching toward the goals of ensuring drinkable, swimmable and fishable waters." This statement is probably too optimistic: legacy contamination remains one of the most serious threats to Michigan's water (plumes, LUST, etc.) and we feel this statement to be somewhat misleading in light of later recommendations regarding the dire need for clean up funds, etc. MEC would like to see this statement revised to read: "Coordination of federal, state, tribal and local regulation and restoration programs can help address this challenging legacy of contamination which continues to put Michigan's water at risk. This network of programs and actions has been instrumental in clarifying the actions and resources needed to ensure drinkable, swimmable and fishable waters as established. . . For example, recent investments by the federal government through the GLRI have accelerated. . ."
- "Ideation" on page 4 is not a term commonly understood. Consider deleting, as "invention and innovation" would seem to cover similar ground.

Again, we applaud the Office of the Great Lakes on this draft document and look forward to an exciting summer of engagement and conversation to advance this important work. As the report makes clear, Michigan is defined by water, and that water needs our collective efforts to meet its full economic and environmental potential.

Thank you for the opportunity to put in comments, and we look forward to working with OGL in the upcoming implementation of this strategy

Brad Garmon

Director of Conservation and Emerging Issues

From: Petrovskis, Erik
To: mi-waterstrategy
Subject: Meijer comments
Date: Thursday, August 27, 2015 3:51:43 PM

Meijer appreciates the opportunity to provide comment on the MDEQ draft water strategy. The strategy is comprehensive and supports the 30-year vision for high quality water resources for the state. Meijer is especially supportive of establishing voluntary water efficiency targets and water conservation and reuse strategies. Meijer would like to see how these MDEQ recommendations can be translated into action items for local units of government who set requirements that conflict with these goals. For example, landscaping requirements and associated irrigation add to water and energy waste.

Erik A. Petrovskis, PhD, PE | Director of Environmental Compliance and Sustainability | Properties

Meijer | 127-06 | 2350 3 Mile Rd. NW | Grand Rapids, MI 49544

P: 616-735-7101 | C: 616-710-2228

Erik.Petrovskis@meijer.com

NOTE: This electronic message and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this message in error, any unauthorized review, use, disclosure, distribution or copying of this message is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message. Unless expressly stated in this e-mail, nothing in this message should be construed as a digital or electronic signature or writing.

MICHIGAN FARM BUREAU®
7373 W. Saginaw Hwy. • Lansing, MI • 48909 • (800) 292-2680 • www.michfb.com

August 24, 2015

Ms. Emily Finnell
DEQ Office of the Great Lakes
P.O. Box 30473-7973
Lansing, Michigan 48909

Sent via email to: Mi-waterstrategy@michigan.gov

Re: Public Comment on *Sustaining Michigan Water Heritage, A Strategy for the Next Generation*

Dear Ms. Finnell,

Thank you for the opportunity to provide comments on the Office of the Great Lakes' draft *Sustaining Michigan Water Heritage, A Strategy for the Next Generation*. Michigan Farm Bureau is our state's largest general farm organization with more than 46,500 members, all of whom care about and depend on the vital water resources Michigan provides. Farmers in Michigan are not only significant water users in the state, but we also depend upon high water quality for agricultural and recreational use, and upon a robust infrastructure to support both rural water management and shipping. We appreciated being part of the Cabinet organized by Director Allan to assist in identifying some of the goals and outcomes that appear in this draft *Strategy*.

We found the process of gathering public input and publishing the *Strategy* draft to be well thought out and inclusive. In particular, the original draft of the *Strategy* offered to the Cabinet for review and suggestions provided us an extensive opportunity to share our thoughts and suggestions on the draft's message and language. That original document with our suggestions is attached for your convenience. Please allow these comments to serve as a supplement to our earlier suggestions.

In an effort to aid staff reviewing public comments on the draft *Strategy*, we offer the following comments in the order in which they appear in the main body of the document, with references to Table 1, the Water Strategy Priority Recommendations and Measures of Success, and Table 2, the Water Strategy Implementation Plan.

Chapter 1: Protect and Restore Aquatic Ecosystems

We support the majority of the recommendations in this chapter, and agree that collaborative engagement at the individual, local, state, and regional level is the most effective way to improve water quality and restore aquatic ecosystems. However, we cannot support the last recommendation under this chapter (page 18), which addresses improving water management in rural landscapes:

> *Eliminate impairments in priority watersheds that have degraded water quality and/or aquatic ecosystems due to nutrient runoff and soil erosion. Engage landowners through a collaborative and adaptive community-based natural resource management process to identify local actions to change behaviors and solutions to achieve those outcomes. Failure to achieve demonstrable outcomes within established timeframes could trigger additional measures.*

The sentence identifying measures triggered by failure to achieve demonstrable outcomes does not comport with the language throughout this chapter of engagement and collaboration. In fact, it does not even acknowledge that water quality impairment can be complex and can be caused by a range of sources, or that improving water quality may require different technologies or practices in different areas and under different land uses. Instead it appears to bring a regulatory or mandated structure into what is otherwise a very broad topic that attempts to address everything from agricultural soil management and drainage to irrigation and conservation easements. Further, Table 2 (pages 60-61) identifies the implementation metric for this recommendation as developing statewide land use activity performance standards and requiring agricultural land uses to follow the standards of the Michigan Agriculture Environmental Assurance Program (MAEAP).

Such mandates for land use standards violate private property rights, and do not follow provisions of the Clean Water Act identifying a separation of standards between point and nonpoint sources of discharge into regulated waters, or provisions of NREPA designating obligations to maintain water quality. In its current form, this recommendation instead purports to dictate land use, soil management practices, drainage, and other methods in ways that may not fit all landscapes, and which may not address priority resource concerns. This goal can be accomplished through continuing the chapter's emphasis on education and engagement of landowners rather than heavy-handed regulatory action. The recommendation's reliance on mandating MAEAP standards further places burdens on landowners through what is explicitly identified in statute as a voluntary program, and which should remain a voluntary program to incentivize environmental stewardship rather than punish landowners who may be unable to comply with all its many high standards.

We urge the Office of the Great Lakes to remove the last sentence of this recommendation. In Table 2, we further urge the Office of the Great Lakes to amend its implementation metric to replace "performance standards" with "best management practices," to encourage rather than

mandate agricultural land use following MAEAP standards, and to eliminate the language to develop escalated "additional actions" triggered by watershed impairment.

Chapter 2: Ensure Clean and Safe Water

We agree with all of the recommendations in this chapter. We do urge the Office of the Great Lakes however, to review the introduction to this chapter (page 21), which states:

> In many areas of the state, nitrate contamination is a concern. In Michigan, the U.S. Geological Survey regards nitrate-N levels of more than 2 milligrams/liter in water as a sign that human-related nitrate sources have adversely affected the water. In rural areas, elevated levels of nitrate can be associated with animal manure and agricultural fertilizers. Septic systems can also serve as a source of nitrate contamination, though that risk is minor if the systems are designed and maintained for nitrogen removal and water wells are properly sited, constructed and maintained.

This paragraph, in contrast to the description of "minor" risk of nitrate pollution from properly maintained septic systems which are the subject of a majority of the recommendations, nitrate pollution is described as inevitably associated with manure and fertilizer. Proper management of manure and agricultural fertilizers can also minimize the risk of nitrate pollution. We urge the Office of the Great Lakes to add the following: "In rural areas, elevated levels of nitrate can be associated with animal manure and agricultural fertilizers *unless they are properly managed*."

Chapter 5: Promote Water-Based Economies

We support the language and recommendations in this chapter identifying opportunities to conserve and reuse water and optimize efficiency of use. We also support the recognition of aquaculture as an important and growing industry that provides a safe and affordable food supply to a growing number of people. However, we object to this draft's identification of specific types of aquaculture operation in this paragraph (page 38):

> Aquaculture is another area that could thrive based on Michigan's plentiful water supply and high water quality. In a world demanding ever-increasing amounts of high-quality fish and protein, growing the state's aquaculture industry will require significant innovation in water technology. In particular, industry and the state should continue to support closed-loop or recirculating systems. Lowering energy costs of production, improving water filtration and strengthening supply chains for commercial aquaculture systems will enable the industry to grow substantially in an ecologically responsible fashion.

Safe and responsible aquaculture operations can take many forms and have the capacity to be managed within our state's water quality standards whether they are closed-loop systems, in-stream systems, or open-water pen systems. For the state to pick only certain types of operations as those worthy of support in a long-term strategy severely limits the aquaculture industry's development and demonstrates a bias against viable and current successfully operating systems. We urge the Office of the Great Lakes to amend the sentence in the above paragraph to: "Industry and the state should continue to support aquaculture development in ways that both build the industry and protect water quality."

We further object to the recommendation (page 39) which states:

> *Establish voluntary water efficiency targets for agriculture in areas of existing or potential water stress.*

In Table 2 (page 66), the implementation metric for this recommendation states:

> By 2017, develop a baseline for water usage, data collection and definitions to inform development of water conservation goals and objectives in areas of existing or potential water stress. Collect data for two years. Establish targets. Increase in the number of water stressed regions that have water efficiency plans and water efficiency targets by 2020.

Agriculture already has standards of efficiency which were developed through years of university research and stakeholder participation: the Generally Accepted Agriculture and Management Practices for Irrigation Water Use. These standards recognize that water use for irrigation (as well as water use for livestock) is vital to many varieties of agricultural products and directly impacts production quality and yield. The standards concentrate on maximizing efficiency of use – that is, reducing waste – rather than dictating volumes, in order to ensure that agricultural production is not hampered by arbitrary limits to water use applied industry-wide. Michigan Farm Bureau policy opposes water allocation that preempt riparian rights or limit agricultural use. Therefore, rather than create an entirely new set of standards or targets for the agricultural industry, we urge the Office of the Great Lakes to amend the above recommendation to say:

> *Establish voluntary targets for agriculture to comply with the Generally Accepted Agriculture and Management Practices for Irrigation Water Use, under Michigan's Right to Farm Law, Act 93 of 1981, in areas of existing or potential water stress.*

We recommend the implementation metric be amended to say:

> By 2017, establish targets to increase the percentage of agricultural producers complying with the Irrigation GAAMP in water stressed regions by 2020.

Chapter 7: Monitor Water Quality

We support all of the language and recommendations in this chapter. However, in Table 1 (page 8), the recommendation stating "Implement a pilot water resource decision framework" lists a measure of success as "Achieve a net stabilization of groundwater depth across the state." This measure of success is, first, impossible to achieve as groundwater fluctuates due to innumerable causes which may not be related to impacts from withdrawals or other anthropogenic causes. Second, this measure is not supported by the language of the chapter, which discusses monitoring and mapping groundwater to ensure sustainable use – not to establish a static threshold standard. We recommend the Office of the Great Lakes amend the measure of success to say, "Achieve sufficient monitoring and mapping of groundwater flows to evaluate environmental impacts and understand the needs of sustainable use of groundwater resources."

We are grateful for the opportunity to participate in the development of such an important part of Michigan's resource management. We support movement forward and implementation of a long-term water strategy that will support the economic, ecological, social, and cultural value everyone in Michigan places upon water. Water is vital to all citizens, all industries, and to the identification of Michigan as the Great Lakes State. We look forward to continuing to work with the Office of the Great Lakes on the completion of this strategy, and to participating in implementation of goals all stakeholders can support. Please feel free to contact me with any questions.

Sincerely,

Laura A. Campbell, Manager
Agricultural Ecology Department

MICHIGAN GROUND WATER ASSOCIATION, INC.
Representing Michigan's Water Well Drilling Industry
601 Dempsey Road • Westerville, OH 43081
Phone (855) 225-6492 • Fax (614) 898-7786
e mail: michigangroundwater@comcast.net web site: michigangroundwater.com

Dear Mr. Allen August 28, 2015

Michigan Office of the Great Lakes:

Since 1928, the Michigan Ground Water Association (MGWA) and its members have been on the front line as defenders of Michigan's water, our state's most precious resource. Many of our current members represent the fifth or sixth generation of hard working, knowledgeable well drillers dating back to the late 1800's. From the beginning of our group's inception, we have held tight to our motto: To PROVIDE, to PROMOTE, and to PROTECT Michigan's ground water. We applaud the State of Michigan's efforts in the 30 Year Water Strategy to share in MGWA's efforts and goals.

MGWA is pleased to hear the State wants to again make remediation of contaminated ground water sites a priority. Clean, natural ground water is vital to Michigan's economy. Reclaiming areas that have been previously damaged increases Michigan's vitality and keeps us on path to a sustainable future.

MGWA also welcomes the idea of providing controls to the installation of closed loop geothermal systems. These unregulated vertical borings pose a significant threat to Michigan's aquifers.

While the MGWA was not contacted for input into the first draft of the Water Strategy, our experience and knowledge is a vital component to developing Michigan's vision for water policy. The June 2015 Draft of the Water Strategy gives very few details in regards to specific targets related to ground water. That fact makes it difficult for our organization to give any detailed changes at this point in time.

In reading the document, however, there are items and issues that raise concern for our membership and all of the private well owners we represent in our state:

- Fracking is not mentioned in the document. While MGWA is neutral on the issue of fracking at this point in time, the process uses large quantities of ground water and has the potential to influence water quality in surrounding wells and aquifers.
- MGWA knows better than any other group the vast diversity of the state's hydrogeology from one area to another. Any water strategy needs to reflect that diversity and understand that what applies in one region of our state does not necessarily represent the entire state.
- Page 50 reads, "Michigan lacks a coordinated and comprehensive strategy for monitoring groundwater quality and quantity to improve understanding of this valuable resource, reduce threats of contamination, and guide better investments and decisions."

MGWA supports scientific research in understanding our resources. The Water Strategy must emphasize the use of real, verifiable, observed data for its research. This data in turn needs to be reviewed in a public forum with real peer reviewed science. The current process of using massaged computer calculations of crude, archaic data (as is the case in the Water Withdrawal Assessment Tool and the current Ottawa County Water Study) only produces fool's gold with no meaningful results. True assessment of the state's hydrogeology requires regional and site specific geological profiling by qualified experienced professionals using proven industry standards.

- On the topic of "Invest in Water Infrastructure" on pages 41-45, the Water Strategy addresses the issues regarding the aging infrastructure that exists in all area of our state. MGWA acknowledges that concern for our state's and local communities' future budgets. The Water Strategy needs to in turn acknowledge that private well owners assume all costs associated with the proper installation, maintenance, and abandonment of their water systems. Private well owners need to be recognized as independent and not viewed as a possible revenue stream (through taxing of water and/or mandatory municipal water connections) to fund these infrastructure repairs.
- Most important, the Water Strategy needs to acknowledge and continue Michigan's proud history and case law recognizing Riparian and Ground Water rights. Michigan property owners have and need to continue the right to the reasonable use of the water under their land. The notion that landowner water rights need to be surrendered to be protected needs to be specifically rejected by any Water Strategy for Michigan.

MGWA looks forward to future discussion on the Water Strategy and being an integral part in its development. While MGWA cannot support the Water Strategy as drafted, we welcome beginning discussions with your office and the agencies of our state to PROMOTE, PROVIDE, and PROTECT our ground water.

Sincerely,

Richard Layman
President
Michigan Ground Water Association

Michigan Legislature

Hearing on Water Affordability and Safety

June 3, 2015
10:00 a.m. – 11:30 a.m.

State Capitol

Convened by Representatives Stephanie Chang (Detroit)
Shelton Neeley (Flint)
LaTanya Garrett (Highland Park)

In Partnership with the Detroit Caucus and Flint Delegation
of
The Michigan Legislature

Alice B. Jennings, Esquire
Edwards & Jennings, P.C.
Detroit, MI

Thank you Representatives Stephanie Chang, Shelton Neeley and LaTanya Garrett for bringing us here today to testify about one of the most fundamental issues of our time, in our great state, affordable, safe and accessible water.

As you know, Michigan is surrounded by five great lakes, or twenty (20%) percent of the fresh water in the world. Yet, Detroit, Michigan, and other urban cities are experiencing a humanitarian and public health crises. Since January 1, 2013 over fifty-three (53,000) thousand Detroiters, residential customers of Detroit Water and Sewerage Department (DWSD), had water and sewerage abruptly terminated to their homes. We know from FOIA requests and Director reports authored by Director of the DWSD, Susan McCormick, that of the thirty-three (33,000) thousand shutoffs occurring in 2014, only approximately eighteen (18,000) thousand homes were restored to service by the end of the year.

This year alone, another several thousand residential homes have experienced the trauma of water service termination. Another thirty thousand homes are scheduled for shutoff in the next season of shutoffs, affecting tens of thousands of Detroiters. In her most recent May 2015 report Director McCormick states how the 2015 shutoffs are now well on their way:

> "From January 2015 to April 11, 2015, 13,303 accounts were checked for possible illegal usage, and 5,794 of those accounts were found on illegally and were re-shut.
>
> Since May 11, 2015, the Department posted 2,882 door hangers notifying customers of pending shut off of services; a total of 794 of those customers have either paid bills, or entered into a payment plan agreement. Currently, there are a total of 30,766 active payment plan agreements with a total combined balance of $25,106,446.53."

I cannot advise you of the exact numbers of Detroit children, disabled, elderly or others at risk Detroiters living in houses without water, though we know almost 15,000 homes were not restored to service by December 31, 2014. It is **unconscionable** that no analytical tool, study or review has been created by state or local government prior to the shutoffs, or at any time to capture the data on the social demographic of the inhabitants in the shutoff homes. We know that after 2007 no comprehensive collection effort was made by DWSD through a shutoffs policy; instead DWSD relied on placing the water bill on the Wayne County tax roll of the property. Wayne County would pay the DWSD bill until a sale through foreclosure allowed Wayne County to receive its payment back. This resulted in many citizens, at the time of water shutoffs, having residential bills in the thousands of dollars.

What we know, from the groundwork of community organizing performed by non-profit social justice organizations in Detroit: Michigan Welfare Rights Organization, Peoples Water Board Coalition, We the People of Detroit, National Action Network, Moratorium Now, and thousands of dedicated volunteers, is that human pain and suffering has occurred and continues to occur in Detroit. DWSD service increases and "payment plans", which are <u>not</u> based on affordability, are not sustainable and the track record in 2014 and 2015 is failure. If the

"assistance programs" were successful, another thirty thousand homes would not be at risk for shutoffs. Not having water service immediately makes a home uninhabitable under Detroit ordinances. Children under State law can be immediately taken from their parents or family and placed under protective services. Fear, humiliation and embarrassment are not uncommon where water has been shut off for non-payment. Public and private sanitation risks are magnified where no water sanitation is available in the home.

Reliance on the water bill going to Wayne County's Tax Collection Department, gave many Detroiters a way to buy food, medicine, pay rent or other expenses, while paying only part of their DWSD bill. In the case of landlords, money was collected in rent; but the water bill was not paid. DWSD's bills grew to thousands of dollars, particularly for low income Detroiters living below the federal poverty level.

The water shutoffs of 2014 were very harsh indeed. In mid-2013 a contractor, Homrich Wrecking, was hired to perform the shutoffs at a cost of five million six hundred thousand ($5,600,000.00) dollars. In April 2014, the DWSD shutoff policy required shutoff if the bill was 2 months late or over $150.00. A majority of Detroiters were at risk for water shutoff.

Recently, in May of 2015, in the face of the Detroit City Council voting to place a moratorium on water shutoffs, until a plan of action could be devised to address families with affordability issues prior to the shutoffs occurring, the DWSD's Board of Water Commissioners voted to extend the Homrich contract by another $1,000,000.00 or to 6.4 million dollars.

The early 2014 Detroit water and sewerage shutoffs occurred and will continue this year where a constellation of other economic and social hardships affect Detroiters:

Poverty – 39.3% of households lived below the federal poverty level. Considering employed Detroiters, the United Way's September 2014 study shows a review of working Detroiters, using 2012 data of "Asset Limited, Income Constrained, Employed" (ALICE), to be 29% of Detroit households that struggle to afford basic household necessities. Over 60% of Detroiters were already in severe financial hardship when the water shutoffs escalated in April 2014:

Unemployment – rates of 12.2% twice as high as other Michigan cities.

Foreclosures – Detroiters were hit hard by predatory lending practices of banks. The banks' targeted homeowners, who had paid off or were close to paying off their homes. Many of these homes were owned by senior citizens, many retired. This year 62,000 homes in Detroit were foreclosed in Detroit alone, up from 52,000 in 2014, and 42,000 in 2013 and 2012.

Bankruptcy – filed in July 2013, by Governor Snyder's Emergency Manager, immediately changed medical co-pay coverage for thousands of Detroit employees and retirees; in some instances several hundred dollars per month.

Bond Payout - Detroit Water and Sewerage Department paid over 500 million dollars for bond swaps to Wall Street when Detroit's bankruptcy triggered early interest payments.

Medical Conditions – Detroit has highest rate of childhood asthma in Michigan; three (3) times the state average.

Racial Disparity –Detroiters, 85% African Americans, are predominantly long term core city dwellers. The lack of city services affected African American population in a disproportionate way, compared to downtown and midtown Detroiters.

Cost of a Basic Necessity - Water – Going up, up, up each year. A DWSD chart shows the water/sewerage combined rate increase each year since 2001[1]. In June 2014, the water and sewerage rates were increased 8.7%. DWSD's proposed combined rate increase (12.8% waste water, 3.4% more in water and 16.7% increase in sewer rates) is scheduled for implementation in July 1, 2015.

Crumbling Water/Sewerage Infrastructure – Placed the costs of repairs and replacement almost 83% squarely on the bills of Detroit residents. Waste water ran unabated in thousands of empty, blighted properties. A estimate of waste water given by Assistant DWSD Director Daryle Latimer, is that 28% to 42% of all water running in Detroit is "waste water" or "non-revenue water" because of the decrepit DWSD infrastructure.

Dishonest Landlords – Renters paid rent, while property owners did not pay water bills.

In mid-2013 the city's contractor began to aggressively shut off water service to homes. By April 2014 the DWSD contractor continued sweeping through Detroit streets in a military fashion. Without following the due process requirements included in its Interim Collection Rules and Procedures of 2003, specifically rules on notice and medical waivers, the contract trucks started at one end of the blocks and shut off water to half or three-fourths of Detroiters on the same blocks. The contractor left a blue stigmatizing mark, spray painted on the water cap and many sidewalks. Thousands of Detroiters' water services were terminated each month after mid-2013.

As the crisis phone calls began to pour into various non-profit organizations, Michigan Welfare Rights Organization, the Peoples Water Board, We The People, Moratorium Now, and other, Detroiters began to take action. First they reached out to help. An international expert, Maude Barlow, from Council of the Canadians; and Charity Hicks (deceased), a "water warrior" from the Detroit People's Water Board; Food and Water, Watch and members of Circle of Blue, moved by the humanitarian crisis, filed a complaint with the United Nations.[2]

Testimony From Detroit

[1] After the 2004 increase the Colton Detroit Water Affordability Plan was created with the Ann Arbor Poverty Law Center, Michigan Welfare Rights Organization and Michigan Legal Services.

[2] Later in October 2014, two United Nations Special Rapporteurs, Lelani Farha and Catarina de Albuquerque made a three day fact finding visit. The United Nations report by the Special Rapporteurs state the Detroit water shutoffs violate the human rights of Detroiters and creates a public health crisis.

A civil and human rights lawsuit was filed on July 21, 2014. The *Lyda et al v City of Detroit* lawsuit was brought by ten Detroit families experiencing water shutoffs; with Constitutional Due Process and Equal Protection Counts[3], Health and Safety Counts and a Count on Public Trust and Human Right To Water.

Organizations with thousands of Detroit citizens affected by the shutoffs, Michigan Welfare Rights Organization, Peoples Water Board, Moratorium Now and Michigan Chapter of the National Action Network, became organizational Plaintiffs.

The pro bono committee of human rights lawyers from across the country heard of very tragic facts[4]:

- A mother of three, Nicole Hill, one of the Plaintiffs in the *Lyda* case, with an Eight Thousand ($8,000) Dollar water bill, sent her children to stay with relatives after the water was shutoff to her residential home. Mom stayed in the house. The little girl, age 7, got up in the middle of the night and decided she wanted her mother. Determined, she left her Aunt's home and walked out into Detroit streets at 2:00 a.m. An angel, a Good Samaritan saw the little girl and called the police. After talking to the child at 3:00 a.m., the police delivered the child to her mother. Crying, the child stated, "Mommy don't make me leave you again!" Ms. Hill was hospitalized with a severe viral infection for over a week after her water was cut off for a second time, again without notice. Ms. Hill's water bill is inconsistent with bills ranging from $27.00 to $689.00 in the last eight month period. Ms. Hill has received water bills during the timeframe when her water service was terminated.

The inhumane facts exposed in the *Lyda et al v City of Detroit* complaint and Plaintiffs' Motion for Injunctive Relief held in September 2014 are tragic:

- Denise Donaldson submitted a Declaration in support of an injunction of water shutoffs. Ms. Donaldson's mother was bedridden and required tube feeding. No provision for medical waiver was stated to Ms. Donaldson when she contacted DWSD about her water shutoff.

- Tracy Peasant, a putative Plaintiff in the *Lyda* case, and a DWSD customer, testified on September 22, 2014. Ms. Peasant's DWSD bill resulting from two (2) homes she rented, one with serious plumbing problems which the landlord would not repair, is over Eight Thousand ($8,000.00) Dollars at the time of shut-off in 2013. Ms. Peasant testified that she and her daughter and grandchildren lived in a home with eight (8) children, ages ranging from 15 to 1. Two of the children have asthma. Ms. Peasant is disabled due to injuries to her back and leg.

---

[3] Commercial customers, some with several hundred thousand dollars in overdue ills, were not subject to the same abrupt DWSD shutoff policies.

[4] A committee of civil rights and human rights attorneys from around the country, the NAACP-Legal Defense Fund, National Lawyers Guild, American Civil Liberties Union, Sugar Law Center, civil and human rights law firms and organizations.

From September 2013 to June of 2014, Ms. Peasant and her family, with an income of less than $700.00 per month, lived in a home without water, attempting to make do with big bottles of purchased water. Only in June 2014, after a "guardian angel" from the DWSD checked to make sure the water remained off, was Ms. Peasant's water restored. The DWSD employee stated after seeing so many children outside, "This is wrong!"

Though Ms. Peasant reached out to non-profit sources for help based on information she received from DWSD, no organization would assist her because her DWSD bill was over $2,500.

Ms. Peasant's water and sewerage was again shutoff in **April 2015**. DWSD requires that she pay $800.00 on her bill, money she does not have. No one from DWSD surveyed her prior to shutting off the water to determine her ability to pay or whether or not children or disabled adults lived in the residence. Despite attempts to obtain assistance, she is not eligible for assistance because her bill, due to plumbing not repaired by her landlord, is now $8,000.00.

Ms. Peasant testified she was not looking for free water, but an affordability plan similar to her utilities payment plan for electricity and gas, which she pays every month, based on her limited income.

- Maurikia Lyda, the lead Plaintiff in the water shutoff lawsuit, testified that she is a customer of DWSD. Ms. Lyda describes her income as low income. Ms. Lyda lives with her four children ages 14, 13, 10 and 5. The children attend public school. Ms. Lyda is a renter.

In June of 2014 Ms. Lyda's water service was cut off. The bill was $1,000.00. Ms. Lyda testified the day her water was shut off no one knocked on her door and advised her that the service was being disconnected. She noted that several other homes in her low income" neighborhood were also shut off.

Ms. Lyda describes how she called DWSD several times, staying on the line two (2) or three (3) hours without assistance, after she received notice that her water was being shut off. After Ms. Lyda went to a DWSD location she was told she had to pay $500.00 on the $1,000 bill and to have the bill removed from her landlord's account and put in her name. Plaintiff's water was shut off approximately one month prior to the morning that Plaintiff filed this lawsuit.

After the water was shutoff Ms. Lyda's <u>children were sent to live with other relatives</u>. Ms. Lyda was fearful that State of Michigan "protective services" would remove her children from the home if it was discovered there was no water in the home. Ms. Lyda describes a blue paint used to mark her home on the day the water services were terminated, which did not come off "that quick".

Though Ms. Lyda's water service was restored on June 21, 2014, without a payment, due to her litigation, she continued to seek help. After several months she received assistance from "Metro". Her bill for September 2014 was $424.00. At the September hearing Ms. Lyda's water was again subject to shut off after September 9, 2014. Ms. Lyda only learned of the shut off after calling DWSD, as she had not received a bill mailed to her home.

- Carol Ann Bogden testified on September 22, 2014 that she is a senior citizen, age 67, living alone on Social Security Disability. At the time of the hearing on September 22, 2014, her water service remained disconnected, from its shutoff date of July 11, 2014.

Ms. Bogden got behind in her own bills attempting to help a disabled adult son with major medical conditions. Ms. Bogden testified she would heat water from bottles on the stove to attempt to bathe herself and to live without running water.

The day of the shutoff Ms. Bogden reports a blue line was painted in front of her home. "I was really embarrassed. I started to cry. I thought that was done and over with back in the Second World War".

Ms. Bogden, though she had 10% to pay on her $1,006.00 bill, was not allowed to enter a payment plan because she did not have a current identification. Her purse had recently been stolen. DWSD refused to accept other forms of identification and at the time of the hearing in September 2014 would not allow her to enter a payment plan in person or by phone.

To get help on her $1,000.00 plus bill Ms. Bogden contacted THAW, United Way, Salvation Army, and Department of Human Services, none of the organizations had funds to assist her. Ms. Bogden indicated even if she was allowed to pay $90.00 a month on her overdue bill "it's going to be very hard", because it has nothing to do with her current bills.

- John Smith, a named Plaintiff in the Lyda litigation, testified in the September 22, 2014 hearing. Mr. Smith lives with his mother, a senior who suffers from lupus and heart problems. Mr. Smith is purchasing his home on a land contract. On or about late January 2014, DWSD shut off Mr. Smith's water services for a $1,099.99 bill. At the time of the water termination no one from DWSD advised Mr. Smith that his water would be cutoff that day, or asked if there was a disabled person in his home. Prior to the shutoff Mr. Smith was having trouble paying his water bill due to a layoff from his employment. Mr. Smith contacted organizations for help, but was denied assistance. During the five (5) months, Mr. Smith and his mother were without water service and he would buy bottled water or take a pail and borrow water from his neighbors.

Like Ms. Lyda, Mr. Smith's water was restored after he filed the litigation. Mr. Smith testified he is now back to work, but is still unable to pay the $1,000.00 bill. His new job pays income of only about $900 per month. Because Mr. Smith is so behind in his bills, he cannot pay the full amount of his water bill.

Mr. Smith testified he is not looking to get free water, but believes his payment plan should be a reasonable percentage of his income. Mr. Smith testified on September 22, that DWSD was going to have his water shut off again on September 23, 2014, according to a bill he saw in Court. He had not seen the bill before. Mr. Smith stated he would not be able to pay his bill and was at risk of having his and his mother's water terminated again.

- Nicole Cannon (deceased), a putative Plaintiff, testified on September 22, 2014 in the TRO hearing. Ms. Cannon testified that she was renting her home through Section 8 low income housing, but because she was paying part of her own rent, she did not receive any assistance with her utilities. Ms. Cannon testified that she receives Social Security Disability in the amount of $648.00 per month.

In 2014, Ms. Cannon's water bill was over $3,000.00, which she states resulted from a leak in the home. Though Ms. Cannon attempted on several occasions to have her landlord fix the leak, it was not done. Under Section 8 HUD rules, Ms. Cannon testified that even though she was renting, she was required to have the water bill in her own name.

Facing shut off of her water service in early 2014, Ms. Cannon paid $382.00 on the $3,000.00 bill in order to keep her water service from shut off. She paid this amount out of her $648.00 Social Security check. At the hearing, Ms. Cannon testified that she must now pay approximately $241.00 per month on her present and past water bill for a period of 24 months, to keep her water service from shut off. Ms. Cannon testified she would not be able to pay the $241.00 per month on her present and past water bill for a period of 24 months, to keep her water service from shut off. The current arrangement is not sustainable and she would likely face shut off of her water again, even though she was aggressively looking for help.

Ms. Cannon described her medical disability as sarcoidosis. She explained that she would not move out of her present home, with the $3,000.00 bill, because the present "bill is too high for me to move and relocate and I would have to take the bill with me".

Tragically, in January of this year Ms. Cannon, at age 44, died, leaving three children. The last few months of her life, Ms. Cannon struggled each month to "make ends meet".

- Chara Reynolds a putative Plaintiff, in this matter is a DWSD customer. Ms. Reynolds earns approximately $600.00 per month. Ms. Reynolds at the injunction hearing learned for the first time that DWSD had placed her in a payment plan presumably in anticipation of her testimony at trial.

Under the "payment plan" Ms. Reynolds would be required to pay both current bills and a part of the arrearages, approximately $170.00 per month. Ms. Reynolds testified that she would have a problem keeping up with a DWSD payment plan which was such a large percentage of her pay. Specifically, where here rent is $210.00 per month and her other utilities $300.00 per month.

Ms. Reynolds testified because of her mortgage terms, overdue water bills, if not paid, jeopardized her ability to keep her home, placing her in a position of default which can lead to tax foreclosure if she is unable to make the payments.

Plaintiff's Expert Testimony on the Water Shutoff Public Health Crisis

On September 22, 2014, Roger Colton, the author of the Detroit Water Affordability Plan, testified in the *Lyda* hearing for injunctive relief, that adoption of his DWAP plan would actually increase the amount of DWSD revenues. Roger Colton will testify at this hearing.

Plaintiffs, on September 22, 2014, presented testimony from George Gaines, MSW, MPH, the former Deputy Director of the City of Detroit Health Department. Mr. Gaines opined that the massive shutoffs, 24,000 in 2013 and 23,000 by September 2014, created a public health emergency:

> That means that you also don't have any water to wash your hands, and so you begin to think immediately about what diseases that would result from insanitary ways of defecating and I have a list of hepatitis, which is focally orally related. Salmonella which is focally orally related from people who defecate and do not sanitize their hands and comes in contact with water or food. Carditis**. . .** all of these diseases are communicable.

- John Armelago, R.N., at University of Michigan Health Center, testified on September 22, 2014, for Plaintiffs in the Motion for Injunctive Relief. In describing the medical impact of lack of water on human health, R.N. Armelago testified, "water service has a number of functions. One is hydration, one is hygiene, and one is sanitation." R.N. Armelago further testified that dehydration, body temperature regulation, joint mobility and central nervous system are all affected by lack of water. Most vulnerable are "the very young and the elderly, especially if the elderly are infirmed."

Regarding hygiene, R.N. Armelago testified that "hand washing is one of the first lines of defense in regards to diminishing the possibility of communicable disease.

- Maureen Taylor, MSW, President of Michigan Welfare Rights Organization (MWRO), testified on September 22, 2014, regarding the work of MWRO and its water shutoff water hotline, which received forty or more calls of water shut off per hour after the aggressive campaign began in April 2014. Ms. Taylor, a school social worker, testified about children attending school without water in their homes.

Ms. Taylor described one case of a DWSD customer who lost her job, had her water shut off; and then her children were taken and placed in foster care by social services. Ms. Taylor, describing her job as a school social worker, testified that she has moved families into homeless shelters or church basements to obtain temporary shelter until water is restored. Parents with children, whose water services were terminated, fear Child Protective Services. If Child Protective Services is notified, it can result in a child or children being removed from their home.

Ms. Taylor described the August 2014, Mayor's 10 Point Plan, created after this lawsuit was filed, as "woefully inadequate", based on the population being a fixed low income. "Folks that didn't have enough money in the beginning can't pay regular bills plus an addition".

In Detroit, in addition to large street protests attended by Detroiters, Michiganders and International Supporters against water shutoffs, Detroiters led by ministers, affected citizens, and human rights activists have been arrested for civil disobedience by blocking the contract trucks from leaving their central yard. The trial for these brave activist is expected in August of 2015.

The *Lyda* case is now on appeal. We have been supported by an Amicus Curie Brief filed by international attorneys from ESCR-NET – International Network for Economic Social & Cultural Rights.

Solutions

- State of Michigan Legislation addressing water affordability, accessibility and safety. The legislation should create a database reporting mechanism for the location and number of homes shutoff from water and sanitation with human inhabitants with protection for children, elders and the disabled. Affordability would be based on income; each residential customer's or family's ability to pay.

- Federal Legislation establishing a policy on water and sewerage affordability, based on each residential customer's ability to pay, requiring each state in the U.S. to have statutes on affordability, accessibility and safety.

- A federal dedicated source of funding to the Drinking Water State Revolving Fund and a renewal of the Build America Bonds Program to address aging water and sewerage infrastructure, which is but one of the reasons for rising costs, passed on to residential customers.

- In Detroit, Michigan, implement by ordinance the original Detroit Water Affordability Plan (2005) created by expert Roger Colton.

- In Detroit, Michigan, an immediate assessment of the number of Detroiters living in homes without water, including a survey of the number of children, disabled, elderly and other at-risk citizens, with a review of public health and safety issues. Restore all water service and then determine eligibility for assistance programs, in one stop, including federal and state assistance. Only if it is determined that the person has the ability to pay, but has not, will the water and sewerage services be terminated.

- In Detroit and Highland Park create a comprehensive DWSD Policy and Procedure for shutoff of residential and commercial accounts.

- Stop all water and sewerage shutoffs until DWSD has implemented policies and procedures addressing shutoffs by implementing the Colton, Detroit Water Affordability Plan.

- Declare an Amnesty on Detroit criminal prosecutions for “alleged water thief”; decriminalize the use of water as a “necessity”; instead evaluate Detroiters charged with water thief for financial assistance and affordability based on what Detroiters can afford to pay. Turn an alleged criminal into a contributor.

- Stop the stigmatization of families by spray painting the front of their homes with blue or yellow paint, when their water and sewerage is cutoff or threatened with shutoff.

WATER IS A HUMAN RIGHT!
Thank you.

Alice B. Jennings

Great La
Alliance des v

August 25, 2015

Mr. Jon Allan, Director
Office of the Great Lakes for Michigan
P.O. Box 30473-7973
Lansing, MI 48909

Dear Mr. Allan,

The Great Lakes and St. Lawrence Cities Initiative (Cities Initiative) commends the State of Michigan and its Department of Environmental Quality (DEQ) for the creation of the Michigan Water Strategy. Recognizing the importance of water for Michigan, all of the Great Lakes and St. Lawrence Basin states, provinces and local governments will only raise awareness and lead to positive change. The Cities Initiative also welcomes the opportunity to comment on the draft version of the Water Strategy.

1. Impacts of Climate Change
The Cities Initiative recommends that the Draft Water Strategy strengthen its position on the impacts of climate change by recognizing that all communities must be supported and equipped by the Water Strategy to adapt to and mitigate the effects of climate change. More frequent and more severe extreme weather events necessitate community-level strategic action plans that will ensure protection of local water resources and communities.

2. Leveraging Ongoing Efforts
The Draft Water Strategy touches on a myriad of elements related to water, showing how important and omnipresent water management is in our region, especially in a state bordered by 4 of the 5 Great Lakes. Many stakeholders mentioned as lead actors already have strategies, implementation plans and specific actions geared towards addressing issues mentioned in the Draft Water Strategy. In order to focus on implementation and respect the deadlines put forward in the Draft Water Strategy, it is important that it can be made flexible enough to leverage and incorporate the work already being done. It will also ensure that the Draft Water Strategy does not become a burden, but more of an umbrella planning document leading to positive action. The Cities Initiative particularly recognizes the Draft Water Strategy's focus on holistic public education; the strategy illustrates that water management involves environmental, economic, social, and cultural thinking, and the Cities Initiative encourages the continued use of this approach to water literacy in public education settings. This strategy can establish an informed citizen base, which may lead to increased support for future projects, good water management practices that start in the home, and sustainable and collaborative relationships among stakeholders.

3. Funding of Strategy Actions
The Draft Water Strategy identifies correctly the need for investment in multiple aspects of water management. In order to ensure the implementation of all the initiatives mentioned, it will be important that a funding mechanism be in place to make sure no specific government level is unfairly responsible for infrastructure funding. A commitment to fair funding would be a welcome addition to the Draft Water Strategy. This funding strategy, combined with an emphasis on public education, would allow communities to work with citizens who are informed about water use and water quality issues while ensuring that adequate funding is available for infrastructure improvements as well as for continued public education efforts.

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

Great La
Alliance des v

Finally, the Cities Initiative would like to acknowledge the inclusion of several key items: first, a commitment to a 40% reduction of phosphorus in Lake Erie by 2025; second, a commitment to ban microbeads at the state level; and third, the overall support and inclusion of Low Impact Development and Green Infrastructure projects. These three items support ongoing work throughout the Great Lakes Basin and ensure a sustainable future for many citizens of the region. We are glad that the State of Michigan is stepping forward as a committed leader in these areas, and we hope that it will consider adding to the Strategy based on our recommendations above.

With questions or requests for further information, please contact Simon Belisle, Program Manager, at 312-201-4517 or simon.belisle@glslcities.org.

Thank you for your consideration,

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

From: Jean Seim
To: mi-waterstrategy
Subject: MI Water Strategy
Date: Sunday, August 23, 2015 2:52:26 PM

Governor and Water Strategy Council:

We need a Michigan Government continual independent audit on the Enbridge oil pipes under the Straits of Mackinac. These pipes are too old to ignore. If problems are found, Michigan must take action to fix the problems. We cannot lose our water.

If this audit must be placed on the ballot, I volunteer to take signatures; please contact me to do it.

Sincerely,
Jean Seim

Sent from Yahoo Mail for iPad

From: JEAN SEIM
To: mi-waterstrategy
Subject: MI Water Strategy
Date: Sunday, August 23, 2015 3:03:59 PM

Governor and Council:

Michigan needs to immediately start an ongoing independent audit of the Enbridge oil pipes under the Mackinac Straits. These pipes are ancient. We cannot lose our water.

If Michigan needs to put this audit on the ballot, I volunteer to take signatures; please email me with info on how to start doing it.

Sincerely,

Jean Seim
jeanmaryseim@gmail.com

6TH DISTRICT
STATE CAPITOL
P.O. BOX 30014
LANSING, MI 48909-7514
PHONE: (517) 373-0823
FAX: (517) 373-5993
E-MAIL: stephaniechang@house.mi.gov

MICHIGAN HOUSE OF REPRESENTATIVES

STEPHANIE CHANG

STATE REPRESENTATIVE

Public Comment Regarding Michigan's Draft Water Strategy
August 25, 2015

Thank you for the opportunity to submit public comment on Michigan's draft Water Strategy. I am particularly glad that goal number two, "Michigan's water resources are clean and safe", is included in the strategy and that there is a focus on protecting drinking water supplies, and that goal number six, "Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems", includes a mention of Detroit's recent water shutoffs and the need for evaluation of current local practices regarding the provision of water.

On June 3, 2015, Representatives Sheldon Neeley, LaTanya Garrett, and I held a public hearing at the State Capitol about Water Safety and Affordability. Residents and community leaders from Detroit, Highland Park, Flint, and other areas joined us to share their stories about water shutoffs, the contamination of the water supply in Flint, and the ongoing crisis in Highland Park.

It is imperative that our state should do more to ensure that the water each of our residents drink is safe, and when there is information available indicating that water is unsanitary, residents need to be notified in a timely manner. The draft water strategy notes that "public water supplies are subject to oversight and frequent inspections to ensure sanitary conditions" yet the situation in Flint in the past year makes it clear that this system has not worked in the way that it should to protect residents.

I am glad that goal number six includes recommendations regarding strategies to support infrastructure improvements and evaluation of "current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation." This should be a high priority for the state of Michigan – but we must go further than evaluating current practices and institute a policy at the state level that every resident has the human right to safe, affordable and accessible water. Our state should also institute policies that protect our most vulnerable populations – including seniors, those with chronic medical conditions requiring access to water, pregnant women, and families with children – from shut offs. Our state should also require water systems to provide data regarding their water rates and any shutoffs that have taken place. Lastly and perhaps most importantly, our state should develop an affordability plan that ensures that residents pay water bills that are based on their household income and ability to pay.

I am working with several other lawmakers in a bipartisan and geographically diverse workgroup to develop a package of legislation to address some of these critical issues related to water affordability and safety. We hope to have legislation introduced by the end of this calendar year. I look forward to reading the final version of Michigan's Water Strategy and working with various parties to address Michigan's water crisis.

August 27, 2015

James Ostrowski
Michigan Department of Environmental Quality
Office of Environmental Assistance

Re: Draft Michigan Water Strategy

Dear Mr. Ostrowski,

I am providing comments from the Kalamazoo Valley Chapter Trout Unlimited on the draft Michigan Water Strategy. Upon review of the current draft our committee would like to thank everyone that has participated in the writing of this document, overall it is very well presented.

We are located in the southwest corner of the Lower Peninsula and have several unique geological attributes. We have numerous coldwater springs and the soil make up in our area provides great opportunity for quality cold water streams. We also have numerous farming and recreational activities within a fairly dense semi-urban population.

With this unique circumstance we have several suggestions on the draft Water Strategy. While several of these items are addressed in the draft we feel that it is important that we highlight the items that are concerns for our region. We understand that some of these details will need to be addressed in the implementation phase of the Strategy. We have addressed them under the outline format that you have provided:

General Comments

- A list of definitions should be included in the document. There are several conflicting uses of terms and it would be beneficial to those reading and implementing this document to understand what the intent of the terms you're using. As a simple example what is the proper definition of navigable waters among other definitions,
- Most of the regulation and monitoring that is being suggested will need funding. There may need to be some sort of water use fee which would be shared by all users including residents, industries and tourist. We understand that this not a simple decision on how to make this fair to all users but fisherman have been paying license fees and a portion of all their equipment prices for funding while other users have no fee assessed to them.

- Focus should be as watersheds and not segments of streams, individual lakes, etc, and not limited on county lines.

Protect and Restore Aquatic Ecosystems

- All water, including ground water, should be under public domain.
- The measurement of success listed should include all trout species, including Browns and Rainbows.
- Surface and ground waters must be protected from excessive withdraws for irrigation or industrial water usage especially during drought periods. More farm fields are being irrigated than ever before in our region and minimal flows must be maintained to assure protection to Ecosystems.
- Drain tiles from farms, golf courses, etc. should be documented and regulated to prevent extra nutrient loading of streams and surface waters.
- Protocols should be developed for buffer strips and storm water retention. Width and design of the buffers should be determined by the slope of the land adjacent to the waterway and adjacent land use,
- Overhead canopies should be maintained on cold water streams.

Ensure Safe and Clean Water

- Road Crossings should be designed to prevent sedimentation and nutrient loading to the flowing waterways or watersheds.

Support Water-Based Recreation

- Removal of unused or unneeded dams should be completed to create better water trail ways. Special consideration must be given to prevent AIS invasion of our waterways in determining which dams are removed.

Promote Water-Based Economies

- Monitoring must be done to ensure watersheds are not damaged due to over withdraw due to irrigation, bottling, manufacturing, etc.
- Ground water, wetland and surface water levels should be monitored to assure protection of Ecosystems due to withdraw, especially during low water cycles.

Monitoring Water Quality

- Nutrient loading due to livestock or “fish farms” should be regulated and monitored.
- Golf courses are a major use of ground and surface water for irrigation and should be monitored to assure proper use of the water and prevent excess nutrient loading.

Build Governance Tools

- Drain commissioners should have a minimum level of qualifications and not be an elected position.

- Better monitoring and reporting of County Drain and Inter-county Drain Commissions must be established to assure use of BMP and prevent erosion and poor stewardship of our waters.
- Drains should be reviewed every ten years to assure that they are still needed and performing as they were intended.
- All drain activities should be permitted and have monitoring by an independent agency (DEQ) during construction and final sign off once the project is complete and all final vegetation, etc. is established.

Thank you for your consideration of our comments. Please contact us if you have any questions.

Respectfully submitted,

Edward J. Hoover
President, KVCTU
[redacted]

BERRIEN COUNTY ADMINISTRATION CENTER
701 MAIN STREET
ST. JOSEPH, MI 49085
TELEPHONE: 269-983-7111 ext 8350
E-MAIL: JGRUCHOT@BERRIENCOUNTY.ORG

ST. JOSEPH RIVER HARBOR AUTHORITY

August 28, 2015

Jon Allan
Director Office of the Great Lakes
MI Department of Environmental Quality
P.O. Box 30473
Lansing, MI 48909

Re: Michigan's Water Strategy

Dear Mr. Allan:

The St. Joseph Harbor Authority would like to voice its support for recommendations within the draft of the State's Water Strategy (*Sustaining Michigan's Water Heritage, A Strategy for the Next Generation*). The harbor formed by the St. Joseph River where it empties into Lake Michigan is both a deep water commercial port and recreational harbor. While portions of the commercial port have been fortunate to receive periodic federal maintenance funding, it hasn't come without challenges because it's classification by the Corps of Engineers as a low use harbor (less than 1 million tons of cargo throughput annually). Funding for the purely recreational portions have been historically sporadic and local, with the exception of the much appreciated MDNR Waterways grant in 2013. Reviewing the *Water Strategy* with this knowledge, it appears that most of the goals and recommendations appear beneficial.

The Authority, therefore, generally supports the *Water Strategy* as drafted, and, from a harbor's perspective, finds some most pertinent. These include the recommendations that directly reference supporting investments in commercial and recreational harbors and ports, as in Goals # 3 and 4. Additionally, the recommendations for enlisting DEQ actions to identify and reduce upstream sources of sedimentations and stormwater' s role in that, establishing a Water Fund, and increasing water literacy (i.e. citizen understanding of and support for a water strategy), as expressed in Goals # 1, 6, and 9, are seen by the Authority as essential to overall success.

Please let our staff know if you need any further information in considering these comments (John Gruchot, 269-983-7111, ext.8350 or jgruchot@berriencounty.org)

Sincerely,

Virginia Sansone

Virginia Sansone,
Chairperson

cc: Berrien County Administrator - William Wolf

August 24, 2015

Department of Environmental Quality
Office of the Great Lakes
P.O. Box 30473
Lansing, Michigan 48909

Dear Mr. Alan and Ms. Tommasulo,

We support efforts within the Water Strategy Initiative to protect and restore Michigan's aquatic ecosystems and waters, increase stewardship of Michigan's waters, and utilize our waters in a responsible and protective manner. However, to result in real, on-the-ground-impacts, we believe the following additions should be included.

Expand and Strengthen Governance Tools in Goal 8

While we respect the intent of protection and restoration recommendations in this initiative, we are skeptical such an effort will result in real, on the ground, protective and restorative impacts to our aquatic ecosystems and waters without inclusion of the development of legally binding and scientifically based mechanisms to ensure these recommendations are implemented. While voluntary measures can help support the accomplishment of these recommendations and benchmarks, historically they have proven themselves to not be effective as a standalone option. For example, voluntary measures have been the tools of choice for decades in an effort to reduce phosphorus pollution that feeds harmful algal blooms. These tools have not been effective to accomplish this goal and significant phosphorous pollution continues to feed harmful algal blooms. We believe history has demonstrated that without mandatory measures in place, the recommendation of a 40% phosphorus reduction goal will not be met.

As the only state in the nation without a statewide septic code, we were thrilled to see the Water Strategy recommends enacting one. However, Michigan's governors and state agencies have recommended for well over a decade that such a policy is desperately needed. This finding was supported by the Granholm administration's visioning and public engagement initiative similar to this, which resulted in "MI Great Lakes Plan: Our Path to Protect, Restore, and Sustain Michigan's National Treasures." Often as Governors, legislators, and leadership in state agencies change, initiatives from previous administrations are not carried forward unless there is a legally binding obligation to do so. We

seriously question how making recommendations under this initiative is different enough that it will result in real, on the ground impacts when it comes time for agencies, businesses, and citizens to take actions now and with future administrations. Again, we recommend expanding Goal 8 to include the development of legally binding and scientifically based mechanisms that will ensure key recommendations are implemented and benchmarks are met.

Apply Protection and Restoration Recommendations to all of Michigan's Waters

It is noteworthy that the key recommendations and measures of success are largely based on economic opportunities. However, waters within a watershed are all connected and therefore linked to a healthy ecosystem. As such, restoration and protection of Michigan's ecosystems and waters should extend to all the waters of the state throughout the Water Strategy. For example, under Goal 2 only source water and drinking water are recommended for protection from contamination and spills. However, contamination or spills to surface waters are equally catastrophic to ecosystem health.

Build Momentum by Collaborating with the Great Lakes Restoration Initiative

Recommendations under the Vision's goals to ensure aquatic ecosystems are healthy and functional and that Michigan's water resources are clean and safe support efforts underway that are part of the federal Great Lakes Restoration Initiative. Rather than working on separate, independent projects, collaborating on projects and adding additional investment into GLRI dollars and projects already happening or slated for Michigan could enhance on-the-ground restoration impacts. As this initiative moves forward, we recommend you seek opportunities to collaborate with the Great Lakes Restoration Initiative.

Thank you for your consideration of these comments. Should you have any questions, feel free to contact Cheryl Kallio with Freshwater Future at 231-571-5001 or Cheryl@freshwaterfuture.org.

Sincerely yours,

Cheryl Kallio, Associate Director
Freshwater Future

VIA EMAIL to: Mi-waterstrategy@michigan.gov

August 28, 2015

Office of the Great Lakes - DEQ
P.O. Box 30473-7973,
Lansing, Michigan 48909

RE: Comments on Michigan's Draft Water Strategy

Dear Director Allan:

These are comments of the Alliance for the Great Lakes (Alliance) and National Wildlife Federation (NWF). 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. The Alliance is a regional organization that has offices in Grand Haven and Detroit, Michigan. NWF is a national organization with its Great Lakes Regional Center located in Ann Arbor, Michigan. NWF's mission is to inspire Americans to protect wildlife for our children's future.

We are pleased that Michigan is focusing on cultural and social relevance of the Great Lakes as a necessary component for long-term ecological health. The draft Michigan Water Strategy is a great step forward which could be strengthened with additional clarity on exactly what agency will implement its recommendations and how progress will be measured and tracked. We hope that these suggestions will help to strengthen the Strategy. Marc Smith, policy director with NWF, serves on the Water Cabinet that helped develop this strategy. Khalil Ligon, Alliance's Southeast Michigan Outreach Coordinator, played an important role in gathering public input from Detroiters. We appreciate the time and commitment by the Office of the Great Lakes in working with a vast and diverse set of stakeholders to shape a common vision for Michigan's water resources. We look forward to working with the state on implementing this strategy.

We believe that the draft strategy should be significantly strengthened with additional clarity on several areas as described below. One general observation is that the importance of maintaining existing

programs in addressing ongoing water concerns should be highlighted. For example, key programs such as the Clean Water State Revolving Fund and the Drinking Water Revolving Fund are briefly discussed in Appendix 3, but are largely not addressed in the main text of the Strategy, except in the context of the enterprise budget. These and similar programs (such as the federal Clean Water Act Section 319 program) should be specifically highlighted in relevant sections addressing water infrastructure or water quality impairments. Similarly, federal Farm Bill programs are only briefly discussed in the Strategy, yet new programs such as the Regional Conservation Partnership Program offer potential to lead to significant local and regional water quality improvements, and the Strategy should reference these programs.

Our more specific comments on the draft Strategy are organized based on the proposed goals, as follows:

Goal 1: Michigan's aquatic ecosystems are healthy and functional.

1. **Invasive species:** Michigan's leadership and efforts to reduce the threat from invasive species is commendable. We are pleased that the draft water strategy continues this high level of commitment. We also appreciate Governor Snyder's commitment to address the invasive species threat from the Chicago Area Waterways System and ask that Governor Snyder use his influence to urge Illinois to engage in finding a long-term solution to this problem. In addition, Michigan should engage with regional partners on all aspects of invasive species management, including early detection and rapid response, risk assessment (in identifying potential new invaders of concern), control and management programs, and public education and outreach.

2. **Algal blooms & phosphorus reduction:** We are very pleased by Michigan's commitment to reduce phosphorus entering the western Lake Erie basin by 40% by 2025. This paradigm-changing commitment is an extremely important first step that follows the scientific consensus that 40% reductions in phosphorus will significantly reduce the prevalence and impact of harmful algal blooms in the basin. Of course, commitments are only valuable to the point that they are implemented. To achieve the proposed 40% reduction of phosphorus entering Lake Erie, Michigan should complete a draft Implementation Plan quickly and provide for public comment with public hearings in key communities within the western Lake Erie basin. After considering public comment, the plan should be finalized and implemented. In order to effectively achieve the goal of reducing phosphorus entering western Lake Erie by 40% and improve Lake Erie's water quality, as well as demonstrate progress, we urge Michigan to:
    a. Set up a process to identify sources of phosphorus and nitrogen including locations, causes and amounts to the greatest extent possible using the best available science. In addition to the known point sources, this effort should differentiate between specific sources such as chemical fertilizers, livestock waste, biosolids, combined sewer overflows, and home septic systems.
    b. Note in the Strategy that the implementation plan will include reference to important existing programs (such as the ongoing Michigan Agriculture Environmental Assurance Program, Farm Bill programs, and urban infrastructure programs), and should identify

interim objectives and deadlines for reaching them. In addition, the Strategy should reference broader ongoing efforts, such as the Great Lakes Commission-led Lake Erie Nutrient Targets Workgroup, and development and implementation of efforts through the Great Lakes Water Quality Agreement Annex 4 process. Furthermore, the implementation plan should mention key watershed approaches to meeting water quality standards, including the total maximum daily load (TMDL) provision of the Clean Water Act, which is not referenced anywhere in the draft Strategy, but which can be a key tool in reducing nutrient loads to impaired waters.

c. Build on existing monitoring work to develop and implement a measurable, reportable and verifiable water quality monitoring system with continuous sampling stations in locations that will provide data for the whole western Lake Erie basin watershed that can be used to determine whether reduction in phosphorus are being achieved. The state should coordinate with federal agencies (e.g. U.S. Geological Survey, U.S. Environmental Protection Agency (USEPA), National Oceanic and Atmospheric Administration (NOAA)), appropriate state agencies (both in Michigan and other Lake Erie basin states), Canadian and Ontario agencies, local agencies, and others as appropriate in developing a comprehensive monitoring system, both in the watershed and in the Lake. This would include monitoring for nutrients, selected harmful algal bloom species and toxins, and temperature and other key ancillary parameters.
d. Report publicly on progress made under the implementation plan on a yearly basis.

3. **Green infrastructure:** There are opportunities to address polluted runoff from cities and encourage the inclusion of green infrastructure targets in measures of success. An example would be to increase mandatory minimums allotted for the green infrastructure in transportation projects. Transportation projects are often the biggest missed opportunities to install large scale, comprehensive green infrastructure. We suggest that Michigan incorporate water resource planning into placemaking efforts and develop a sustainability checklist to guide land-based planning and development. In addition, we recommend modernizing road and highway planning and infrastructure to effectively manage stormwater runoff and infiltration needs on site, thereby reducing the costs and impacts of flooding. In add, due to the significance of urban sources of pollution to surface waters, in particular in southeast Michigan, the state should expand partnerships with Detroit and nearby communities to further advance green infrastructure solutions to ongoing problems associated with combined sewer overflows and other wastewater issues.

Goal 2 – Michigan's water resources are clean and safe.

1. For the first key recommendation to protect from oil spills, Michigan should follow Alaska's and California's example and increase the state's financial responsibility requirements for vessels carrying oil across the Great Lakes. Increasing these requirements will help to ensure adequate funds for clean-up and remediation in the event of an oil spill. We welcome the

recommendations of the Petroleum Task Force to improve the safety of oil pipelines, as well as those to increase transparency and accountability. However, Michigan must act swiftly to implement the recommendations if they are to be meaningful and actually protect against oil spills. The oil transportation industry has set its sights on the Great Lakes to increase capacity to move heavy crude oil to Midwestern refineries. The state should also consider implementation of more specific recommendations made by NWF in our report *Sunken Hazard* (https://www.nwf.org/pdf/Great-Lakes/NWF_SunkenHazard.pdf), including development of a regulatory framework considering broader impacts of oil pipelines and spills, development of requirements for spill response plans and reporting, and restrictions on any new interstate pipelines and expansion plans.

2. For the third key recommendation to "Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites," we recommend that the recommendation encompass corporate responsibility. For example, Michigan might consider holding polluting industries accountable for historical and future contamination of Michigan water resources by imposing a surcharge at a level that incentivizes businesses to eliminate adverse practices and implement sustainable practices to protect the water resource.

3. The fourth key recommendation to "Establish priorities and address emerging pollutants of concern," should include enacting a statewide ban on the sale and production of plastic microbeads (as is already stated on p. 25 of the draft Strategy).

4. We request that you insert the word "human" to the first measure of success: "100 percent of the [human] population has safe drinking water with no reported violations of health-based standards." Inserting the word "human" reinforces the target for this measure of success and addresses equity issues around this goal.

5. We also request that you add the following text to the second measure of success: "No drinking water advisories, beach closures or aquatic life impairments due to harmful algal blooms [or any other existing or emerging pollutant of concern]." Furthermore, the state should move more aggressively in expanding water quality standards to include priority chemicals of emerging concern.

Goal 3: Michigan communities use water as a strategic asset for community and economic development.

1. We ask that the first key recommendation be revised to add the following text: "Leverage water resource assets at state, regional and local level to create sustainable economic opportunities [and ensure community benefit]."

2. To ensure the community benefits from its resources, the Strategy should include development of enhanced marketing plans for water-based recreation tourism (i.e. through Pure Michigan campaign), expansion of annual summits to include all public and elected officials, and development of a shared cost plan for infrastructure needs encouraging public-private partnerships.

3. This section should acknowledge and stress the importance of ensuring that waterfront areas are and will continue to be accessible to all to promote social equity.

4. The Strategy should include guidance that harbor planning should be included in land use planning efforts.

Goal 4 – Michigan's water resources support quality natural resources, recreation and cultural opportunities.

1. We urge that key recommendation 2 (p. 8) be revised to add the following text: "Prioritize investments in recreational harbors [and shoreline restoration] to address long-term infrastructure needs."

2. Key recommendation 3 should be expanded beyond the creation of water trails by adding the following text: "Develop and implement a water trails system [and market coastal recreational opportunities]." This will help foster a greater sense of connection to the community and water stewardship.

3. The measures of success should add the following "100% of the human population has convenient access to swimmable and fishable water."

4. To protect water resources, Michigan should stress public responsibility and encourage behavioral modifications and lifestyle changes (e.g. eliminated microbead use, littering, plastic water bottle use and participating in curbside recycling programs). This can be done through a statewide "Go Green" campaign/program that incentivizes such activities. . In addition, the state should provide resources to smaller and/or poorer communities unable to implement their own recycling and related programs.

5. This goal supports "quality natural resources" and hunting and fishing, but the recommendations and measures of success do not adequately protect wildlife and threatened habitat or support wetland restoration. Given the significant contribution wetlands have in Michigan towards protecting and restoring our Great Lakes, inland waterways and providing critical wildlife habitat for ducks, geese and numerous other migratory birds and wildlife, we recommend adding a key recommendation advocating a net gain in wetlands, especially in those regions faced with a significant wetland losses. The strategy should support retaining Michigan DEQ's assumption of Clean Water Act Section 404 jurisdiction (as is stated in Goal 8,

recommendation #4) and maintaining a strong state program on the conservation of Michigan wetlands, including with support through the Great Lakes Restoration Initiative, the North American Wetlands Conservation Act, and other programs designed to protect, restore, enhance and manage wetlands.

6. For recommendation #2 concerning mercury reduction activities (p. 64), the implementation metric should include a footnote providing more details. For example, it is not clear if the goal is that all fish vs. the median of samples vs. 90th percentile, etc. are to meet the target, Furthermore, the target concentration itself (0.35 ppm) is still above a concentration at which moderate- to high-consumption fish consumers would be ingesting mercury at levels sufficient to threaten health.

Goal 5 – Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.

1. The Key recommendations should include establishing an on-site stormwater management standard for all land use developments.

2. Key recommendation 1 using the business led council must ensure that the public's perspective is represented at the table so that the council is not purely profit driven, to the exclusion of environmental, social and cultural values. Including community and environmental groups on the council could help achieve this goal.

3. Key recommendation 2 should be revised to require mandatory water efficiency targets.

4. Key recommendation 3 should be revised with the addition of the following text: "Develop water conservation and reuse strategy for the state [local governments, and private and public facilities] that incorporates the use of green infrastructure, grey water systems and energy production and includes recognition programs.

Goal 6-- Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.

1. The state should explore water affordability plans to equally distribute the cost burden of water infrastructure, while not denying access to those who cannot afford it.

2. The state should provide training to educate the public in the conceptual statewide enterprise budget for stormwater, drinking water and wastewater.

Goal 7 - Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.

1. Michigan's monitoring systems should expand opportunities to engage citizen volunteers and participation, such as the Michigan Clean Water Corp (MiCorps) program, in gathering water quality and quantity data, in restoration, in providing access and in maintenance of important water-related resources. The strategy should clearly define how this information will be used and shared and what agencies/entities will warehouse this data. To the extent that the effort does not duplicate existing provision of data through the MiCorps program, this could be a state managed website or dedicated online portal linked to the Pure Michigan campaign.

Goal 8 - Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.

1. Governance structures and policies must be implemented to ensure the work of the Strategy transcends changes in administration.

2. The Measure of Success for this goal states: "By 2030, achieve a 40% reduction in number of designated uses or impaired waters." It is not clear why a reduction in designated uses would be considered a positive environmental outcome. Presumably this measure of success should be focused on reduction in the percentage of impaired waters (i.e., so that more waters are meeting water quality standards, including their designated uses).

Goal 9 – Michigan citizens are stewards of clean water and healthy aquatic ecosystems.

1. Key recommendation 1 should be revised with the addition of the following text: "Integrate water literacy [principles] into [place-based education and] State of Michigan curriculum standards [tied to Science, Technology, Engineering and Math (STEM) principles across all grade levels]

2. Measures of success 1 should include increasing the number of people engaged in water stewardship activities.

3. In support of this Goal, we offer several specific suggestions:
   - arts should also be included;
   - sessions should be offered to elected official and decision makers to orient them to the strategy and its goals;
   - An outline of the process of ongoing engagement that organizations can expect with the Office of Great Lakes through the finalization and implementation of this Strategy is needed;
   - opportunities for youth engagement beyond K-12 education should be strengthened in the Strategy;
   - implementation of stewardship activities should be coordinated with existing and potential grassroots efforts;
   - efforts must address social and cultural gaps in access and affinity for water since people are more likely to engage in stewardship that has a direct relational connection to water resources; and

- ensure sustainable funding sources for community-based stewardship efforts.

Thank you for the opportunity to provide these comments. We appreciate your consideration and look forward to working with you to implement Michigan's Water Strategy.

Sincerely,

Molly M. Flanagan, Vice President, Policy
Khalil Ligon, Southeast Michigan Outreach Coordinator
Alliance for the Great Lakes

Marc Smith, Policy Director
National Wildlife Federation

From:	JulieJim
To:	mi-waterstrategy
Cc:	Patty Troy; Lori Eschenburg; Kristen Lyons; Donna Strang
Subject:	Michigan Water Strategy draft -- suggested revisions
Date:	Tuesday, August 18, 2015 2:01:20 PM

My name is F. James Clatworthy and I serve on the St.Clair River Bi-National Public Advisory Committee.

I have two suggested revisions for the Michigan Water Strategy draft document:

1.) Goal 1, p. 11 "Prevent Introduction of and Manage Aquatic Invasive Species" second paragraph the devastating effects of sea lamprey communities ---- insert before sea lamprey **rainbow smelt and**

Rationale: The DNR needs to recognize they were responsible for the accidental release in 1912 and then intentional releases in 1919 and mid-1920's of our "voracious fish of prey" [Ryck Lydecker, Feb. 10, 1973, University of Wisconsin Sea Grant Project] Little Ozzie, or *Osmerus Mordax*. Smelt spawn in the spring and Lake Trout spawn in the fall so as the smelt population expanded the Lake Trout population started to decline even before the arrival of the sea lamprey in the 30's. And when the lamprey applications stared to reduce lamprey populations the Lake Trout population continued to decline. The most notable example for Lake Trout population increase was after the smelt die off of 1947-49. Improved populations of Whitefish and Walleye were also apparent after the die off.

A good source for the pro and con for the destructive nature of the Rainbow Smelt can be found in Clifford R. Gerhart's book, Pity The Poor Fish Then Man, 1987, ISBN 0-932212-52-2.

2.) Goal 8 p. 22 " Develop a Spill and Communication Strategy" Edit this line to read: Develop a Spill Prevention Strategy and in case of a Spill then a Communication Strategy.

Rationale: It is one thing to have a spill or leak strategy, but **why not have a prevention strategy?** The two 20 inch pipes across the Straights of Mackinac carrying twenty million gallons of light crude (do we know for sure) in pipes that are 63 years old is a disaster waiting to happen. *Must the State wait until the pipes leak before it has a strategy?* The State needs to be PRO ACTIVE when it comes to protecting the Great Lakes and the connecting channels. The St. Clair River has numerous pipes crossing the river that have the potential to leak.

The State needs to act with all do diligence to prevent leaks from oil and chemical pipes under the Straights of Mackinac and the St.Clair and Detroit Rivers. All pipes crossing any portion of the Great Lakes or connecting Channels must be required to have automatic closing valves in response to pressure drops. Whenever possible, pipes should be routed through abandoned tunnels[St. Clair River] and under bridges[Mackinac Bridge] and placed within a larger pipe like the Alaskan

Pipe Line in the Artic.

From: Patty Troy
To: mi-waterstrategy
Subject: Michigan Water Strategy draft -- suggested revisions
Date: Thursday, August 27, 2015 3:02:16 PM

On behalf of Mr. Clatworthy, I submit the following comments:

From: JulieJim [mailto:twojsj3@comcast.net]
Sent: Tuesday, August 18, 2015 2:01 PM
To: Karen Tommasulo
Cc: Patty Troy; Eschenburg, Lori; Kristen Lyons; Donna Strang
Subject: Michigan Water Strategy draft -- suggested revisions

My name is F. James Clatworthy and I serve on the St.Clair River Bi-National Public Advisory Committee.

I have two suggested revisions for the Michigan Water Strategy draft document:

1.) Goal 1, p. 11 "Prevent Introduction of and Manage Aquatic Invasive Species" second paragraph the devastating effects of sea lamprey communities ---- insert before sea lamprey **rainbow smelt and**

Rationale: The DNR needs to recognize they were responsible for the accidental release in 1912 and then intentional releases in 1919 and mid-1920's of our "voracious fish of prey" [Ryck Lydecker, Feb. 10, 1973, University of Wisconsin Sea Grant Project] Little Ozzie, or *Osmerus Mordax*. Smelt spawn in the spring and Lake Trout spawn in the fall so as the smelt population expanded the Lake Trout population started to decline even before the arrival of the sea lamprey in the 30's. And when the lamprey applications stared to reduce lamprey populations the Lake Trout population continued to decline. The most notable example for Lake Trout population increase was after the smelt die off of 1947-49. Improved populations of Whitefish and Walleye were also apparent after the die off.

A good source for the pro and con for the destructive nature of the Rainbow Smelt can be found in Clifford R. Gerhart's book, Pity The Poor Fish Then Man, 1987, ISBN 0-932212-52-2.

2.) Goal 8 p. 22 " Develop a Spill and Communication Strategy" Edit this line to read: Develop a Spill Prevention Strategy and in case of a Spill then a Communication Strategy.

Rationale: It is one thing to have a spill or leak strategy, but **why not have a prevention strategy?** The two 20 inch pipes across the Straights of Mackinac carrying twenty million gallons of light crude (do we know for sure) in pipes that are 63 years old is a disaster waiting to happen. *Must the State wait until the pipes leak before it has a strategy?* The State needs to be PRO ACTIVE when it comes to protecting the Great Lakes and the connecting channels. The St. Clair River has numerous pipes crossing the river that have the potential to leak.

The State needs to act <u>with all do diligence</u> to prevent leaks from oil and chemical pipes under the Straights of Mackinac and the St.Clair and Detroit Rivers. All pipes crossing any portion of the Great Lakes or connecting Channels must be required to have automatic closing valves in response to pressure drops. Whenever possible, pipes should be routed through abandoned tunnels[St. Clair River] and under bridges[Mackinac Bridge] and placed within a larger pipe like the Alaskan Pipe Line in the Artic.

Consumers Energy

A CMS Energy Company

Environmental & Laboratory Services

August 28, 2015

Michigan Office of the Great Lakes

Michigan Department of Environmental Quality

P.O. Box 30473-7923

Lansing, MI 48909

RE: Sustaining Michigan's Water Heritage: A Strategy for the Next Generation-Comments of Consumers Energy

Consumers Energy congratulates the Office of the Great Lakes and the Michigan Department of Environmental Quality, the Michigan Department of Natural Resources, the Michigan Department of Agriculture and Rural Development, and the Michigan Economic Development Corporation on the development of this complex, integrative strategy to protect and restore Michigan's water resources while, at the same time, assuring their wise and sustainable use in Michigan's economic, social, and cultural settings. While the Strategy is billed as a strategy for the next generation and has a vision that looks forward thirty years, it is also a strategy for today and a strategy that should be built on for generations to come. Water is more than a natural resource and much more than a commodity; it is one of the four "essences" that is literally essential to life as well as a pervasive force in our natural heritage, our culture, and our economy.

Strategic Actions

Consumers Energy is supportive of the nine strategic actions proposed in the Strategy. We suggest, however, that one of these strategic actions, "Monitor Water Quality", be expanded to "Inventory and Monitor Water Quantity and Quality". The explanatory text below the heading for this strategic action clearly shows that monitoring of water quantity was also intended. Additionally, while many of Michigan's waters are well-known and have been monitored for years, a very large portion of Michigan's water resources have not been inventoried with respect to quantity and/or quality. Before monitoring can begin on these waters, an inventory to establish baseline conditions is required. The need to inventory additional Michigan stream flows, lake volumes, and groundwater aquifers in glacial geology was clearly recognized in the Water Use Advisory Council's December 2014 recommendations: EM1.1 and EM 1.2, IL 1.1 and IL 1.2, and EM 2.1 through EM 2.5, respectively.

Table 1: Water Strategy Priority Recommendations and Measures of Success

Goal 1: Michigan's aquatic ecosystems are healthy and functional

The key recommendations are insufficient to support the first measure of success, "brook trout are present and thriving with no net loss of cold water habitat.... For the latter to occur, watershed-based management and controls that restore the hydrology of brook trout watersheds are required. The brook trout measure of success also seems too low a bar. Restoring the brook trout, Michigan's state fish, to all or a measureable portion of its' historic range should be considered in addition to "no net loss".

Chapter 1 Restore Hydrologic Connectivity

Restoration of hydrologic connectivity considers the potential impact of allowing upstream movement of invasive species. Too often, review is limited to sea lamprey. Consideration must also be given to the impact of species such as round gobies and ruffe on local fish communities, or even the impacts of "naturalized" exotic species such as Pacific salmon, which can have negative impacts on native fish species, invertebrate fauna, and steam substrates.

While this recommendation also recognizes the potential for the release of contaminated sediment trapped behind dams, it does not recognize the threat posed by the transfer of contaminants from the Great Lakes carried upstream by Great Lakes fish. Janetski et al. (2012)[1], document the contamination of upstream food webs by Pacific salmon in rivers and streams that connect with the Great Lakes. PCB concentrations in brook trout that ate salmon eggs in some tributaries exceeded both the EPA threshold for the protection of fish-eating wildlife and Michigan's fish consumption advisory threshold for women and children. Recent work on contaminants in Great Lakes fish in the Au Sable, Manistee, and Muskegon Rivers by Datema (2012)[2] showed that while total PCBs in Great Lakes fish had declined substantially since the 1990s, the 2,3,7,8 TCDD dioxin equivalents in Great Lakes fish had changed little over approximately two decades. With hazard quotients (HQs) > 10 for all three rivers, Great Lakes fish, and particularly salmon, which die after spawning and are thus readily available to fish-eating wildlife, continue to pose population level hazards to eagles and other fish-eating wildlife such as mink and otter. When restoring hydrologic connectivity requires the removal of barrier dams or other barriers to Great Lakes fish, the impact of contaminants from Great Lakes fish on the upstream fish and wildlife communities must be considered along with the threats posed by present and future invasive species.

Chapter 2: Ensure Clean and Safe Water

Recommendations in this section focus on the clean-up of legacy contamination and the prevention of environmental impacts from new contaminants. Some thought needs to be given, however, to the legacy pollutants such as PCBs and their breakdown products (congeners) as they may be differentially concentrated by novel, AIS-dominated Great Lakes food webs. It is at least disconcerting to observe, in the Datema (2012) citation above, that, while PCB concentrations are significantly lower in Great Lakes fish than they were in the 1990s, that the dioxin equivalents remained much the same. More research appears needed to validate these observations, which have a bearing on whether the State is using the appropriate measure in the assessment of the hazards posed by PCB residuals to wildlife and human health. Fish consumption advisories relative to PCB may require further research relative to the congeners of PCBs in the fish and their relative toxicity in dioxin equivalents.

Chapter 3: Create Vibrant Waterfronts

Consumers Energy supports these recommendations to foster the development and redevelopment of Michigan's waterfront communities.

Chapter 4 Support for Water-based Recreation

The mercury reduction numbers do not seem plausible given the limited explanation in the text. Given the emission reductions to date and even considering total elimination of coal fired power plants, it's hard to see how the report arrives at a 80-90% mercury reduction. The assumptions need to be revisited and more thoroughly explained.

Chapter 5: Promote Water-based Economies

Consumers Energy supports the recommendations in this chapter. As noted in this chapter, Consumers Energy has established a water intensity reduction target of 20% between 2012 and 2020, and the Company is on track to meet this sustainability goal. Since water use varies greatly among industries, any voluntary efficiency target development should involve appropriate stakeholders. We also fully agree that sustainable water use makes both social sense and business sense.

Chapter 6 Invest in Water Infrastructure

Consumers Energy supports the concept of public and private investment to support Michigan's water resources.

Chapter 7 Monitor Water Quality

As noted in Consumers Energy's comments on these nine strategies, a substantial amount of inventory work is needed before Michigan's water resources as a whole can be monitored. We support the development of an integrated system of monitoring and accounting for water use and we also recommend a central repository for all Great Lakes related water quality data. As it stands today, Michigan does not have a formal metric that can be applied across sectors that can measure water use trends, evaluate the effectiveness of water conservation programs, or reliably demonstrate compliance with the Compact. An integrated system of accounting is needed. We believe that vetting a pilot program with the public is appropriate; it also would be appropriate to attempt to integrate this system on a Great Lakes scale, which would provide common metrics for use by Great Lakes states to gauge their progress in implementing the Compact relative to their past performance and also relative to their peers.

Chapter 8 Build Governance Tools

Consumers Energy supports the concept of community, regional, and statewide stakeholder involvement in the development of governance tools to implement Michigan's water strategy.

Chapter 9 Inspire Stewardship for Clean Water

Consumers Energy supports efforts to improve water literacy in Michigan's. This is in keeping with the Company's own commitment in this area through the Consumers Energy Foundation, which funds numerous proposals annually that emphasize water and place-based education, such as Cranbrook's

"Water on the Go" program or water education opportunities for minority students on several projects our Foundation has supported by Friends of the Rouge.

Consumers Energy appreciates this opportunity to comment on Michigan's Water Strategy. If you have any questions with regard to these comments, please contact me.

Sincerely,

Gary A. Dawson, Ph.D.

Director of Land and Water Policy

(517) 788-2432

gary.dawson@cmsenergy.com

[1]Janetski, D.J., D.T. Chaloner, A.H. Moerke, R.R. Radiske, J.P O'Keefe, and G.A. Lamberti. Resident fishes display elevated organic pollutants in salmon spawning streams of the Great Lakes. Environ. Sci. Technol. 2012, 46, 8035-8043.

[2]Datema, Peter P. 2012. Using Bald Eagles to Monitor Hydroelectric Projects License Requirements along the Au Sable, Manistee, and Muskegon River, Michigan. Master's Thesis, Clemson University. 72 pages.

From: Gosen, Craig R.
To: mi-waterstrategy
Subject: Michigan"s Water Strategy
Date: Friday, August 21, 2015 3:03:25 PM

Comments regarding Michigan's Water Strategy:

As the Township Supervisor of a rural township (Midland County) I do not support Recommendation numbers 5 and 6 for Goal #2 on page 62. Requiring every County Health Department to assess all single-family septic systems will be a significant burden on County Health Department resources. Even if funding for such a requirement is initially identified, the likelihood of that funding being sufficient to cover the long-term costs is very low. This cost will ultimately be borne by the rural residents of this state. Mandatory periodic on-site performance inspections will be even more burdensome for our residents. This will cost most rural home owners several hundred dollars periodically and the state or local units of government will have to pay for or subsidize inspections and upgrades for the lower income home-owners.

No one can argue with the overall goal of clean and safe water resources but as government officials it is incumbent upon us to find cost effective ways to achieve this goal. Implementing a monstrous new statewide inspection program to identify a few underperforming residential septic systems is far from efficient. A thorough cost/benefit analysis must be conducted before a large-scale program such as this is implemented. Once the cost/benefit analysis is complete this program should be evaluated against other statewide priorities. Couldn't these funds be used for roads, additional policing efforts, education, or a host of other high priority programs? Please keep in mind that millions of animals use our lakes, woods, fields, yards, and streams as their restroom every single day. Should we also implement an animal diaper requirement or animal porta-jon program? How did the human race ever survive the outhouse days?

Craig R. Gosen
Edenville Twp Supervisor

From: Phil Bednarek
To: mi-waterstrategy
Subject: Michigan"s Water Strategy
Date: Wednesday, August 26, 2015 2:30:00 PM

Hello,

I just wanted to comment on your 30 year study. Personally I have been in the water industry for the last 30 years and a member of the Michigan Ground Water Association. My experience on the board and an advisor have given me a great deal of understanding of what we need in our state. We have worked with the Health Department and the DEQ on many occasions.

My main concern is the general language used to describe policy and future projects. Obviously anytime the state needs to add new ideas and time spent, it will cost money. So a revenue source is needed. What we don't want to see is the right of home owners taken away. They have the right to the water below them. This have been confirmed in the courts already.

The other area of concern is the possibility of a future taxation (or user fee) of groundwater in private wells. This is the people's water, state controlled, but still the people of our state own it. Please don't consider taxing an item that you really don't have any direct testing, control, or understanding of. Not to mention it is not a part of your infrastructure. After all, it isn't exported and never to return.

Surface water is an area that needs to be protected. Tourism and natural beauty must be preserved. Industrial abandoned polluted property needs attention as well. Otherwise no one will want to see or come and buy property. (Detroit needs this attention the most, but payback is best in western Michigan).

Please keep the Michigan Ground Water Association on your invite list for any future meetings when more details are discussed. George Carr is our lobbyist and we would appreciate your contact with him as well.

Thank you for your time.

Phil Bednarek

FULLER SUPPLY COMPANY

1958 Turner Ave. N.W.

Grand Rapids, MI 49504-2034

P. 616-364-8455

F. 616-364-4817

philb@fullersupplycompany.com

www.fullersupplycompany.com/

From: Tim Ott
To: mi-waterstrategy
Subject: MiWaters Draft Water Strategy comments
Date: Monday, June 15, 2015 12:50:00 PM

To whom it concerns,

-Page 53 under heading "Align Resources, Tools and Regulatory Framework to Achieve Outcomes", first paragraph, 3rd sentence – "Great Lakes region-level regulations manage water diversions and flows and help prevent evasive species introductions such as Asian Carp through the Chicago Area Waterways System." I believe this should read invasive.

-Page 63, #9- Is this only regarding residential use products such as cosmetics? Or would this also include regulated industrial use of ion exchange resins (which are basically microbeads) as well?

Thank you for you time.

Respectfully,

Timothy J. Ott
AEP/ D.C. Cook Nuclear Plant
Environmental Specialist
Phone: 269-465-5901 ext. 1383
Pager: 8501
Cell: 860-501-3736
Email: tjott@aep.com

"The Power is Yours!"

August 28h, 2015

Office of the Great Lakes,
Michigan Department Of Environmental Quality
P.O. Box 30473-7973
Lansing, Michigan 48909

Re: Comments on Draft "Sustaining Michigan Water Heritage, A Strategy for the Next Generation" Report

Michigan's incredible freshwater resources are an essential part of the Great Lake State's economy and way of life. The development of a comprehensive 30-year vision for our freshwater therefore is wholly appropriate and reflects a strong commitment to prioritizing and protecting the health and vitality of our lakes, rivers, and streams. The Michigan League of Conservation Voters (LCV) appreciates the work and deliberation that the Office of the Great Lakes, the Department of Environmental Quality, the Department of Natural Resources, the Department of Agriculture and Rural Development, and the Michigan Economic Development Corporation put forward to compile the draft report.

Michigan LCV supports the recommendations outlined within the report and the effort on the part of Michigan's state agencies to advance meaningful action to address serious threats to our waterways. However, we would hope that the final version of the report would include more specifics on how these recommendations will become realities for our state. Outlining implementation metrics, end dates, and lead actors is a good first step, but readers should walk away from the report understanding in a concrete way how these recommendations will be implemented. Additionally, we would urge for more clarity in how these recommendations will be funded and what work on them means for already tight departmental resources and staffing. Finally, given the sheer scope of the report we would push for a greater level of prioritization in the recommendations, both in the priority recommendation and the additional recommendations.

We at Michigan LCV are committed to seeing policies and regulations put in place that are effective and fully reflect the importance of clean water to our state. Recognizing the difficulty of the task that stands before our state governing bodies, Michigan LCV is happy to provide support and to act as a resource in the following areas:

- Develop a comprehensive strategy to prevent nuisance and harmful algal blooms
- Achieve a 40% phosphorus reduction in the western Lake Erie basin
- Develop and implement a uniform statewide sanitary code
- Establish inspection requirements for residential on-site wastewater systems
- Pass comprehensive legislation phasing out the use and sale of microbeads in Michigan

- Develop a water conservation and reuse strategy for the state that incorporates the use of green infrastructure, grey water systems, and energy production that includes recognition programs
- Establish sustainable funding mechanisms to achieve the Water Strategy goals including water infrastructure management
- Evaluate and implement necessary changes to laws including state and local land-use statutes as well as the Michigan Drain Code to create a more integrated, watershed based system for managing water at the landscape level and achieving water quantity and quality outcomes

Thank you for the opportunity to provide comments. We look forward to working with you as you pursue the recommendations outlined in the draft strategy. If you have questions please contact me at 734-222-9650 or charlotte@michiganlcv.org

Sincerely,

Charlotte Jameson
Policy Manager
Michigan League of Conservation Voters

Mr. Jon Allan & Committee

Because I consider myself not to be, what I consider to be totally educated and informed as to the various efforts and players in this process. I only wanted to take a few minutes to share a few of my thoughts with you as related to your *DRAFT* proposal for Sustaining Michigan's Water Heritage.

I was an attendance at your first presentation at Saginaw Valley State University. Though to group was small, I believe we shared some good ideas and thoughts. To add a little more background to some of what we discussed, as you might remember there was much discussion as to names and titles and terms that were used. My suggestion is that each of the 10 Regions would have at least one trained volunteer "State Water Ambassadors" (ideally 2 to cover turn over). These people would be able and expected to train as many more 'Regional Water Ambassadors'. As determined by each region. These folks should be able to articulate and educate all of the various groups identified in the plan. The most important component is that they would be up to date on the overall efforts and information (they would understand all of the areas of the plan, from the State and Regional groups. If this idea has any merit you can of course can change or enhance the job description for the suggested positions. Further they can share successes and other efforts across the various Regions. This I feel would put more informed assets in each Region that would be solely dedicated to this effort and it would not be an added responsibility or activity that many of the current members of your committees have, I believe that if the right folks are selected, trained and provided with materials can allow this program to try and meet the objectives of the plan and to measure and monitor the progress of the plan.

Thank-you, for all of the time and efforts already spent on this 'Plan' so far and for allowing for public comment. It would be interesting to hear the results and changes that come out of the meeting and public comments.

Mike Weiler
[redacted]

From:	Christine Kosmowski
To:	mi-waterstrategy
Cc:	bhannon@mbce.com; jerry@mi-wea.org
Subject:	MWEA Water Strategy Comments
Date:	Friday, August 14, 2015 3:02:32 PM
Attachments:	MWEA Water Strategy Complete Comments.pdf

To Whom It May Concern:

The Michigan Water Environment Association (MWEA), established in 1925, is one of Michigan's oldest organizations. MWEA represents more than 2,000 water quality professionals statewide who are dedicated to preserving, restoring and enhancing Michigan's water resources. MWEA is a member association of the Water Environment Federation (WEF), an international organization with more than 40,000 members worldwide. The MWEA brings together a diverse group of individuals whose careers involve the water environment and who have similar objectives from a variety of backgrounds.

Because of the expertise of members of the MWEA, we were invited to review the recently released draft water strategy developed by the Office of the Great Lakes entitled, "**Sustaining Michigan's Water Heritage, A Strategy for the Next Generation**." Overall, we applaud the State for its efforts to put together a strategy related to the waters of the state, and their many uses. The natural water resources – including the Great Lakes, inland lakes, groundwater, wetlands, and rivers and streams – make Michigan a unique place in the world. Putting together this plan to protect and restore the natural aquatic systems while continuing to use them for recreation, drinking water sources, and as a tool for economic growth is exceptionally forward thinking. This strategy document substantiates Michigan's role in the Great Lakes region and nationwide as a thought leader in environmental stewardship and a state that understands the complexities and interdependence of environmental, social and economic objectives. The document's goals, measures of success, implementation steps and metrics provide an effective framework that insures that the state intends to realize its plans. This strategy is unique in its scope and structure. Well done!

A task force was convened with subject matter experts of various water environment backgrounds from our membership and attached are their comments for your review and consideration. In addition to the comments made by the Task Force, our Association is interested in helping to champion elements of the strategy where applicable. We look forward to working with the Office of the Great Lakes on the Implementation of "**Sustaining Michigan's Water Heritage; A Strategy for the Next Generation."**

Sincerely,

Brian Hannon, PE
MWEA President

Christine Kosmowski
MWEA Water Strategy Task Force Chair

michigan water environment association

michigan's water quality people

P.O. Box 397 ♦ Bath, MI 48808
Ph 517-641-7377 ♦ Fax 517-641-7388
www.mi-wea.org

President
Brian Hannon, P. E.
616-363-9801
bhannon@mbce.com

President-Elect
Brian Ross
810-735-7135
bross@gcdcwws.com

Vice President
Cheryl Vosburg
269-781-3985
cvosburg@cityofmarshall.com

Past President
Tim Sikma
248-521-9605
tsikma@wixomgov.org

Secretary
George Davis
616-551-2304
georgebd@mac.com

Treasurer
Michelle LaRose
313-575-8933
mlarose@livgov.com

Association Directors
Sherrie Elliott
231-348-0368
selliott@petoskey.us

Harry Price
313-237-3935
hprice@nthconsultants.com

Federation Delegates
Todd Wibright
616-457-0720
wibrightt@cityofgrandville.com

Jennifer Zelski
517-545-2500
jenz@hamlettenvironmental.com

Executive Director
Jerry Harte
517-641-7377
jerry@mi-wea.org

We Recycle

August 12, 2015

Office of the Great Lakes
DEQ
P.O. Box 30473-7973
Lansing, Michigan 48909

To Whom It May Concern:

The Michigan Water Environment Association (MWEA), established in 1925, is one of Michigan's oldest organizations. MWEA represents more than 2,000 water quality professionals statewide who are dedicated to preserving, restoring and enhancing Michigan's water resources. MWEA is a member association of the Water Environment Federation (WEF), an international organization with more than 40,000 members worldwide. The MWEA brings together a diverse group of individuals whose careers involve the water environment and who have similar objectives from a variety of backgrounds.

Because of the expertise of members of the MWEA, we were invited to review the recently released draft water strategy developed by the Office of the Great Lakes entitled, *Sustaining Michigan's Water Heritage; A Strategy for the Next Generation*. Overall, we applaud the State for its efforts to put together a strategy related to the waters of the state, and their many uses. The natural water resources – including the Great Lakes, inland lakes, groundwater, wetlands, and rivers and streams – make Michigan a unique place in the world. Putting together this plan to protect and restore the natural aquatic systems while continuing to use them for recreation, drinking water sources, and as a tool for economic growth is exceptionally forward thinking. This strategy document substantiates Michigan's role in the Great Lakes region and nationwide as a thought leader in environmental stewardship and a state that understands the complexities and interdependence of environmental, social and economic objectives. The document's goals, measures of success, implementation steps and metrics provide an effective framework that insures that the state intends to realize its plans. This strategy is unique in its scope and structure. Well done!

A task force was convened with subject matter experts of various water environment backgrounds from our membership. The Task Force reviewed the full document and also devoted concentrated effort on specific chapters where the team had expertise. We are pleased to submit the enclosed comments. Below is a summary of main points observed and attached are the detailed assessments of them. Reviews are kept in the format used by each team, which reflects their own thoughts and style.

Chapter 1

- Generally well thought out; there are many areas where MWEA may be able to contribute to implementation.
- Measures of success in Table 1 associated with the goal of healthy and functional aquatic ecosystems should be better connected to the narratives in the chapter relating to this goal; for example, fish and wet weather impacts are presented in Table 1 but receive little or no discussion in Chapter 1.
- The strategy should include detailed discussion and recommendations for habitat preservation and restoration, and of specifics for Lake Erie nutrient load reductions.

- Research opportunities and multistate collaboration should be emphasized more.
- Discussions of HAbs, water levels, and invasive species in the water strategy document should be more accurate.

Chapter 6

- The proper operation and maintenance of infrastructure is an important element in safeguarding the waters of our state which we all enjoy. Two key challenges need to be addressed in order to provide the critical funding necessary to perform adequate operation and maintenance. The Water Strategy Report touches on these topics but we feel an expansion of the subject is warranted:
- The promotion of utility asset management is rightfully included in the Report. We feel that a program similar to the current Stormwater, Asset Management and Wastewater (SAW) should be continued which is a modest investment that ultimately will result in more local responsibility for infrastructure investment and less reliance on state funding for such activities.
- We must continue to discuss the unique challenge of stormwater funding and explore alternatives in order to enable communities to address the growing need for managing their stormwater systems and controlling pollutants contained in runoff. The current limitations of the Headlee Amendment and the Supreme Court's Bolt Decision have made it close to impossible for communities to move forward in this area. A resolution will be extremely difficult, but alternative (ideally, local) funding mechanisms are nevertheless absolutely necessary.

Chapter 7

- Several terms are used which make the first recommendation confusing. Terms such as systems-based monitoring; integrated water-based monitoring; integrated outcome-based monitoring systems; and integrated system of monitoring aren't defined, making it confusing for the reader on exactly what is being proposed.

Chapter 8

- This recommendation talks mostly about surface water. The second recommendation focuses on surface water, but groundwater is an important component to this section could apply to both (all water).

Chapter 9

- Agree that water literacy principles be incorporated into place-based education and state of Michigan curriculum.
- Professional development for teachers required to teach water literacy principles.
- Statewide public education campaign for all Michigan residents.
- Inclusion of local water infrastructure assets on the survey tool.

Groundwater Review

- Include the volume of calculated groundwater in the introductory paragraph.
- Strongly support the need for coordinated and comprehensive GW monitoring--the second paragraph on page 50 is key
- Continued support of wellhead protection should be promoted and expanded
- Statewide education and marketing of water education utilizing existing materials. It should be a coordinated effort not a fragmented recreating of the wheel by local units of government who lack expertise and motivation
- Outreach and education to include water in land use planning and decisions

General Comments

- Reference should be made to the U.S. DOE's Water Energy Nexus, and the importance that energy has to water use in the state of Michigan.
- The strategy should include provision for Michigan's continued and expanded role in national and international forum. Michigan is fortunate to have access to an abundance of clean water. There are many areas of this country and the world that do not. Having an abundance of water, Michigan will have unique opportunities for economic and social development. It also has a responsibility to be aware of national and global needs. The Vision for Michigan's Water Strategy should have a chapter dedicated to the outward looking strategy.
- Those responsible for conceiving and preparing the plan should be complimented for the comprehensive plan prepared in the short span of time available. Of note is the focus on collaboration.
- The Summary of Current Michigan Water Protection Activities in Appendix 3 is an impressive and a testimony to the importance that Michigan has placed on the environment in general, and water in particular.

In addition to the comments made by the Task Force, our Association is interested in helping to champion elements of the strategy where applicable. We look forward to working with the Office of the Great Lakes on the Implementation of *Sustaining Michigan's Water Heritage; A Strategy for the Next Generation*.

Sincerely,

Brian Hannon, PE
MWEA President

Christine Kosmowski
MWEA Water Strategy Task Force Chair

Memorandum

From: Paul Freedman, P.E., B.C.E.E
Brendan Cousino, P.E.
Tad Slawecki
John F. Bratton, Ph.D.

Date: August 5, 2015

To: Christine Kosmowski

SUBJECT: **Sustaining Michigan's Water Heritage – A Strategy for the Next Generation**
Protect & Restore Aquatic Ecosystem Section
DRAFT Review Comments

Scope & Format

Our scope in the MWEA review of Michigan's draft Water Strategy was to focus Chapter 1: Protect and Restore Aquatic Ecosystems and the related information in Tables 1 and 2. Our substantive comments are given in the first sections below, and are followed by minor comments related to the grammar and language used in the document.

This document is a draft of our comments and not intended for any use other than internal use by the MWEA committee which is preparing an overall submittal of comments on the Michigan draft Strategy. It should not be distributed to others or cited. In the next phase of the process to develop MWEA overall comments we expect to provide more input.

General Review Comments

Overall, we applaud the State for its efforts to put together a strategy related to the waters of the state, and their many uses. The natural water resources – including the Great Lakes, inland lakes, groundwater, wetlands, and rivers and streams – make Michigan a unique place in the world. Putting together this plan to protect and restore the natural aquatic systems while continuing to use them for recreation, drinking water sources, and as a tool for economic growth is exceptionally forward thinking.

This strategy document substantiates Michigan's role in the Great Lakes region and nationwide as a thought leader in environmental stewardship and a state that understands the complexities and interdependence of environmental, social and economic objectives. The document's goals, measures of success, implementation steps and metrics provide an effective framework that insures that the state intends to realize its plans. This strategy is unique in its scope and structure. Well done!

Our review of Chapter 1 includes four sections:

- Areas where MWEA can contribute
- Additions and recommendations
- Scientific and technical improvements
- Minor textual revisions

Areas that MWEA Can Contribute

Many of the goals of this plan align very closely with the goals of MWEA and our knowledge base. Therefore we want to highlight the areas where MWEA can contribute to and support the implementation of this plan. Here are five areas where MWEA could assist in implementation and/or plan improvements:

1. Training: The strategy calls for extensive training in several topic areas, including as an example green infrastructure. MWEA has decades of experience in providing this exact kind of training for water professionals, public officials, and school groups, and would look forward to collaborating on training.
2. Regulatory flexibility: Achieving the goals of the strategy in hard economic times will likely require regulatory flexibility to accomplish objectives at lower cost using innovative approaches. MWEA and its members have extensive experience developing programs that balance complex water quality objectives against limited resources. We would look forward to collaborate on the development of flexible regulatory programs, where the outcomes or improved water quality and habitat are of higher importance than the prescriptive methods to achieve them.
3. Innovative programs: Implementation of innovative approaches will be important to achieving the strategies long term objectives of 40% reduction in Lake Erie nutrient loads. Examples include watershed management, adaptive management, trading, credit exchanges, nutrient reduction BMP practices, etc. MWEA members have nationwide experience and intimate understanding of Michigan conditions. MWEA would look forward to working with the State to develop new approaches that allow us to achieve more for less.
4. Prioritization: In all situations, investments in programs can never be done all at once and must be staged. MWEA would look forward to working with the State to develop strategies to prioritize efforts to those deemed most important and cost effective.
5. Measures and Metrics: MWEA would like to work with the State in refining the list of measures of success and implementation metrics. What we measure we accomplish, so this is a key element of the strategy that needs close attention. It is important that we have useful measures of success and that the implementation plan have metrics that we are comfortable help us move towards achieving those measures of success.

Additions / Recommendations

Although the strategy document is quite comprehensive, we feel there are several elements that need more emphasis and/or addition. These are:

1. Habitat: We recommend that the State expand the discussion of habitat loss and restoration in this chapter. Habitat loss is as big an issue in degradation of state waters as

nutrients and AIS. Restoration of habitat and ecosystems is barely mentioned in the Chapter and does not include a direct recommendation or measure of success. The river and stream restoration measures recommended in the implementation plan (Table 2) are limited to dam removal and hydrological impediments such as culverts. We recommend additional focus on restoration of aquatic ecosystems, including identifying funding sources, be included in this chapter.

2. Wet weather impacts: The specific measures of success in Table 1 associated with wet weather discharges are generally not related to aquatic ecosystem considerations (the focus of Chapter 1), except as may relate to agricultural loads of sediments, nutrients, and pesticides/herbicides. Further, there is no discussion in Chapter 1 of untreated sewage or wet weather discharges, even though reductions to those sources are included as Chapter 1 Aquatic Life measures of success in Table 1. In general, CSO/SSO discharges are not aquatic life issues, but when of concern more related to impairments in full contact recreational uses. We recommend if this remains an ongoing measures of success in the final Strategy that it be included under Goal 6 as measures of adequate funding for water infrastructure rather than in the Aquatic Life Chapter in the strategy.

3. Measures of success: There is no discussion in the Chapter of why brook trout, sturgeon, or lake trout should be the selected measures of success. Although declines in brook trout populations are linked to coldwater habitat loss, there may be other species in other areas that are equally relevant and not all waters fall into this classification. While those species are certainly indicators of health in some ecosystems, there are many other types of ecosystems in Michigan that are in need of protection and restoration where other species may be more appropriate, such as warm water fish species or amphibians. We recommend that the report be modified to include either more discussion on why these measures were chosen, or better additional measures of success for other types of habitat, and that the report include further discussion on the links between the measures of success and the recommendations contained in the report.

4. Nutrient reductions: There are no specific recommendations on how the 40% phosphorous reductions in Lake Erie are to be achieved. Further details are needed to understand whether those reductions will be achieved through point-source reductions (NPDES programs) or non-point sources (primarily through agriculture). Consideration should be given to the implementation of trading programs or a nutrient exchange, a municipality (or industry) can pay into a fund that nonregulated parties (such as agriculture) could use to implement nutrient reduction projects. In any case a flexible program is needed that allows all parties to prioritize where to act, not just tighten up on very small loads from WWTPs. In addition, we feel it would be useful to outline a prioritization for actions where each additional investment has the most effective reduction.

5. Decision support tools and research: The strategy goals are laudable but challenging, especially when faced with limited resources, an impatient public, difficult legislative, regulatory and budgeting choices, and competing demands. It is therefore very important that the state invest more in development of tools, models and frameworks that help us identify critical casual factors, and highest priority needs. Water resource decision frameworks are mentioned in the strategy implementation, but more discussion in needed. Research may very well be a critical component to developing these tools.

6. Research: The strategy mentions the needed for more research on technology, and this is important. However, much more research is needed to understand the causes and stresses that impact our aquatic health so that we can better quantify and prioritize our efforts to improve conditions focused on those that will make the most difference. Additional research is probably warranted on topics including lake levels, lake evaporation and ice cover, climate change impacts and adaptations, causes and consequences of HABS, nutrient enrichment of inland lakes and reservoirs, and agricultural controls as examples.
7. Multistate collaboration: Michigan shares four of the Great Lakes with other states (and Canadian provinces). To ensure success protecting and restoring the Great Lakes we need a unified effort among all governments involved. The document calls for this related to AIS but not elsewhere. We therefor recommend that the strategy include a stronger emphasis that calls out for inter-state and US-Canadian cooperation on strategies, regulations and funding.

Scientific & Technical Improvements

The Strategy document is generally a high level document that is not intended to be a scientific examination of issues, and such issues are generally only mentioned to give the Strategy context. None the less, it is important that all discussions, even if limited, are scientifically accurate. There are several places that need improvement or correction.

1. Water levels: The comments on Great Lakes water levels on page 11 may be outdated given the resurgence in lake levels over the past few years and should be reviewed. Additional discussion on the impact of evaporation – especially the ice cover over the lakes (and subsequent lower water temperatures) – being an influential factor in the lake levels in addition to the average annual precipitation would be useful. Increasing our understanding of the factors that control the lake levels and the impact of lake levels on the aquatic ecosystems and near-shore land based ecosystems will help to improve our ability to protect and restore those ecosystems. Additional recommendations may include increase monitoring, more measurements of evaporation, data collection, habitat and ecosystem assessments, and model development to further our understanding of those critical natural systems.
2. Excess nutrients: the focus of discussion on nutrients in the Strategy seems to be on Lake Erie. However, excess nutrients and sediments is an issue in not only Lake Erie. For example, there are nutrient issues in Saginaw Bay and also nearshore Lake Michigan. There may be other areas impacted by excess nutrients as well, including inland lakes. This needs to be highlighted. Further research is needed to understand nutrient impacts in other waters to inform sound policy decisions in the future. Also, we suggest citing draft guidance from Annex 4 of the Great Lakes Water Quality Agreement as the basis for the 40% reduction.
3. HABs: The relationship between HABs, invasives like Dreissenids, and nutrient cycling needs to be better understood and hence the comments on this refined. Cladophora is another related issue that needs mention. While actions to reduce the phosphorous loadings can and should be taken immediately, an adaptive management approach should be used where policies can be adapted as our understanding of the science and natural processes improves over time.

New guidance has been released by EPA on microcystins that supersede some of the statements in this document: see

http://www2.epa.gov/sites/production/files/2015-06/documents/microcystins-report-2015.pdf

Also, the characterization of the Toledo response to the 2014 HAB is not precisely accurate. The water system was not shut down – a drinking ban was issued. The presence of the HAB did not cause the ban, but rather issues with the utility's ability to treat raw water sufficiently to remove the toxin produced by the HAB, microcystin. Maybe minor distinction, but not all blooms, even if obnoxious, cause problems with microcystin. Also, note that the definition of a HAB is not linked directly to drinking water standards.

Agreed that algal bloom factors are controlled by both phosphorus and nitrogen. Phosphorus limits blooms early in the season, and nitrogen later, but nitrogen also controls toxin production. The particulars depend on the water body, climate, temperature, rainfall, and land use, so it may be better to avoid getting into the complexities of this. Lots of variety in inland lakes.

4. Invasive species: this topic may require some review of the statements.

   Dreissenids consume good (green) algae and provide advantages for blue-green algae which they do not eat, and enhance nutrient cycling and availability of ortho P, which also makes blue-green algae and cladophora more prevalent.

   Round goby dominate the shallow lake floor, outcompete native fish for food, eat fish eggs—especially a concern with lake trout and salmon eggs; possible link to botulism outbreaks and deaths of fish-eating birds (mentioned later, but without linking to goby); note that gobies eat mussels and have also become prey fish for some species

   Spiny and fish hook water fleas are not just problems for fish lines but also compete with plankton-eating fish for food, like alewives (also invasive but now a major prey fish), which disrupts the lower food web, leading to declining gamefish populations.

   Consider specifically mentioning ballast water and inland movement of boats from lake to lake as major vectors; perhaps also mention more regulation of plants and animals in trade (e.g., aquariums and water gardens), and include consideration of climate change, which is allowing expansion of subtropical species from the south into the Great Lakes (e.g., water hyacinth)

5. Overall goal: The stated Goal (Goal: Michigan's aquatic ecosystems are healthy and functional.) and outcome (Outcome: Aquatic ecosystems are resilient and diverse.) are both very general. Goals express intended outcomes in general terms and objectives express them in more specific terms. There are many more outcomes of healthy and functional ecosystems beyond being "resilient and diverse". Michigan may want to reevaluate how they express the outcomes and what terminology they use. Maybe this is minor but worth consideration.

Minor Text Revisions

The document is in general well written. That said, there are still places in the document where the text is awkward or unclear, something small is missing and/or there are typos. Below are a few specific examples.

- p 11 - para 5 – change to active tense..."sea lampreys devastating fish communities" instead to match grammatical construction of other impact examples.
- p 15 - First full paragraph "are used" should be "is used";
- p15 - voluntary programs aren't defined.
- p 18 - Natural Resource Working Group feels like there should be a reference or footnote.
- In Table 1, the measure of success for Goal 8 calls for "reduction in number of designated uses". This should be a reduction in "nonattainment of water quality standards in designated uses" or "reduction in number waters not meeting designated uses".

Chapter 6: Invest in Water Infrastructure

GOAL: Michigan invests in infrastructure and supports dedicated state and local funding mechanisms to maintain clean water and healthy aquatic ecosystems.

OUTCOME: People support investment of both public and private funding in Michigan's water resources.

The state's infrastructure – roads, commercial ports, drinking water systems, ~~sewer~~ wastewater systems, drainage systems, energy plants, transmission systems and recreational facilities – form the backbone of the economy. All water withdrawn from the Great Lakes, groundwater, rivers, and lakes for any purpose passes through some form of water infrastructure; it is a complex system. Additionally, rainwater becomes runoff and must be conveyed through our infrastructure. A functioning water infrastructure system keeps the state running.

Improve Understanding of the True Cost of Water

Most people think of their monthly water bill as the cost they pay for water. But in reality, water, as a natural resource~~, is actually free for any purpose and for any amount used by any entity~~ requires additional investment~~,~~ by public and~~or~~ private entities~~, as long as its use does~~in order to keep us from further ~~not~~ degrading~~e~~ the resource. Water may come at a very low marginal cost~~is free~~ to those who want water to drink, to businesses that use it in industrial processes, to those that bottle it for consumption and to homeowners who water their lawn; however, the cost to maintain the quality of that water and deliver it is significant. Put simply, t~~T~~he economic value of water is nearly infinite, as it drives Michigan's economy.~~but for Michiganders it is a free, shared resource to use for all kinds of human purposes. While water as a resource may be free, there are costs associated with managing Michigan's water resources to ensure that water is of high quality and available for human uses.~~

Comment [gpk1]: Referring to water as "free" is not really accurate. The point we need to be making is that it is NOT free, thereby requiring investment.

Through their water and sewer bills, Michiganders instead pay for the infrastructure to deliver safe drinking water and carry away and treat waste, and for the operating costs, like energy, to treat and condition water/wastewater~~ and maintain infrastructure~~. Those outside the area of a municipal water supply system pay for well construction, treatment if necessary, the pump and the energy used to supply water to the tap. In addition, the cost of infrastructure to supply water is contained in the final price of all commodities and services.

Michiganders also pay for the safe transport and discharge of water caused by rainfall (also known as stormwater), which is a component of infrastructure wholly separate from water and wastewater. Although several Michigan communities charge a stormwater fee to handle this infrastructure component, most communities have no dedicated funding source for stormwater.

~~Water's~~ The cost for water, wastewater, and stormwater is determined by volume-based pricing that allows the collection of revenues to pay for infrastructure and operations used to deliver water or safely dispose of wastewater and stormwater. Under this scenario, there is often a lower ~~per unit, usually gallons, fee on~~unit charge for water/wastewater for higher volume users~~ and amounts~~. Water and

wastewater rates are commonly skewed in such a way that users pay lower rates~~less~~ as ~~volumes~~ total consumption rises, because the price is pegged to infrastructure costs and not to the value of water itself. In some instances, this can act as a complicating factor when trying to achieve water use reduction or conservation, as conservation equates to lower revenues for municipalities.

A customer's use of less water does not necessarily ~~or directly~~ equate to lower operational costs of infrastructure. There is still a substantial cost to ~~have safe drinking water delivered~~maintain the distribution systems to deliver ~~at~~ adequate quantities and pressures whenever the tap is opened and to have fire protection available ~~at the curb within the reach of a standard fire hose in event of an~~ for emergencies~~y~~. Similarly, the wastewater collection system requires a base investment that does not necessarily decrease when system demand is lower. Stormwater collection systems must function no matter how much water demand there is, as their function is dictated by the amount of rain that falls on a community.

Michigan has a long experience and legal history of not putting a commodity price on water, thus keeping water a free resource, and an important element of the state's economic and social well-being and stability. During public outreach for the Water Strategy, many residents suggested either putting a fee on water for all or some groups of water users – in its simplest form, a per gallon charge for water as it comes from the environment. Some suggested that only some types of water users, like agriculture, water bottlers or industrial users should pay a per gallon fee for withdrawing water. Others suggested all users should pay a surcharge or a per gallon fee for the use of water, regardless of user or purpose. Given that Michigan's citizens and businesses withdraw more than 4.2 trillion gallons per year, equivalent to the amount of precipitation that falls on the U.S. per day, even a tiny surcharge or access charge would add up quickly. The economic logic may make sense in the abstract, but it does not currently fit the culture and history of water and water use in the state.

Conversely, some argued that adding a price to water, even as an access charge versus a price on water per se, would commodify the resource, when it has historically been a public good or a public trust resource. Maintaining the ability to manage and ensure the sustainability of the water resources of Michigan and the Great Lakes is of utmost value to the state and the region, and even though a revenue stream could be created from a volume or access charge on water, the values potentially compromised under this scenario are too great to lose. However, there is still a compelling and growing need for investments in water and water infrastructure and for administrative and programmatic support in order for the state to meet its long-term vision for healthy, functional systems and prosperity.

To address the gap between actual investment need and public perception of that need, Michigan should launch a public education campaign to improve residents' understanding of the economic, environmental and social benefits of clean water, linking the investments necessary to achieve the benefits. If the public wants clean beaches and good water quality – and they say they do – public support of water infrastructure investments is critical. While we do not seek to facilitate a volumetric surcharge on water access, if that is something the public would ultimately support, then it would add to the options for funding long-term infrastructure and desired outcomes.

Given the state's recent $450 million dollar commitment in the Stormwater, Asset Management and Wastewater (SAW) Grant program (asset management plans for wastewater and stormwater systems), there is a unique opportunity to highlight the plans that emerge from these asset management efforts in order to demonstrate the actual funding gap that exists for typical wastewater and stormwater systems. These plans will identify the impacts of aging infrastructure and the associated decreases in federal funding for water infrastructure.

Water rates have historically been low and water both plentiful and affordable in most Michigan communities. Detroit's recent water shutoffs, the loss of urban population in other communities, and an overall increase in domestic water conservation has put a sharper focus on water rates, affordability, and the ability to continue to fund aging infrastructure costs. There is currently no statewide assessment of shut-off practices or policies that relate to affordability and water access for human use.

Recommendations

- Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water as well as the benefits infrastructure provides for drinking water, recreation, cultural and economic opportunity.
- ~~Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.~~ Using the SAW Grant asset management plans that emerge during the next several years, highlight the actual funding gap between current revenues and investment needs for wastewater and stormwater infrastructure. The magnitude of this funding gap will reveal the economic realities of maintaining our aging infrastructure.
- Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation.

Invest in Water Infrastructure

One of the biggest challenges facing communities is aging, deteriorating infrastructure systems with more operational needs than financial resources to meet them. Poor infrastructure degrades the value of water, results in costly efforts to mitigate impacts, and creates or increases drag on the economy.

Given that much of our water and sewer infrastructure was funded through the federal government in the 1970s and 1980s (grant programs stemming from the 1972 Clean Water Act), and that much of our remaining infrastructure was financed and constructed by private land developers, we are currently enjoying the subsidies of that investment, which is why sewer rates have been so low during the last 20 years. Now that these assets are nearing the end of their useful lives, it will be up to municipalities to maintain and replace them. This will require significant changes to local fee structures.

In a perfect world, users of the system would pay for the cost of service. Rates would consider operation and maintenance costs as well as long-term capital investment needs. Unfortunately, rates in Michigan are typically set by elected officials who have political difficulty charging rates necessary to maintain infrastructures.

Asset management planning is critical to allow communities ~~, performed properly, would support municipalities' efforts~~ to optimize future costs and collect revenues sufficient to operate and maintain the system. The current SAW Grant program will help to facilitate this process for hundreds of Michigan cities. Since 2013, some large municipal wastewater treatment plants have been required to develop an asset management plan as part of their nonpoint source discharge elimination standard (NPDES) permit; however, this requirement doesn't apply to all water utilities. Outcome-based asset management planning that includes more efficient use of resources can result in cost efficiencies that can be used to address capital costs while keeping rates affordable.

Communities can realize cost efficiencies to manage water infrastructure systems and to meet the needs of the future by increasing efficiencies in the delivery and treatment of water through implementation of energy efficiency measures, the use of technologies and a combination of grey and green infrastructure. A more integrated systems approach can improve water management, reduce energy costs and result in savings for communities as opposed to investing in traditional methods which typically have higher capital investment costs.

~~If communities continue to use traditional methods to manage infrastructure, conservative estimates range in the billions to~~It will cost billions of dollars to rehabilitate and improve stormwater, drinking water and wastewater management systems in Michigan during ~~over~~ the next 20 years, largely to address those assets previously built by developers or through federal grant programs. Although a large majority of these costs is~~are~~ not the responsibility of federal or state government, the state needs to implement a long-term strategy to sustain state water programs, including funding to maintain critical regulatory oversight programs, water quality monitoring and provide assistance to communities to local water infrastructure. In addition, the state should explore a variety of options to close the widening gap between existing funding sources and future revenues needs, including incentivizing asset management planning, creating legislation that allows communities to develop stormwater enterprise funds, state bonding and borrowing options, dedicated capital and trust funds, public-private partnerships, insurance and leveraging, private equity, and service area consolidation. Without adequate funding, Michigan's economy, aquatic ecosystems and quality of life will be diminished.

The unique challenge of funding stormwater improvements and facilities needs to be specifically acknowledged and ultimately addressed. In addition to the same problem of an aging infrastructure network experienced in drinking water and wastewater systems, the state and federal regulatory agencies are on the verge of enacting new legislation and requirements aimed at eliminating some of the pollutants generated by stormwater runoff. This will require significant investments in new facilities and technologies beyond the basic needs of maintaining current services. As stormwater activities are funded through general fund taxes which are limited by the Headlee Amendment, communities are functionally unable to raise revenues in a way not faced by water and wastewater utilities. Communities have attempted to create stormwater utilities but the Supreme Court decision, commonly referred to as the "Bolt Decision," has made it extremely difficult to defend such utilities in a legal challenge. Resolving this dilemma will be difficult, but Michigan must develop a workable solution if communities are expected to comply with future environmental requirements and maintain their stormwater systems in a sustainable manner.

Recommendations

- Incentivize and require outcome-based asset management planning for all public water, wastewater, and stormwater utilities that includes more efficient use of resources and identifies revenue levels necessary to maintain an adequate Level of Service for all users.
- Continue the SAW Grant program beyond its current budget horizon to allow for asset management planning for additional Michigan communities and to include drinking water assets.
- Develop legislation that enables communities to legally establish stormwater user fees (a/k/a stormwater utilities). This helps to address an existing serious gap in funding for this critical water infrastructure component. Due to recent judicial precedent, additional stormwater utilities will not likely be possible without specific enabling legislation.
- Establish sustainable funding mechanisms to achieve Water Strategy goals including water infrastructure management.

Develop an Enterprise Budget for Water

The state needs to complete an enterprise budget to more fully understand the complex relationships between water/wastewater/stormwater~~,~~ infrastructure needs and funding across all entities, including state agencies, federal agencies, local municipalities, drain commissioners and inter-county drain boards. An enterprise budget is a theoretical budget – not a responsibility budget – that portrays revenue and expenditures regardless of agency or governmental unit. The four principal~~le~~ revenue sources related to water in the state – federal, state and local revenues and fees, and private revenues – should be included in the enterprise budget as shown in Figure 2. This budget will also assist in understanding how to maximize the sustainability of the funds used to support water infrastructure and state programs.

COMMENTS ON FIGURE 2 (CONCEPTUAL STATEWIDE ENTERPRISE BUDGET FOR STORMWATER, DRINKING WATER AND WASTEWATER)

- **In the "Local Fees and Taxes", this should be broken out into three primary categories**
  - **Dedicated/Perpetual Enterprise Funding**
    - **Water**
    - **Wastewater**
    - **Stormwater**
  - **Non-Dedicated Funding**
    - **Local taxes / General Fund**
  - **Project-Specific, non-perpetual funding**
    - **Drain Assessments**
    - **Tax millage for specific use**
    - **Other Assessments**

Recommendation

- Develop an "enterprise budget" to better understand the complex relationships between managing water/wastewater/stormwater~~,~~ infrastructure, long-term needs, and funding.

EXCERPT FROM TABLE 2 (Goal 6 only) WITH SUGGESTED CHANGES

Goal 6: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.			
Outcome: People support investment of both public and private funding of Michigan water resources.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water and the benefits infrastructure provides for drinking water, recreation, and cultural and economic opportunity.	By 2017, implement a communication strategy focused on connecting economic, environmental, social and cultural values to Water Strategy outcomes.	NGOs, MDEQ, MDCH
2	Using the SAW Grant asset management plans that emerge during the next several years, highlight the actual funding gap between current revenues and investment needs for wastewater and stormwater infrastructure. The magnitude of this funding gap will reveal the economic realities of maintaining our aging infrastructure.~~Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.~~	By 2020, increase the number of communities that have pricing and funding strategies as part of their asset management plans to support infrastructure improvements over a baseline established in 2015.	Local units of government, water utilities
3	Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for	By 2017, increase the number of communities that have practices in place to ensure financially distressed customers have access to water for drinking and sanitation over a	Local units of government, water utilities

	drinking and sanitation.	baseline established in 2015.	
4	Incentivize and require outcome-based asset management planning for all public water, wastewater, and stormwater utilities that includes more efficient use of resources and identifies revenue levels necessary to maintain an adequate Level of Service for all users.	By 2020, require all major NPDES-permitted dischargers to develop and implement asset management planning for each system (including collection and treatment systems). By 2020, require all municipal community water suppliers serving more than 1,000 people to develop and implement asset management planning for each system (including treatment and distribution systems). By 2020, require all MS4 –permitted dischargers to develop and implement asset management planning for their stormwater collection systems.	MDEQ
5	Continue the SAW Grant program beyond its current budget horizon to allow for asset management planning for additional Michigan communities and to include drinking water assets.		MDEQ
6	Develop legislation that enables communities to legally establish stormwater user fees (a/k/a stormwater utilities).	By 2017, pass referenced legislation with Governor's signature.	Legislature
7	Establish sustainable funding mechanisms to achieve the Water Strategy goals including water infrastructure management.	By 2020, implement a long-term funding strategy to achieve goals of the Water Strategy and support existing Quality of Life Agency programs and policies.	State agencies, Legislature
8	Develop an "enterprise budget" in order to better understand the complex relationships between managing water/wastewater/stormwater infrastructure, long-term needs, and funding.	By 2016, develop an enterprise budget for water to inform the long-term funding strategy.	MDEQ

Formatted: Normal, No bullets or numbering

Michigan Water Strategy – MWEA Comments
Chapter 7 & 8 – Erin Campbell & Laura Gruzwalski

Chapter 7 – Monitor Water Quality

- Several terms are used which make the first recommendation confusing. Terms such as systems-based monitoring; integrated water-based monitoring; integrated outcome-based monitoring systems; and integrated system of monitoring aren't defined, making it confusing for the reader on exactly what is being proposed.

- This chapter states the integrated system should include quality and quantity monitoring, condition assessment, modeling and forecasting tools for the entire water cycle. The "entire water cycle" should be defined as surface and groundwater are directly addressed. Wetlands should be specially listed.

- More explanation is needed about the pilot decision-support framework; it is unclear who will be using the framework. It states local and regional watershed scales. This is unclear, what about groundwater or source water scales. These may be different than watershed scales or boundaries.

- The need for monitoring funding could be more specific. The first recommendation discussed the need for integrated system monitoring but then addresses funding for only surface/ground water monitoring.

- An additional goal should be added: research/identify new technologies to enhance monitoring strategies (Page 49).

Chapter 8- Build Governance Tools

- On page 53 they say "county drain commissions", it should read by "County Drain Commissioners or Water Resource Commissioners".

- Again, this recommendation also talks mostly about surface water. The second recommendation focuses on surface water, but groundwater is an important component to this section…could apply to both (all water).

Table 2:

- Overall, we thought wastewater/groundwater or wetlands were not addressed nearly enough throughout the Implementation table. They mentioned infrastructure funding a bit, but effluent monitoring for emerging pollutants could be included (and in Chapter 7).

- The Implementation Metric schedules are a bit unrealistic, considering current MDEQ and MDNR workloads and state and local government budgets. Particularly for Goal 7 & 8 – schedules should be spanned out 2 years.

MICHIGAN WATER ENVIRONMENT ASSOCIATION

Comments on Chapter 9: Inspire Stewardship for Clean Water

Cheryl Vosburg and Christine Kosmowski

General Review Comments

Chapter 9 of Sustaining Michigan's Water Heritage; A Strategy for the Next Generation details the importance of Michigan's citizens becoming stewards of clean water and healthy aquatic ecosystems. One of the Critical Objectives of the MWEA's Strategic Plan is to increase the awareness of the value of water and to expand MWEA's commitment to public advocacy for clean water and public health and inspire respect for water and water professionals. As reviewers, we were pleased that the need to inspire stewardship was considered an important element of the document and we support its inclusion.

Additions / Recommendations

We fully agree that water literacy principles be incorporated into place-based education and state of Michigan curriculum as a necessary step to help better inform our citizens. We also agree that increasing volunteerism and community engagement will help inspire stewardship. We have additional recommendations, however.

- We urge that on-going professional development for teachers be a mandatory requirement for the teaching of water literacy principles. Teachers must be well trained in order to teacher their students.
- We suggest a statewide public education campaign be launched. For example, it could be patterned after the Pure Michigan campaign with a slight variation, such as a Pure Michigan Water slogan. The benefit of a statewide public education campaign would augment current public education efforts in urbanized areas and would also target all citizens, not only K-12 students, to help instill the importance and value of water.
- The implementation table for Goal 9 discusses the development of a survey tool. We suggest the inclusion of questions that would assess the knowledge of local infrastructure assets, including sanitary systems, drinking water systems, storm sewers systems, and county drainage systems. Our experience indicates that quite often the public is not fully aware of the functioning of its infrastructure, and therefore, is not fully aware of its value and importance.

Areas that MWEA Can Contribute

The MWEA strives to engage its members in advocacy programs to support and enhance the impact of their efforts and to instill the value of water and underscore the importance of the water profession. In those two areas, especially, we feel we can assist with the effort to inspire stewardship of clean water and healthy ecosystems.

Groundwater Review Team:
Christine Spitzley and Wayne Kukuk

Introduction:

- Include the volume of calculated groundwater in the introductory paragraph. For example:
  With more than 11,000 inland lakes, 76,000 miles of rivers, 6.5 million acres of wetlands, ***550 trillion (5.5 x 10^{14}) gallons of groundwater****, and more than 3,200 miles of freshwater coastline—the longest in the world—leveraging the power and presence of this treasured natural resource and ensuring its long-term sustainability are critical to advancing Michigan's prosperity*

Chapter 2:

- Strongly support the need for **coordinated** and comprehensive GW monitoring--the second paragraph on page 50 is key
  - Agencies that have relevant information (MSU, MDARD, MDNR, MDEQ, USDA, USGS, EPA, et al.) need to be in intrinsic communication with each other on water-related issues in Michigan
  - Increased stream gauging and GW analyticals across the State
  - Make all monitoring results easily accessible to the general public
- Continued support of wellhead protection should be promoted and expanded
  - Including ALL public water supplies that use groundwater and/or surface water as their source of water

Chapter 9:

- Statewide education and marketing of water education utilizing existing materials. It should be a coordinated effort not a fragmented recreating of the wheel by local units of government who lack expertise and motivation
  - Something like the Groundwater Education in Michigan (GEM) project of days gone by…
- Outreach and education to include water in land use planning and decisions
  - There should be more emphasis on agricultural issues, i.e. location of Concentrated Animal Feeding Operations (CAFOs), manure management, fertilizer & pesticide application, soil erosion. There doesn't seem to be a great emphasis on agricultural operations in the Strategy.

MWEA Water Strategy Task Force Meeting

Date: July 25, 2015

To: Christine Kosmowski, Chair MWEA Water Strategy Task Force

From: Pete Cavagnaro, MWEA Member

Subject: Overall Review of Michigan's Water Strategy

The following are observations on the document titled "DRAFT, Sustaining Michigan's Water Heritage, A Strategy for the Next Generation" dated June 4, 2015 (Michigan's Water Strategy). Comments, Observations, and Requests associated with specific parts of the strategy are identified in a Table below. The following speaks to a subject that does not appear to be included in the current draft.

Water – Energy Nexus

In 2014, the US DOE published a report titled The Water-Energy Nexus: Challenges and Opportunities, Overview and Summary[1] (which updated a previous report from a US DOE lab regarding the Energy-Water Nexus).

> Present day water and energy systems are interdependent. Water is used in all phases of energy production and electricity generation. Energy is required to extract, convey, and deliver water of appropriate quality for diverse human uses, and then again to treat wastewaters prior to their return to the environment. Historically, interaction between energy and water have been considered on a regional or technology-by-technology basis. At the national and international levels, energy and water systems have been developed, managed, and regulated independently.

The US DOE has identified Six Strategic Pillars (listed below) to address the Water-Energy Nexus. Many of these are identified as issues in the Michigan Water Strategy. Michigan's Water Strategy should be expanded to describe how Michigan will interact and collaborate with neighboring states, states across the union, the national government, and other outside agencies, to achieving integrated solutions.

1. Optimize the freshwater efficiency of energy production, electricity generation, and end use systems
2. Optimize the energy efficiency of water management, treatment, distribution, and end use systems
3. Enhance the reliability and resilience of energy and water systems

[1] http://www.energy.gov/downloads/water-energy-nexus-challenges-and-opportunities

4. Increase safe and productive use of nontraditional water sources

5. Promote responsible energy operations with respect to water quality, ecosystem, and seismic impacts

6. Exploit productive synergies among water and energy systems

Acknowledgement

Those responsible for conceiving and preparing the plan should be complimented for the comprehensive plan prepared in the short span of time available. Of note is the focus on collaboration. The Summary of Current Michigan Water Protection Activities in Appendix 3 is an impressive and a testimony to the importance that Michigan has placed on the environment in general, and water in particular.

Thank you for the opportunity to comment. Please contact me at 734-255-5523 if there are any questions or requests.

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
1	-	Introduction		At the beginning of 2015, the World Economic Forum in its global risk report identified water crisis as the number one risk influencing the global economy.[1]		This statement is followed by a number of other references to the "world", each of which makes reference to the recognition that the world has on Michigan's water. Michigan is fortunate to have access to an abundance of clean water. There are many areas of this country,

DRAFT

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
						and the world who do not. Water has been described as the "oil" of the coming century. Having an abundance of water, Michigan will have unique opportunities for economic and social development. It also has a responsibility to be aware of national and global needs. The Vision for Michigan's Water Strategy should be outward looking as well as inward looking. There should be a chapter dedicated to the outward looking strategy.
11	1	Protect and Restore Aquatic Ecosystems	Prevent Introduction of and Manage Aquatic Invasive Species	Since the 1800s, more than 182 nonindigenous aquatic organisms, including animals, plants, bacteria and viruses, have colonized the Great Lakes ecosystem, forever altering its ecology. The introduction of AIS into the Great Lakes and inland waters has caused significant damage to the state's natural resources and many human uses. Of particular note, invasive mussels	*Work with other Great Lakes states and provinces to harmonize aquatic invasive species prevention, early detection processes, and response actions across the Great Lakes region.*	That this most excellent recommendation be expanded to include the Great Lakes states use their influence to lobby the USEPA in particular, and MARPOL in general, to develop new standards for discharge from ships entering the Great Lakes basin.

DRAFT

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
				have disrupted the energy flow,		
	35	Promote Water Based Economies	Market Michigan's Strategic Advantages	Michigan and other places across the globe face complex challenges in addressing water quality and quantity concerns. The state is well-positioned to be a powerhouse for solving these complex problems and grow its economic opportunities around water in a manner that ensures good stewardship of the resource. Collaboration among industry, regulators, economic developers and academia directing water research and development is the right place to start.	*Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.*	In addition to the abundance of natural water assets, is the excess capacity of water and wastewater treatment plants throughout the state, that provide capacity to those people and industries that would be interested in moving to Michigan to live and do business.
	36	Promote Water Based Economies	Optimize Efficient Use of Water in Business, Utilities and Municipalities	In addition, cleaning and purifying water for drinking water, manufacturing and discharge is very costly. Nationally, between 4 percent and 13 percent of all energy is used to pump and treat water, for waste management, or for industrial and commercial processes.	*Promote innovative technologies that reduce cost and water loss or convert waste products to usable materials.*	Nationally, approximately half of a local government's electric bill goes to pumping and treating water and wastewater. The Water Strategy should speak to the fact that regulatory changes may be required to allow and facilitate the type of innovation that will be needed to achieve this goal. Suggest expanding the

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
						importance of energy efficiency in water and wastewater utilities. Doing so will reduce local operating costs.
	36	Promote Water Based Economies	Optimize Efficient Use of Water in Business, Utilities and Municipalities	In addition, cleaning and purifying water for drinking water, manufacturing and discharge is very costly. Nationally, between 4 percent and 13 percent of all energy is used to pump and treat water, for waste management, or for industrial and commercial processes.	*Fund a pilot project, through a competitive bid process, for the initiation and evaluation of a new model for wastewater management. This pilot program will assess the opportunities and barriers to creating a "Water Resources Utility of the Future" focused on: ...*	Suggest that this section be expanded and that a permanent initiative to promote effective energy use. The New York State Research and Development Authority (NYSERDA) has been a leader in research and development in this area. Wisconsin's Focus on Energy's wastewater program has been recognized nationally. The California Energy Commission has also made important contributions. Suggest that Michigan's energy program needs to include an energy component focused on water and wastewater facilities (treatment and pumping)
	36	Promote Water	Optimize Efficient	Agriculture is another example of a	*Establish voluntary water*	Suggest including reference

DRAFT

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
		Based Economies	Use of Water for Agriculture	major water user in Michigan that has made significant advancements to improve efficiency. Water, energy and food are inextricably linked.	*efficiency targets for agriculture in areas of existing or potential water stress.*	to the Energy/Water Nexus (which some think is the Energy/Water/Agric Nexus). The interrelation of Energy and Water should be addressed in the Chapter on Economics.
42	6	Invest in Water Infrastructure		The state's infrastructure – roads, commercial ports, drinking water systems, sewer systems, energy plants, transmission systems and recreational facilities – form the backbone of the economy. All water withdrawn from the Great Lakes, groundwater, rivers, and lakes for any purpose passes through some form of water infrastructure; it is a complex system. A functioning water infrastructure system keeps the state running.		Experience has shown that investing in water and wastewater infrastructure stimulates local economies. Investment in water and wastewater infrastructure should be viewed as a contributor to economic development.
42	6	Invest in Water Infrastructure	Improve Understanding of the True Cost of Water	Through their water bills, Michiganders instead pay for the infrastructure to deliver safe drinking water and carry away and treat waste, and for the operating costs, like energy, to treat and condition water and maintain infrastructure. Those outside the area of a municipal water supply system pay for well	*Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water as well as the benefits infrastructure provides for drinking water, recreation,*	Recommend determining the amount of embedded energy in water supply (example of California) to inform people on the amount invested in delivering clear clean water.

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
				construction, treatment if necessary, the pump and the energy used to supply water to the tap. In addition, the cost of infrastructure to supply water is contained in the final price of all commodities and services.	*cultural and economic opportunity.*	
44	6	Invest in Water Infrastructure	Invest in Water Infrastructure	One of the biggest challenges facing communities is aging, deteriorating infrastructure systems with more operational needs than financial resources to meet them. Poor infrastructure degrades the value of water, results in costly efforts to mitigate impacts, and creates or increases drag on the economy. Communities can realize cost efficiencies to manage water infrastructure systems and to meet the needs of the future by increasing efficiencies in the delivery and treatment of water through implementation of energy efficiency measures, the use of technologies and a combination of grey and green infrastructure.	*Incentivize and require outcome-based asset management planning for all public water utilities that includes more efficient use of resources.*	Suggesting including that energy savings can be a source of funding of improvements using delivery methods such as Energy Savings Performance Contracting.
52	8	Build Governance Tools	Align Resources, Tools and Regulatory	Water resources are managed at various scales and by many levels of government. State-level regulations		A Recommendation is needed to communicate the local resources that facilitate

Page	Chap	Chapter Title	Topic	Text	Recommendation	Request
			Framework to Achieve Outcomes	and policies establish performance expectations for managing important water and water-related resources.		the Water Resources Facility of the Future. Tools such as the Michigan Waste Biomass Inventory need to be expanded.

DRAFT

MWEA Water Strategy Task Force

Date: July 31, 2015
To: Christine Kosmowski, Chair MWEA Water Strategy Task Force
From: Joe Goergen, Chair MIWARN
Subject: Overall Review of Michigan's Water Strategy
Comments on the document titled "DRAFT, Sustaining Michigan's Water Heritage, A Strategy for the Next Generation"

My comments are from someone affected by the document as well as from a member of the MWEA.

The document is a good "vision" for the waters of the state of Michigan. As a 30 year vision it is much larger, ambitious plan. It is necessary and the MDEQ needs to be applauded for generating such a documented strategic plan. The document is a Michigan "inward" perspective. This perspective takes ownership and responsibility much beyond the state boundaries. The plan needs to add "outward" perspective to include all the Great Lake states and Canada. A true watershed approach. The success of this plan hinges on the "buy-in" and commitment of the Federal Government, all the Great Lake States, Canada and the shipping community with ballast water exchange and treatment along with the Asian carp prevention measures, etc.

The Goals and strategies are broad and far-reaching. They impact MWEA members in many ways across the spectrum, Surface water, watershed management, Wet weather extremes, aquatic pollution, storm water, ground water, etc. Certainly not all the impacts are negative. We are in an industry that prides itself in recognizing, measuring, treating, protecting health and environment as well as renewing the water resources of the state of Michigan.

MDEQ and the state needs to understand most of these goals and strategies cannot be addressed with a "one size fits all" approach. Site specific strategy was not mentioned though is very real in achieving the CWA goals. Revising sanitary code, infrastructure needs and funding, banning micro-beads, aquaculture, waste streams, and non-point source water stress locations all are areas that MWEA members are intricately woven into this strategy. Ideally the plan will come with the needed funding To "invest" in the infrastructure and protection of water quality.

Mercury reductions cannot be achieved with a Michigan only strategy since well over 90% of the source Hg to the Great lakes is from air deposition from outside the state borders.

Goal #5 looks to have been excerpted from NACWA's "Utility of the Future" publication.

Understanding the water energy and quality of life interconnections is essential to the plan. As is the return on investment cited as 3:1 & 6.6:1 for water resource assets.

The references to technical and financial support and seek and secure long term funding are code for more fees and taxes. Which translate to increased user fees and debt in a slow economy with many areas of the state struggling to recover economically.

COMMENTS ON DRAFT SUSTAINING MICHIGAN'S WATER HERITAGE: A STRATEGY FOR THE NEXT GENERATION

The Water Strategy is organized around nine goals and outcomes and provides recommendations for the implementations of each. Those that relate most closely to the community colleges in the state and Northwestern Michigan College (NMC) specifically are:

Goal 5 Promote Water-Based Economies – Michigan needs to collectively build robust multi-sector and multidisciplinary public-private partnerships between business, industry, academia, private capital and government. These partnerships will link ideation, invention and innovation, research and development, capital investment and end users. This approach will bring technologies to the market to better manage and solve water challenges in Michigan and across the globe. Directed research and development to address specific water challenges should provide the basis for forming a new paradigm of collaboration.

Outcome: Policies and innovative technologies are developed and adopted to grow and promote water-based economies

Recommendation #1: Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.

> ***NMC Comment:*** *Position Michigan as a world-class fresh water destination for water based technology development and business location, specifically in the fields of sonar/acoustic applications and marine platforms including autonomous underwater vehicles where technology is developed, employees are trained and businesses are created which have global reach.*
>
> *Additionally, utilize Michigan's maritime education and training presence to enhance Great Lakes shipping options including clean diesel, biofuel development/testing and transportation strategies (short sea shipping).*

Recommendation #7: Create a strategic focus on water innovation to attract and accelerate new technologies to market through a business-led council comprised of private investors, entrepreneurs, corporations, public agencies and universities to better manage water challenges in Michigan and worldwide.

NMC Comment: *Include community colleges in this discussion as several Michigan community colleges already have strong business relationships with industry as it relates to water. Michigan community colleges serve as access to the Michigan New Jobs Training Program which can provide a mechanism for training of new positions created to expand water-related industry sectors.*

NMC charge: *Convene all Michigan Community Colleges to capture breadth of education and training applicable to water in the State, particularly as related to workforce development, while fostering new/additional collaborations that would benefit Michigan's water strategy.*

Goal 7 Monitor Water Quality – Michigan needs to develop and fund a coordinated, long-term monitoring strategy to provide baseline and trend information about surface and groundwater quality and quantity. This information is necessary to base decisions and best direct actions and future investments to support healthy people, ecosystems, communities and economies.

Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.

Recommendation #3: Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies.

NMC Comment: *Include in this funding source, availability of funding for surface water monitoring equipment including, but not limited to buoys and allow for the applicability of this funding to include community colleges.*

Goal 9 Inspire Stewardship for Clean Water – Most importantly, Michigan residents need greater opportunities to learn about water. Michigan is surrounded by 20 percent of the world's fresh surface water, and with that comes a deep ethical obligation to be good and thoughtful stewards of this global treasure. A shared water ethic will guide Michigan into the future and ensure our children and future generations will have the same or better quality of life than we have today. The durability of this Strategy and ensuring the health of our water resources for generations to come depends on creating a culture of stewardship through lifelong education about water.

Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding water resources.

Recommendation #1: Integrate water literacy principles into place-based education and State of Michigan curriculum standards tied to Science, Technology, Engineering and Math (STEM) across all grade levels.

NMC Comment: *Utilize existing expertise from the State's community colleges to support the development and implementation of water literacy education into State of Michigan curriculum standards. Provide support for guided/connected pathways toward post-secondary education relating fresh water opportunities.*

NMC Comment: *Position the state as the premier educational destination in the nation for education and continuing education ranging from applied technologies through advanced post-doctoral research.*

NMC Charge: *Develop and present a comprehensive inventory of the state's post-secondary water related programming for the purpose of stimulating discussions and an action plan for a national effort in student recruitment as Michigan is a world-class fresh water destination for water based education, technology development and business location.*

From: stengeljohn@sbcglobal.net
To: mi-waterstrategy
Subject: NOT NEEDED
Date: Sunday, August 23, 2015 8:53:35 AM

Sent from Windows Mail

From:	Atkinson, Alyssa A
To:	mi-waterstrategy
Cc:	chersey@pscinc.com; Nash, James H
Subject:	Oakland County WRC - Comments on MI Water Strategy
Date:	Wednesday, August 26, 2015 9:44:55 AM
Attachments:	Signed_OCWRC_CommentOnDraft_MIWaterStrategy.pdf

Please see attached for Oakland County Water Resources Commissioner Jim Nash's comments on the draft of the Michigan Water Strategy.
A hard copy is also being mailed to the office of Jon Allan.

Thank you,

Alyssa Atkinson
Assistant to the Commissioner
Oakland County WRC
(248) 858-0967

53RD DISTRICT
STATE CAPITOL
P.O. BOX 30014
LANSING, MI 48909-7514
PHONE: (517) 373-2577
FAX: (517) 373-5808
E-MAIL: jeffirwin@house.mi.gov

MICHIGAN HOUSE OF REPRESENTATIVES

JEFF IRWIN

STATE REPRESENTATIVE

August 11, 2015

Office of the Great Lakes
Michigan Department of Environmental Quality
P.O. Box 30473-7973
Lansing, Michigan 48909

To whom it may concern:

I congratulate the Office of the Great Lakes for your admirable work in drafting a comprehensive water strategy plan. Such forward thinking is particularly necessary in Michigan because of our extraordinary fresh water resources and Great Lakes shorelines. I am grateful for the opportunity to offer constructive comments on the draft on behalf of my constituents. There are three main areas that should be expanded in the final strategy: dealing with climate change, providing for increased stormwater infrastructure, and implementing Michigan's mercury emissions rule.

Climate change is already having an impact on water quality, systematically influencing everything from invasive species to toxic cyanobacteria blooms to catastrophic precipitation. Because the water strategy is meant to be an accurate guide for future action and decision making, it must include an analysis of how climate change will affect water-related environmental outcomes and the methods we plan to use to achieve better outcomes. This analysis should not be confined to a single area of the strategy. The effects of climate change pervade almost all the areas discussed in the draft strategy, so every chapter should include a discussion of climate trends as they relate to each topic. We cannot plan for the future without considering the best scientific predictions of what will happen in that future.

I also believe the draft strategy would benefit from an explicit commitment to address the challenges and opportunities around stormwater management in our state. As recent events have demonstrated, the Atlas 2 statistical model for 100-year storm events was a gross underestimate for Michigan. Climate change will only make these instances of extreme precipitation more frequent, exacerbating contamination from runoff and overloading antiquated municipal stormwater systems. Many municipalities, including my own district of Ann Arbor, are struggling to accommodate record amounts of runoff and to separate storm and sanitary sewers. Municipalities are very limited in their ability to raise the revenue needed for overhauling stormwater infrastructure, due to a Michigan Supreme Court decision requiring voter approval of stormwater fees. This water strategy should include a strategic path for communities to satisfy their stormwater management needs, coupled with a call for the Legislature to authorize tools such as improved stormwater utilities.

ecosmart GREEN INKS
Recycled Paper

Runoff is a major source of pollution by phosphorus, nitrogen, and pathogenic bacteria in surface water. In order to reduce runoff contamination, the state water strategy should include a recommendation for funds to enable local governments to improve stormwater infrastructure. These funds, in the form of grants or revolving loans, should be available not just for conventional stormwater management but also for bioswales, permeable surfaces, downspout disconnection programs, and other green infrastructure initiatives to mitigate flooding and runoff.

Finally, it is vital that the water strategy include plans to enforce a state rule to protect Michiganders from mercury, in the wake of the Supreme Court decision vitiating the federal mercury emissions rule. The draft strategy recognizes that mercury emitted from power plants is the major contributor to making fish unsafe to eat in our state. The final version of the water strategy should include a strong recommendation that MDEQ fully implement and enforce its Part 15, Air Quality Rules, MAC R.336.2501-2513, to timely reduce mercury emissions from coal-fired power plants. This state rule was in abeyance while the federal Mercury and Air Toxics Standards (MATS) rule was in effect, but the state rule has a clause reinstating it now that the MATS rule is no longer applicable. If the federal government cannot act to save lives and prevent disability in Michigan, our state government must step up to protect our citizens from the deadly effects of mercury.

Thank you again for your work on this strategy to safeguard the people of Michigan and the water resources on which we all depend. I appreciate your careful consideration of the areas of potential improvement I have identified for our state's strategy.

Sincerely,

Jeff Irwin
Representative, 53rd District

CC:
Evan Pratt, Washtenaw County Water Resources Commissioner
P.O. Box 8645
Ann Arbor, MI 48107-8645

James Clift
Michigan Environmental Council
602 W. Ionia Street
Lansing, MI 48933

From:	Campbell, Laura
To:	mi-waterstrategy
Subject:	OGL Draft Water Strategy Comments
Date:	Tuesday, August 25, 2015 5:05:21 PM
Attachments:	MFB Comments on OGL Water Strategy.pdf Draft Water Strategy and Appendices Laura Campbell comments.pdf

---

Attached please find Michigan Farm Bureau's comments on the Office of the Great Lakes' draft Water Strategy, along with the attachment referenced in our comments reflecting earlier red-line strikeout comments on the original Strategy draft. Please feel free to contact me with any questions.

Thank you,

Laura A. Campbell
Manager, Ag Ecology Department
Michigan Farm Bureau
Office: 517-679-5332 Cell: 517-420-7936
Email: lcampbe@michfb.com