Michigan's Water Resource Utility of the Future

Michigan's
Water Resource Recovery Leadership Summit

Prepared for

Michigan Department of Environmental Quality

Water Resources Division

By

michigan water environment association mwea the water quality people

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Table of Contents

Conventions

WERF vs. WE&RF

Subsequent to the Water Resource Recovery Leadership Summit on April 8, 2016, the Water Environment Research and Water Research Foundations joined to form the Water Environment & Reuse Foundation (WE&RF). All references to WERF have been changed to WE&RF.

Water Resources Utility of the Future vs. Water Resource Recovery Facility

The term Water Resources Recovery Facility (WRRF) will be used to represent the same concepts and ideas as the term Water Resources Utility of the Future (UOTF).

Wastewater Treatment Plant vs Water Resource Recovery Facility

This document describes the transformation of the wastewater industry towards resource recovery. For the purpose of clarity and continuity all facilities will be referred to as Water Resource Recovery Facilities. Where specific facilities are referred to, efforts are made to respect the legal name of the facility.

Water Resource Recovery Facility of the Future

The term Water Resource Recovery Facility of the Future used in the Michigan Water Strategy shall be taken as being synonymous with the term Water Resource Utility of the Future used in this document.

Transformation

The wastewater industry is undergoing changes that may be more profound than at any time in its history. Those changes will have a major impact on the industry and those who are a part of it.

In 2013, the National Association of Clean Water Agencies (NACWA), Water Environment Federation (WEF), and the Water Environment Research Foundation (now Water Environment and Reuse Foundation (WE&RF)) released the *Water Resources Utility of the Future… Blueprint for Action*.[1] The document was prepared in response to unprecedented challenges faced by the wastewater industry and the need to change traditional ways of thinking to meet these challenges. **Water Resources Utilities of the Future (UOTF) produce clean water, protect the Great Lakes, recover nutrients (such as phosphorus and nitrogen), generate energy, utilize green infrastructure, and contribute to the sustainability of local communities**.

A successful transformation to the UOTF approach will achieve beneficial outcomes for environmental, social and economic improvements, commonly referred to as the triple bottom line.[2] It is of utmost importance that everyone realize that this will be accomplished without relaxation of water standards or treatment while moving Michigan to better water quality overall.

The transformation is not just a physical challenge or change, however. It is also a cultural one. The road we decide to travel will affect our industry, engineering firms, construction contractors, equipment companies, laboratories, public officials, and local communities large and small.

Today there are 393 municipal wastewater treatment plants in our state. Collectively, those who work in those plants are responsible for more than 1.364 billion gallons of wastewater daily. That's an incredible daily achievement. It benefits millions of us in Michigan.

The Water Resource Recovery Leadership Summit was conceived as a way to introduce the Utility of the Future Concept to Michigan's wastewater leadership and to obtain feedback on barriers to implementation and conditions that might favor implementation of the concept throughout the state.

I invite you to take time to read and learn more. After you do, I think you will agree that the Water Resources Utility of the Future concept and the potential we have to make that vision a reality by working together, is indeed, awesome.

Peter V. Cavagnaro, P.E.
Lead Author / Editor: Recap of Michigan's Water Resource Recovery Leadership Summit

Chapter 1: A New Challenge

In June of 2015, Ed McCormick of Oakland, California, then president of the Water Environment Federation (WEF), spoke at the opening session of the annual conference of the Michigan Water Environment Association (MWEA). Mr. McCormick's presentation on the Water Resource Utility of the Future (UOF) included a vision for improved energy, nutrient and solids recycling and recovery at Water Resource Recovery Facilities (WRRFs) throughout the country. This vision sparked an impassioned interest in Mr. William "Bill" Creal, then Chief of the Water Resources Division (WRD) of the Michigan Department of Environmental Quality (MDEQ), regarding the opportunities these concepts provide for communities in Michigan.

Later that year, Mr. Creal proposed, with the support of the Governor's office and the head of DEQ, to develop recycling metrics for the state's Water Resource Recovery Facilities (WRRFs). The metrics focus on biosolids, nutrients (nitrogen and phosphorus), and energy resources. In late summer, WRD leadership invited the Michigan Water Environmental Association (MWEA) to review and comment on draft metrics. The metrics were reviewed and feedback was provided to WRD. The metrics were presented at the Michigan Water Environment Association (MWEA) Sustainable Energy Seminar on October 20, 2015.[3]

Implementation of recycling metrics at Michigan's WRRFs was an important step towards establishing a vision for Water Resources Utilities of the Future in the State of Michigan. The next step was formation of a joint MDEQ/MWEA task force to discuss the opportunities. These discussions led to MWEA submitting a grant proposal to MDEQ to develop and explore ideas to assist in launching a program to promote recycling at the state's WRRF's. After review, the grant proposal was eventually approved by DEQ in January 2016. The desired outcome of this effort is creation of a roadmap for implementing those ideas. The following tasks were established to help reach these objectives.

- Task 1 - Grant Management (ongoing)
- Task 2 – Recycling Metrics & Baselines (includes energy survey)
- Task 3 – Roadmap Literature Review
- Task 4 – Michigan WRRF Recycling Summit
- Task 5 – Summit Recap Document and Roadmap
- Task 6 – Recognition Program Recommendations
- Task 7 – Outreach Program

The following document was prepared in fulfillment of Task 5 – Summit Recap Document and Roadmap. The activities associated with Task 5 were to include:

- Documenting information shared & gained during the Summit.
- Documenting information gathered during topics identified during the Summit.
- Updating Vision Statement.
- Offering suggestions for adjusting Recycling Metrics, developing baseline, and establishing benchmarks.

- Organizing recommendations as an action plan for consideration by MDEQ.
- Preparing a vision document for Michigan Water Resources Recovery Facilities.

The work product was to be a "Summary of subjects and information generated during the Recycling Summit," and a "Michigan Water Resources Utility of the Future (Roadmap)." The subject matter of the proposed document was diverse. One part looked to the past. The other to the future. For this and other reasons, the work product was divided into two volumes:

- Michigan's Water Resource Utility of the Future, Recap of Michigan's Water Resource Recovery Leadership Summit.
- Michigan's Water Resource Utility of the Future, A Vision for the Transformation of Michigan's Wastewater Industry to Water Resource Recovery Facilities.[1]

> ***The wastewater industry is in need of renewal. Are we going to replace it with 30-year-old technology, or create the water resources Utility of the Future?***
>
> William Creal, February 2016

[1] The reader will probably note reference to Water Resources Recovery Facility (WRRF) instead of Water Resources Utility of the Future (UOTF). The term WRRF will be used in this document to represent the same concept as the term UOTF.

Chapter 2: Michigan's Water Resources Leadership Summit

Introduction

The Water Resource Recovery Leadership Summit (Summit) was organized in three sections. The first presented information about Michigan DEQ's vision, information and insight on the state of the industry, a wastewater recycling metrics initiative, and an energy survey that has been initiated.

The second section focused on describing the Water Resources Utility of the Future, the concept of Water Resource Recovery Facilities, the N-E-W paradigm, and resources available to guide the transformation from WWTP to WRRF.

The third section was an opportunity for participants to meet and share insights and information in Focus Groups; followed by a report out by the Focus Groups.

The following document presents a summary of the Water Resource Recovery Facility Leadership Summit conducted on April 8, 2016.

Presentations

Presentations given at the summit are available on the Michigan Water Environment Association web site, at:

http://www.viethconsulting.com/projects/presentations.php?org_id=MWEA&pid=3818429

Following the welcome and introductory remarks by Jerry Harte, Pete Ostlund[4] spoke of how in the mid-1900s it was a struggle to get municipalities and industries to implement very basic forms of treatment. The 1970s saw passage of the federal Clean Water Act, followed by implementation of controls for toxic materials based on science in the 1980s. In the 1980s and 1990s combined sewer overflow control efforts started, followed by sanitary sewer overflow control efforts in the 1990s and 2000s. The city of Flint drinking water crisis has brought a renewed attention to the need for properly investing in water and wastewater infrastructure. On March 31, 2016, Governor Snyder announced appointments to the new 21st Century Infrastructure Committee, recommendations due by November 2016.

Mr. Ostlund explained that a partnership had been formed between the Department of Environmental Quality's Water Resources Division (WRD) and the Michigan Water Environment Association. One aspect of that partnership is moving the vision of Water Resource Recovery Facilities into reality in Michigan. Implementing water resource recovery principles has the potential for improving environmental, economic, and social outcomes and for achieving a paradigm shift from simply managing wastewater to the sustainable management of resources.

Finally, he thanked those present for their active participation in the Water Resource Recovery Leadership summit, and for their efforts in achieving this vision. The efforts performed at the Summit, such as providing feedback, identifying barriers, and identifying solutions as part of the five focus groups this afternoon, will go a long way toward establishing the vision and building momentum for creating the water resources utility of the future.

Ed McCormick[5] explained that historically, water pollution agencies have focused on treating waste, and speaking in terms of wastewater and sludge. He then described the Water Resources Utility of the Future, citing the efforts of East Bay Municipal Utility District (East Bay MUD) to become the first Water Resource Recovery Facility in the US to generate sufficient power to meet all its needs and export the balance. Mr. McCormick spoke of the Water Energy Nexus, given the energy sector being the second largest user of water after agriculture, and energy being one of the highest cost centers for water treatment and transport. Reference was made to the importance of agriculture/food to the nexus, and the challenges associated with managing water resources. Ed suggested that, given that 80% of the energy in wastewater is **thermal,** coupled with Michigan's long cold winters and hot summers, that recovery of heat from wastewater interceptors should be strongly considered. This simple technology is currently being used successfully in Japan and northern Europe.

Figure 1 Utility of the Future Today Categories

The concept of Water Resources Recovery Facility is gaining momentum, with driving forces based on environmental sustainability, water resiliency, and economic benefits. The WRRF concept revolves around the Nutrient-Electric-Water (N-E-W) paradigm. There is interest gaining in the addition of stormwater to this mix (N-E-W-S). The focus is on the products that are recovered rather than the raw material(s). Benefits of recovering phosphorus were described, as were the concepts of codigestion of food waste that keeps materials such as fats, oils, and greases out of the wastewater collection systems. Mr. McCormick defined the emerging transformation of the wastewater industry as moving from treatment only to becoming manufacturing facilities – "green factories" that produce valuable products for society including renewable electricity, heat, transportation fuel, fertilizer, soil amendments, phosphorus, and recycled water.

Mr. McCormick's presentation included announcement of the then-soon to be released Utility of the Future – Today Recognition Program, in which a WRRF could apply for recognition in any of eight categories, so long as Organizational Culture was one of at least two categories applied for. In August 2016, the City of Grand Rapids, Michigan was notified that they were one of only 60 North American WWRF's to be recognized by EPA, WEF, NACWA, WateReuse and WE&RF as a "Utility of the Future – Today!"

Charlie Hill[6] spoke on the initiative undertaken by the Water Resources Division (WRD) of Michigan Department of Environmental Quality to monitor recycling efforts at the state's Water Resource Recovery Facilities. WRD has proposed, with the support of the Governor's office and the head of DEQ, to develop "recycling" metrics, with a goal of establishing a vision or roadmap towards a Water Resources Utility of the Future.

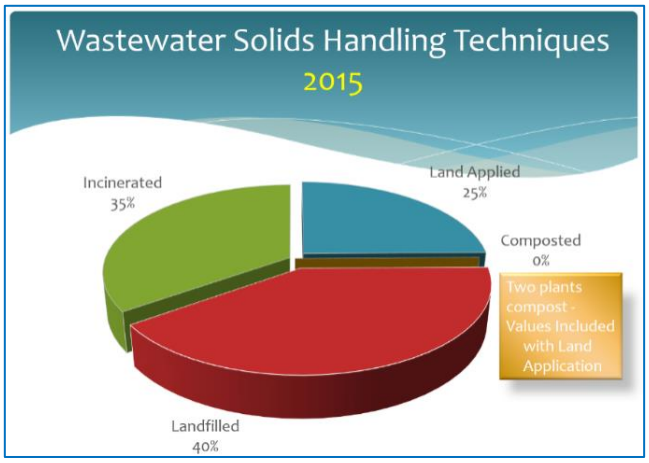

Figure 2 Michigan WRRF Solids Handling Techniques

The metrics identified to date, focus on biosolids, nutrients (nitrogen and phosphorus), and energy resources – consistent with sustainability metrics discussed for WRRF's. Mr. Hill explained existing recycling efforts within the State of Michigan: The current estimate of biosolids recycling is 22%, Phosphorus is at 14%, and Nitrogen at 6%. All are expected to increase significantly when the Great Lakes Water Authority (GLWA) biosolids dryer is fully operational. The goals of the initiative are:

- Solid Waste Recycling Goal is to double recycling rate from 15% to 30% in 2 years
- Wastewater Recycling Goal to be similar?
- Ultimately, maximize beneficial reuse
- Continue to promote and encourage such efforts

Christopher Conn[7] described the Energy survey that started with a group of large WRRF's in Michigan. The first efforts are to establish the baseline energy consumption at the largest WRRF's in Michigan. Sixteen (16) facilities have participated in the survey & representing approximately 68% of the State's treated wastewater.

The goal is to determine how much energy is used to treat wastewater and where and how that energy is used. The next step will be to establish energy benchmarks for Michigan WRRFs. The survey has collected information on electric consumption and demand, natural gas consumption, information on plant process, and influent flows and loads.

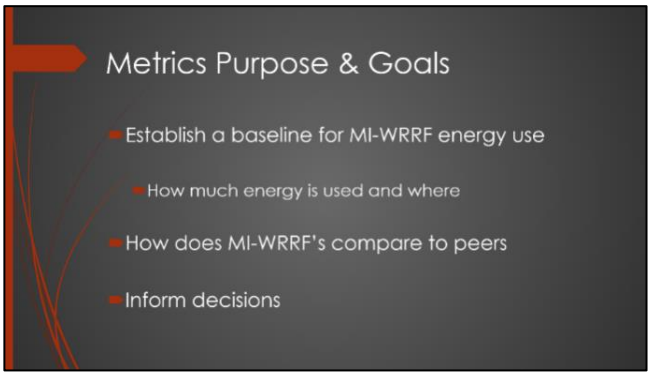

Figure 3 Michigan Energy Survey

Barry Liner, PhD[8] spoke of the Water Environment Federation's Energy and Nutrient Roadmaps, as well as technical resources available to those embarking on the journey to becoming a Water Resources Utility of the Future. Dr. Liner explained that compounds in wastewater that had previously caused maintenance problems, such as struvite, are now being captured and turned into products such as

fertilizer pellets. Another example was the collection and processing of recoverable oil from restaurants, keeping the material out of collection systems, thereby reducing maintenance and the potential for sanitary sewer overflows (SSOs). Other new technologies were described, along with an introduction to the Blue Tech Forum. He explained the possibilities for use of digester gas, including power generation, exporting power, and exporting pipeline quality gas.

Dr. Liner described a number of resources, including: the Utility of the Future Blueprint for Action; The Framework for Direct Potable Reuse; The Nutrient Roadmap; The Energy Roadmap; and the LIFT Program.

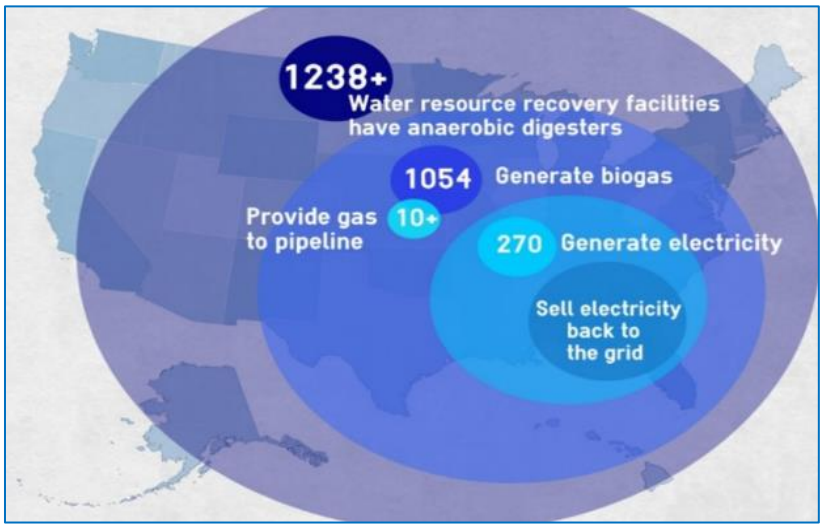

Figure 4 WRRF Anaerobic Digester Statistics

Lauren Fillmore[9] spoke of the Water Environment & Reuse Foundation's work over the past ten years to integrate Science and Practice. In that time, a body of knowledge has been developed around biosolids to energy solutions, including best practices that may reduce the demand for energy by up to 40 percent. The focus today is on management of carbon to maximize energy conversion: enhancing anaerobic digestion; promoting co-digestion; exploring heat recovery; short-cut nitrogen removal; and technologies to recover the remaining potential of biosolids. Lauren explained that the cutting edge is high value carbon products, which can be expected to evolve over the coming decade. Ms. Fillmore described WE&RFs efforts towards benchmarking of WRRFs. The fundamental question has been whether to base benchmarks on flow or load, however, plant specific differences are too great to establish generic energy targets. Operational variations and control of microbial processes are complex, and blower demand is not a direct function of organic load.

WE&RF research has revealed a list of barriers to energy related projects. The first is economic. Simple Payback is too short a metric for analysis of infrastructure investment with 30-50 year life span and a switch to life cycle financial decision making is needed. Financing for capital projects is not readily available and innovative sources of funding such as grants, incentives, energy savings performance contracts, and public private agreements should be considered. She noted that distributed power generation is important for resiliency of public infrastructure, and may be an important point in obtaining funding for energy related projects. Another approach is to consider incorporating energy efficiency with new projects as being more cost effective than retrofitting existing facilities.

Leaders Innovation Forum for Technology (LIFT) is a WE&RF/WEF initiative to identify, screen, and evaluate new technologies and share the risk and cost of conducting demonstrations. The process for evaluating new technologies and the associated LIFT Focus Areas were described.

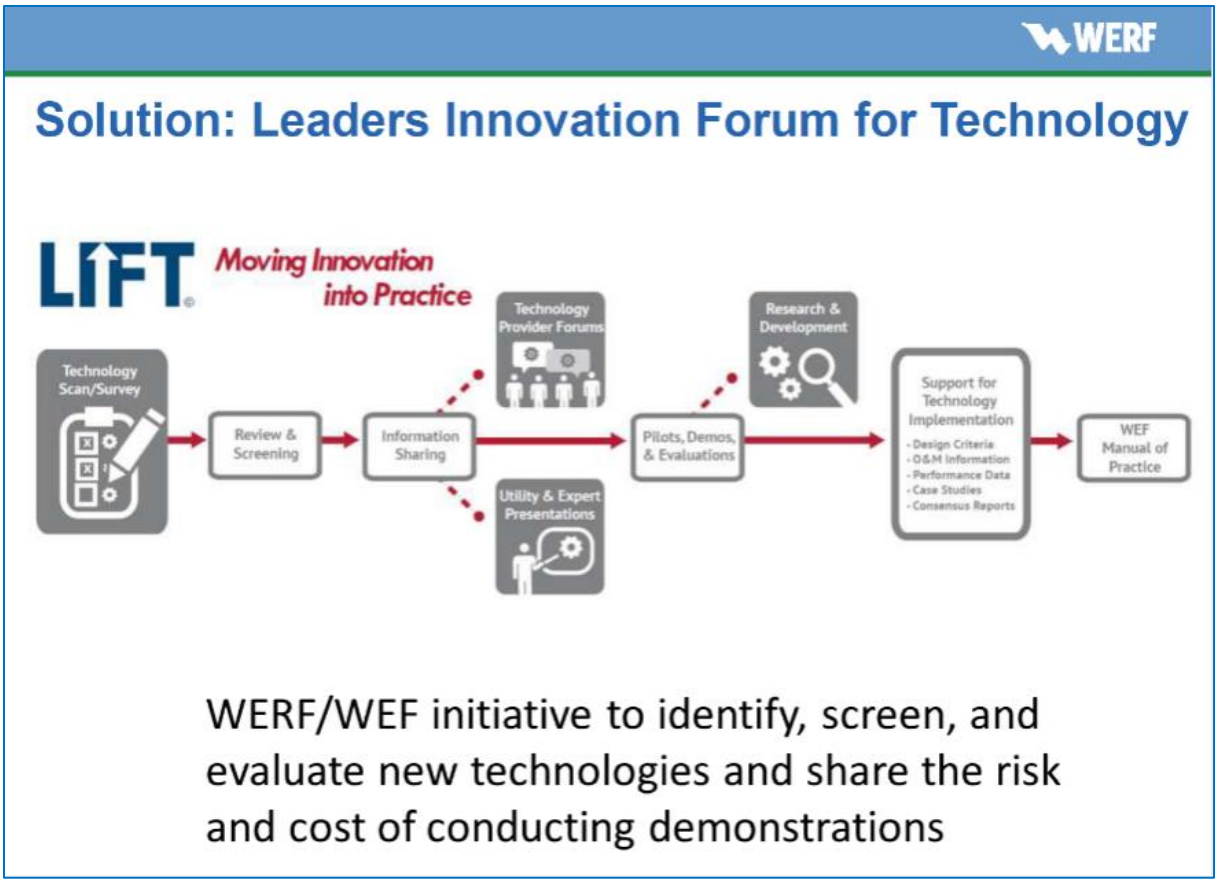

Figure 5 Leaders Innovation Forum for Technology Process Chart

Scott Hutchins[10] spoke of the US Department of Energy involvement in the water sector. The DOE was the first to note the direct connection (nexus) between water and energy. Strategic Pillars for DOE were noted, as was the recognition of water as an industrial sector, with entry of 19 water and wastewater utilities into the DOE Better Plants program.

There are 24 University based Industrial Assessment Centers (IACs) across the US that are now providing free assessment for small and medium sized water and wastewater plants.

A variety of tools, available online[11], are available from US Department of Energy (US DOE).

Other DOE assistance is available from the Combined Heat and Power Technical Assessment

Mr. Hutchins highlighted the recent Energy Positive Water Resource Recovery Workshop conducted in April 2015, which built upon previous work of WEF, WE&RF, NACWA, EPRI, USDA, DOD, and the three hosting agencies (DOE / EPA / NSF)

Figure 6 Water Resource Recovery Facility of the Future

Steve Tarallo[12] spoke of the research project to identify the most effective way for WRRFs to achieve energy neutrality, or Net-Zero Energy. Mr. Tarallo explained that a WRRF that is energy neutral generates 100 percent or more of the energy needed for operations solely from the energy embedded in the water and wastes it treats.

Mr. Tarallo provided an overview of the WE&RF ENER1C12 research project that explored pathways for WRRFs to achieve Net Zero Energy. Energy models were prepared for 25 typical and 25 best practices WRRF configurations, and Sankey Diagrams were used to show the flow of energy between each unit process. Key Findings of the project were:

- Use of best practices to minimize energy use, including:
  - Clean and properly maintain fine-bubble diffusers
  - Use high-efficiency motors and generators, operating near design points
  - Maximize solids capture in solids processing
- Maximize primary sludge capture efficiencies
- Co-digestion of high-strength waste in anaerobic digesters is a valuable approach to achieving energy neutrality
- Use anoxic zones for energy recovery in nitrification plants
- BOD removal-only and nitrification facilities can be net energy positive utilizing established technologies.

- Mainstream short-cut nitrogen removal is required to push energy neutrality beyond 50-60% for BNR and ENR facilities
- Dewatered biosolids retain a significant portion of influent chemical energy
- Thermal energy in wastewater is a significant resource that is underutilized in the U.S.

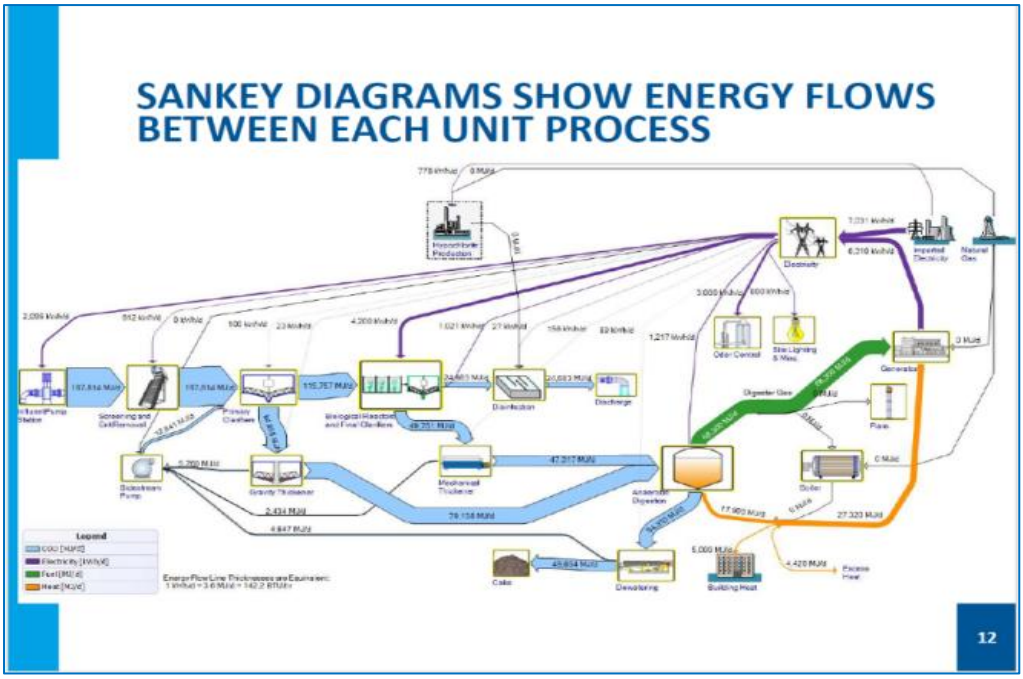

Figure 7 Example Sankey Diagram

Nancy Love, Ph.D.[13] spoke on the relationship between Sustainability and Innovation. Dr. Love explained that those facilities constructed when the Clean Water Act was first passed have exceeded or are approaching their design life, thereby providing opportunity for innovation. Whereas plants were originally designed to protect public health by removing pathogens, the role has expanded to include protection of the environment by removing oxidizable organic carbon, nitrogen and phosphorus. Conventional, centralized, wastewater treatment facilities, have evolved in stages, adding technology with each new goal. The result has been achievement of high effluent quality with plants that are not optimized for energy or resource recovery.

Dr. Love explained that if the oxidation state of material in the waste stream were to be considered, different processes would evolve that use less aeration. She spoke of collaborative efforts with university to university relationships and utility to university relationships that facilitate innovation and have resulted in new technologies and operational concepts that reduce energy requirements and lead to recovery of important resources.

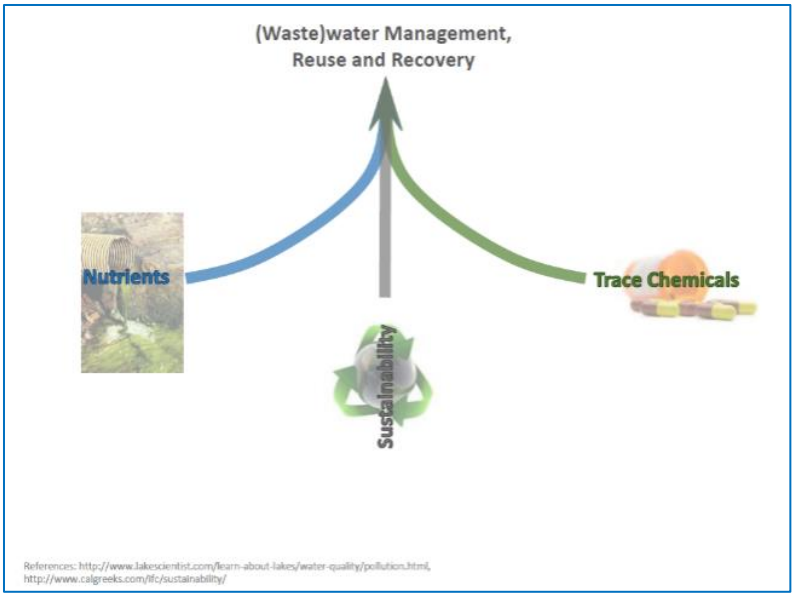

Figure 8 Wastewater Management Reuse and Recovery

Glen Daigger, Ph.D.[14] spoke on the need for leadership as the industry is at the threshold of a new paradigm. He spoke of the difference between prudence in deciding how to move forward as compared to conservativism, which is doing what we have always done. Courage is required to set the bar high, meeting the regulatory requirements is the minimum standard that should be accepted. Pursuing the concept of the WRRF will benefit the community in many ways including lower costs.

Dr. Daigger further observed that the world is changing, and that in a changing world, the riskiest think is to keep doing what you have always been doing. The safest path is changes. Infrastructure needs to be replaced, and old solutions will not meet future needs. Consideration should be given to repurposing existing facilities and technologies to meet new needs.

Adam Krantz[15] described the National Association of Clean Water Agencies (NACWA) role in representing and advocating for WRRFs, nationally, and locally, with seven utility members in the State of Michigan. NACWA led the work with WEF and WE&RF on the Water Resources Utility of the Future Blueprint for Action, and the annual report on progress of this initiative. Mr. Krantz explained how integrated planning allows consideration of affordability, innovation and prioritization for infrastructure investments and resource recovery. He spoke at length on the importance of this initiative, encouraging all those present to take a leadership role within their own agencies.

Figure 9 WRUOF Graphic

Chapter 3: Focus Groups

Metrics and Benchmarking[16]

The discussion centered on monitoring of nutrients in Water Resource Recovery Facility (WRRF) influent and power usage at facilities. Overall, participants recognized the benefit of establishing nutrient and energy metrics and benchmarking and generally agreed with the proposed methods.

The general conclusion from group discussion regarding a nutrient and energy metrics and benchmarking process can be summarized as:

- Facilities should collect and report pertinent nutrient and energy data.
- Report data to DEQ. There is data already being collected that could contribute to these efforts that is not currently being reported. Examples cited during the summit included reporting of influent phosphorus levels; influent and effluent values for TKN; and energy consumption. Participants suggested the use of MiWaters as an effective tool for reporting this information.
- DEQ should compile and analyze data. The analysis should factor the size of the facility, and normalize the data to the organic loading to the plant.

There were recommendations to consider other metrics, such as infiltration/inflow, staffing & training, facility improvements, electric rates, and construction permits. Training of site staff was also reported as a metric to consider.

Regulatory Challenges[17]

Interconnect Requirements: Of paramount importance under regulatory challenges are the impediments to distributed generation (on-site generation of power by solar, digester gas, or other sources). Michigan energy regulations currently allows for net metering and interconnection from distributed and renewable sources, however, there are limitations that could affect the full realization of power generation at WRRF's. For example, net metering programs currently limit the amount of power from on-site generation to qualify at 150kW. On the interconnection side, one participant identified the challenge of being penalized by the electric utility for periods when they ran on-site power turbines due to stringent power factor restrictions. Participants identified the low rate paid for power exported to the grid, combined with technical and financial hurdles with interconnection requirements as discouraging factors for achieving full investment in resource recovery projects.

An alternative model is needed to de-couple volume-based sales of the electric utility & profitability to encourage the development of distributed power, and to reward the electric utility for implementing energy efficiency programs. An ideal model would include provision for assistance by electric utilities to help shepherd connection to the grid from decentralized and renewable power sources.

Industrial Pretreatment Program: Industrial Pretreatment regulations are perceived by some as a barrier to accepting off-site wastes for co-digestion. Participants identified a need for guidance and compliance assistance by regulatory authorities on this topic. There is no indication in Industrial Pretreatment regulations that diversion of high strength wastes from an industrial source to a properly sized and well mixed digester designed to process the combined mixture of

sludge and high strength waste fall under the requirements of Industrial Pretreatment regulations. To the contrary it has been well documented that co-digestion can improve digester operability and performance. Participants expressed a need for clarification by regulatory authorities to allow co-digestion at publicly owned facilities, as long as the system is well designed, operated and maintained.

Part 41 Construction Permit Design Standards: A concern was expressed that the technical review requirements of Part 41 Construction Permitting prevent the use of technologies that would be used for energy reduction, nutrient recovery, and/or water reuse. Concern was additionally expressed regarding the risk of enforcement due to temporary exceedances of permit limits during startup or trials of innovative technology.

Some favored the *hybrid* regulatory approaches being used in the biosolids program (regulation + advocacy + outreach). Reference was made to the favorability of market approaches to pollution control.

Funding[18]

While regulatory requirements are the number one driver for moving projects forward, lack of funding is the major obstacle cited for moving projects forward. However, a range of sources have been used in the State of Michigan to fund projects at wastewater treatment plants. The sources are nothing like the Construction Grants program of the 1960's and 1970's, but can substantially reduce the costs and financial risk to a community, using a portfolio of funding sources. These sources include SRF and WIFIA loan funding, as well as a variety of smaller grant and loan programs.

Most discussions around the future of project funding start out with the same premise. The facts are simply this, either rates will have to rise to keep up with aging infrastructure and to support innovation or these programs would have to somehow fund themselves. The answer actually lies firmly between these two scenarios and will vary from plant to plant.

In general, mounting debt in order to keep up with infrastructure needs is becoming a critical issue. This was consistent among all participants. Other than limited existing capital dollars and grant opportunities, the predominant project funding sources have been debt instruments such as state revolving funds and traditional bond issuances. These funds, however, stack up against a given plant's debt capacity and therefore create competition for limited dollars, which have sidelined or eliminated viable sustainability projects. The primary driver for most wastewater utilities moving to Water Resource Recovery Facilities have been the long-term economic benefits. For smaller or cash-strapped utilities, Public-Private Partnerships (P3) can be a way to move from energy efficiency measures alone to energy generation and even nutrient recovery – to their long-term economic benefit.

The two alternate ownership/operation models mentioned during the summit were a Power Purchase Agreement (PPA) for a solar PV project and a few operations outsourcing of plant specific operations to a third party. Both participants had positive things to say in regards to their experience with third party ownership and operations. Another alternate ownership model that was mentioned but had not yet been leveraged was the Public Private Partnership (P3). One final participant expressed success with Energy Savings Performance Contracting (ESPC) as an alternate means to develop, deliver and fund a wide range of capital projects. As an alternate overall model, it was said that ESPC was not necessarily a direct replacement for the

aforementioned funding sources but a means to enhance the business justification and bring with it additional sources of funding. The consensus was that there needs to be training on the alternative funding options available outside of GO Bonds, SRF and WIFIA

Important Factors Moving Forward:

- Updated rate analysis – current revenue a limiting factor
- Educate local leaders on the financial, social and environmental importance of both resource recovery as well as alternate funding options
- Ensure State and federal energy policy includes consideration to support and/or enable resource recovery
- The value of resource recovery can enhance the business case dramatically, potentially to the point of self-funding

Technology Challenges Focus Group Breakout Session[19]

Technologies commonly associated with Water Resource Recovery are beginning to be seen in Michigan but not at a pace that will likely be impactful. The effort to adopt innovation was reported to be overwhelming which helps explain the slow pace of adoption. Two major impediments were cited:

Regulatory – Comments from the focus group revealed that many believe current regulations are not supportive of the WRRF paradigm requiring utilization of new and innovative technology and practices to achieve the gains possible in nutrients, energy and water. A summary of focus group responses related to regulatory obstructions include:

- ✓ 10 State Standards that do not adequately allow consideration of innovative technologies and consistently require over-design which adds cost and decreases efficiency ***[See Appendix 3 for commentary]***
- ✓ Water/Energy/Air/Solid Waste regulations are isolated from one another, lack of consideration of carbon footprint and lack of the integration that could result in sustainable utilities

Financial – Naturally there are risks associated with implementation of new technologies that have financial implications. There is a lack of financial programs that would incentivize early adoption and full scale deployment of viable technologies and offset financial risks

A number of ideas were put forth for creating the type of support needed to create a culture of support for innovation, including:

Clearing House - Create statewide hub as clearing house for matching technology to opportunity. This could include the use of the LIFT network as a resource to create a similar Michigan WRRF network for communities

- ✓ needs for resources
- ✓ feedstocks to potential facilities

New Partnerships

- ✓ University/Utility Partnerships, apply practically to theory and research, validate innovative technology for application thru WRRF
- ✓ Engage (regulate) energy utilities to form partnerships with WRRFs that seek to optimize the local nutrient and water-energy nexus and eliminate factors that commonly hurt WRRF trying to pursue innovation.

Regulatory Review - Streamline the regulatory review phase of WRRF projects using innovative technology

- ✓ Create a review process that ensures regulations are satisfied, the public is protected and promotes (not discourages) adoption of innovative WRRF technologies

Practical Solutions include:

- ✓ Development of risk navigation tools that can be used by mid-size and smaller plants that do benefit from an "economy of scale".
- ✓ Use mature technologies in innovative ways, e.g. trickling filters which has much lower energy costs than activated sludge
- ✓ "Right Size" innovative facilities to keep costs in-line
- ✓ Consider appropriate levels of redundancy of mechanical systems depending on need, whereas past practice in the industry has been to almost always provide redundant systems.

Some mature but new emerging innovation and technologies worthy of further consideration and support include:

- ✓ Low energy alternatives to activated sludge
- ✓ Short cut nitrogen treatment
- ✓ Nutrient recovery and re-use
- ✓ Energy from biomass
- ✓ Thermal recovery from wastewater

<u>Outreach to the Public and Elected Officials</u>[20]

The importance of Outreach activities to changing the culture throughout the state was discussed. The activities would focus on engaging citizens and public leaders to overcome misperceptions and preconceptions about the wastewater industry, and the importance and benefits (environmental, economic and social) of resource recovery.

A number of examples of successful outreach programs in Michigan communities were cited. Common qualities of these programs is that the messaging is consistent and efficient.

- Meeting in a box in Midland
- Public engagement toolkit used by the City of Ann Arbor.
- Flint River Watershed Coalition
  - ✓ Project GREEN Water Testing
  - ✓ Science Teachers
- Oakland County use of mentoring

- City of Grand Rapids
  - ✓ Social media
  - ✓ Billboards
  - ✓ Marketing firm
- Citizens Academy

A useful tool would be case studies of successful projects and of the communications programs cited above.

Special Topics

Public Private Partnerships

- Encourage and support more public-private partnerships as it relates to resource recovery.
- Incentivize low-hanging fruit such as implementing energy efficiency programs that can be implemented at all WRRF's.

Food Waste Management

- Incentivize redirection of food waste from landfills to AD digesters at WRRFs to increase renewable energy generation while reducing greenhouse gas emissions.
- Divert feedstocks to innovative technological facilities from existing landfill disposal

Chapter 4: Summary

The information shared during the presentations and ideas shared during focus group sessions indicate that:

- The wastewater treatment plants constructed as part of the Clean Water Program are reaching the end of their useful life, and significant investment will be required to renovate to maintain the operating condition of the facilities. New and increasingly stringent discharge limits; an aging work force; and the changes and variability of energy and nutrient removal costs are all drivers for change.
- WRRFs are becoming more complicated and there is a need for higher level licensure to operate, coupled with the limited number of these highly licensed people.
- There is a vision for the Water Resources Utility of the Future that is based upon transformation of wastewater treatment plants to water resource recovery facilities that reclaim water, energy, and nutrients from waste to produce valuable products for our communities, and there is enthusiasm for adopting that vision.
- Traditional sources of funding are more difficult to obtain.
- Technologies exist and are being developed to facilitate the transformation, however equipment vendors, consulting engineers, regulators, and operators are not always familiar with those technologies and explicit standards for regulating do not exist.
- Innovation is viewed by many as being difficult and frustrating. The primary barriers to innovation appear to be the effort required to have new ideas adopted, the associated regulatory risks, and lack of funding.

Appendix 1: List of Figures

Appendix 2: Abbreviations

CCP	Composite Correction Program
LIFT	Leaders Innovation Forum for Technology
MDEQ	Michigan Department of Environmental Quality
MGD	Million Gallons per Day
MPSC	Michigan Public Service Commission
MWEA	Michigan Water Environment Association
NACWA	National Association of Clean Water Agencies
OCWA	Ontario Clean Water Agency
PPP	Public-Private Partnerships
P3	Public-Private Partnerships
UBN	Utility Branding Network
UOTF	Water Resources Utility of the Future [Note to reader: this abbreviation is consistent with NACWA's abbreviation of the phrase]
US EPA	United States Environmental Protection Agency
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WE&RF	Water Environment & Reuse Foundation
WRD	Water Resources Division
WRRF	Water Resource Recovery Facility
WWTP	Wastewater Treatment Plant

Appendix 3: Commentary on 10 States Standards[21]

- *Public Act 451 of 1994 protects the environment and natural resources of the state.*
- *Part 41 of PA 451 presents the requirements for Sewerage Systems, and requires that "Before the construction or alteration of a sewerage system or portions thereof, plans and specifications shall be submitted to the department for review and issuance of a construction permit."*
- *Rule 38 (1) of Part 41 states, in part, that "…In making its review, the department* ***shall consider*** *design criteria as set forth in recommended standards for sewage works [10 States Standards] and shall be assured that the sewerage system or portion thereof is so designed so as to protect the public health and prevent unlawful pollution [emphasis added]." Similar requirements exist for preparation and review of Engineering Reports, basis of design, and Plans and Specifications.*
- *The Water Resources Division (WRD) is charged with administering the Public Sewerage System program governed under Part 41. The DEQ has established a process requiring submittal of a Part 41 Permit Application for the construction, alteration, addition, or improvement of the wastewater system.*
- *The reference is titled "Recommended Standards for Wastewater Facilities", otherwise known as the "10 States Standards". The 10 States Standards, consisting of proven technology, are intended to* ***serve as a guide in the design and preparation of plans and specifications for public wastewater systems, to suggest limiting values for items upon which an evaluation of such plans and specifications may be made by the reviewing authority, and to establish, as far as practicable, uniformity of practice.***
- *10 States Standards states that it is not possible to cover recently developed processes and equipment in a publication of this type (e.g. 10 States Standards).* ***The policy is to encourage, rather than obstruct, the development of new processes and equipment****.*
- *Unlike some other states, public sewerage system design standards are not codified into Michigan Law, providing flexibility for use of the 10 States Standards. Michigan law, regulations, and policy, which provides room for innovation. The question is why so many practicing engineers find this document to limit innovation. The task is to identify and overcome barriers that exist.*

Appendix 4: Attendees

Water Resource Recovery Leadership Summit Attendees
April 8, 2016
Eagle Eye Banquet Facility, East Lansing, MI

Last name	*First name*	*Organization*	*State*
Alibasic	Haris	City of Grand Rapids	MI
Allan	Jon	Office of the Great Lakes	MI
Allen	Kolene	City of Grand Rapids	MI
Austin	Andy	Scenic View Dairy	MI
Becker	Jennifer	Michigan Tech	MI
Bernhardt	Rick	Kinross Township	MI
Burke	Jon	City of Wyoming CWP	MI
Bush	Noel	City of Midland	MI
Case	Robert	City of Flint	MI
Cavagnaro	Peter	Johnson Controls, Inc.	MI
Conn	Chris	Michigan DEQ	MI
Creal	William	Retired-MI Dept of Environmental Quality	MI
Daigger	Glen	University of Michigan	MI
D'Andrea	Tara	DTE Energy Resources	MI
Daukss	Peter	Tetra Tech	MI
Davenport	Joel	Holland Board of Public Works	MI
Davis	George	MWEA Board of Directors	MI
Diorka	Sandra	Delhi Charter Township	MI
Dopp	Chris	City of Battle Creek	MI
Elliott	Sherrie	City of Petoskey	MI
Fedders	Carl	City of Battle Creek	MI
Filmore	Lauren	WERF	VA
Gardner-Andrews	Nathan	National Association of Clean Water Agencies	DC
Goergen	Joe	Genesee County WWS-ARTP	MI
Goodman	Curt	City of Marquette	MI
Grant	Tom	Hubbell, Roth & Clark, Inc.	MI
Green	Kelly	MDEQ	MI
Grether	Heidi	Michigan Agency for Energy	MI
Hannon	Brian	Moore & Bruggink, Inc.	MI
Hart	Perry	City of Battle Creek	MI
Harte	Jerry	MWEA	MI
Harvey	Mike	Donohue and Associates	IL
Hill	Charles	MDEQ	MI
Hummel	Glenn	HESCO	MI
Hutchins	Scott	U.S. Department of Energy	DC
Jonatzke	James	Bento Harbor St. Joseph WWTP	MI

Last name	*First name*	*Organization*	*State*
Kaiser	William	City of Grand Rapids	MI
Kenzie	Earl	City of Ann Arbor	MI
Krantz	Adam	National Association of Clean Water Agencies	DC
Krause	Kevin	Michigan Public Service Commission	MI
Kuhn	Scott	Sterling National Bank	MA
Liner	Barry	WEF	VA
Love	Nancy	University of Michigan	MI
Lunn	Mike	City of Grand Rapids	MI
Lynch	Tim	Bento Harbor St. Joseph WWTP	MI
Mack	Daniel	Johnson Controls, Inc.	MI
Maringer	Mike	Quasar Energy Group	OH
Masterson	Brian	Kinross Twp Water & Sewer Dept	MI
McCormack	Keith	Hubbell, Roth & Clark	MI
McCormick	Sue	Great Lakes Water Authority	MI
McCormick	Ed	McCormick Strategic Water Management	CA
Monette	David	City of Warren	MI
Mourad	Fadi	DTE Energy	MI
Nash	Jim	Oakland County Water Resources Commission	MI
Ostlund	Peter	Michigan DEQ	MI
Person	Michael	MDEQ	MI
Pugh	Lucy	AECOM	MI
Pugh	Jeff	Fleis & VandenBrink	MI
Rafter	John	Fishbeck Thompson Carr and Huber	MI
Ross	Brian	Genesee County Water & Waste Services	MI
Saber	Leila	Consumers Energy Business Energy Efficiency Program	MI
Safferman	Steven	Michigan State University, Biosystems and Agriculture	MI
Scheuerman	Bob	City of East Lansing	MI
Sikma	Tim	City of Wixom	MI
Spagnuolo	Jessica	Consumers Energy	MI
Tarallo	Stephen	Black & Veatch	VA
Timmer	Gary	Suez	MI
Walker	Dave	MPSC	MI
Wibright	Todd	City of Grandville	MI

Appendix 5: Citations

[1] http://www.nacwa.org/images/stories/public/2013-01-31waterresourcesutilityofthefuture-final.pdf
[2] The Water Resources Utility of the Future, A Blueprint for Action, accessed http://www.nacwa.org/images/stories/public/2013-01-31waterresourcesutilityofthefuture-final.pdf
[3] Cavagnaro, P.V., "MDEQ Observations on Sustainability, Municipal Wastewater Recycling in Michigan – How Can We Measure?" Michigan Water Environment Association, Sustainable Energy Seminar, October 20. 2015.
[4] Pete Ostlund, Acting Chief, Water Resources Division, Department of Environmental Quality Vision & Goals
[5] Ed McCormick, McCormick Strategic Water Management - Water Resources Utility of the Future
[6] Charlie Hill, P.E., MDEQ Water Resources Division - Solids and Nutrient Metrics and Baselines
[7] Christopher Conn, MDEQ Water Resources Division - Michigan WRRF Energy Survey
[8] Barry Liner, Water Environment Federation – Water Environment Federation's Energy & Nutrient Roadmaps
[9] Lauren Fillmore, Senior Program Director, Water Environment & Reuse Foundation - Roadmaps Barriers and Solutions to Energy Efficiency and Recovery
[10] Scott Hutchins, U.S. Department of Energy – U.S. Department of Energy's Wastewater Initiative & Resources
[11] https://ecenter.ee.doe.gov/Pages/default.aspx
[12] Steve Tarallo, Black and Veatch - Energy Neutrality Opportunities
[13] Nancy Love, University of Michigan - Sustainability – Individual Efforts and Innovation
[14] Glen Daigger, University of Michigan - Remarks on Sustainability
[15] Adam Krantz, National Association of Clean Water Agencies - Regulatory Update
[16] Keith McCormack (HRC) and Charles Hill (MDEQ)
[17] Christopher Conn (MDEQ) and Michael Harvey (Donohue)
[18] Dan Mack (JCI)
[19] Tom Grant (HRC) and Glen Hummel (HESCO)
[20] Jerry Harte (MWEA)
[21] Recommended Standards for Wastewater Facilities, Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities, 2014 Edition, A Report of the Wastewater Committee of the Great Lakes – Upper Mississippi River, Board of State and Provincial Public Health and Environmental Managers.