Manufacturing and Energy Use
Technical Work Team White Paper

Minnesota Water Sustainability Framework
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Team co-chairs
Gary Hohenstein, Manager of Environmental and Regulatory Affairs
3M

Jerome Malmquist, Director of Energy Management
University of Minnesota Energy Management

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A. Key Findings

- **Perception –** The need for, and use of, natural resources (especially water) by energy and industrial production facilities are not generally well understood by the public and those who represent them. This can lead to significant misperceptions with dire consequences. In general, there is no clear connection with the public on how societal demands for products and services impact resource use.
- **Competing Demands -** Water has multiple uses, creating competition and frequently conflict. Everyone expects it to be readily available for their use, inexpensive and clean.
- **Science, Research and Data -** To facilitate effective and efficient water use policy and procedures, it is essential that credible data and the appropriate application of science and research be ensured. At the same time, it must be recognized that there are not unlimited resources to conduct unlimited scientific research. Appropriate cost-sharing means must be considered.
- **Technology –** Predictability of future technologies is quite uncertain. This applies to manufacturing technologies that may exert demands on water resources as well as treatment/conservation technologies that could improve water sustainability. The understanding of existing and potential technologies is often insufficient to evaluate all impacts. The use of ñtechnology-forcingò regulations to bring about environmental improvements needs to be very carefully considered relative to feasibility and potential unintended consequences.
- **Regulatory -** Water quality and quantity regulations already exist and are intended to ensure the sustainability of Minnesotaôs water resources for future generations. However, rigorous review processes involving multiple agencies can create conflicts and delay decisions. Future regulations might consider going beyond the classic ñcommand and controlò approach to include incentives for improved environmental performance.
- **Economic and Industrial Growth –** Policy decisions must encourage economically and environmentally prudent water use that result in retaining existing companies and encouraging new industry to locate in Minnesota.

B. Introduction

Water is the most abundant compound on the Earthôs surface. It can exist in liquid, solid and gaseous states. In each of these states, water has a purpose. It is the foundation of life and as such, is in high demand. Manufacturers and energy producers depend on this resource. The availability of reliable and affordable energy is another key resource essential for a strong manufacturing base. Together they are critical elements in helping to fuel a healthy economy. However, competing demands for water can cause conflicts. It is therefore critical that policy makers and the public understand, or at a minimum acknowledge, the water requirements for energy and manufacturing.

The manufacturing and energy sectors, as represented by the members of this team, all have a strong interest in the sustainability of the State of Minnesotaôs valuable water resources. These resources should be considered one of Minnesotaôs great assets for competing in the national and global economies. Entities represented by this team also play important roles in sustaining a healthy manufacturing environment for the production of durable goods, electricity and fuels required by our society. Water resources are critical to their work in producing electrical power, steam, chilled water, hot water, and clean water needed in the manufacturing of a wide variety of products. The sectors represented by this team also spend considerable time and resources properly collecting, treating and managing wastewater and storm water.

Some industries call Minnesota home because that is where key resources are located. Agriculture, agricultural processing, forest products and mining are several examples. For others, proximity to key markets or customers drives their location decisions. Examples here might include energy businesses or industries where transportation of raw materials or finished goods can be cost prohibitive. But many industries do have a choice relative to location. In fact, even power industries have some choice with the power transmission infrastructure that is in place today. Business climate is an important factor in attracting and retaining good companies and regulations - environmental and otherwise - that become too restrictive or burdensome can be a factor in this regard. While Minnesota may want to be a leader in environmental protection, it must consider carefully how progressive to be and also the consequences ï intended and otherwise ï to its actions. In a competitive global environment, imposing unnecessarily stringent requirements within fixed geographical boundaries can lead to economic, social and/or environmental declines in those areas.

There is, of course, a well-recognized economic benefit in many industries for good environmental performance. Numerous studies have indicated that companies who are committed to sustainability principles tend to be the healthiest from a financial standpoint. Accordingly, there are investors and mutual fund managers who select only companies who are dedicated to environmental stewardship as part of their business values. The Dow Jones Sustainability Index is a prime example of an approach that attempts to provide a bridge between companies implementing sustainability principles and investors wishing to profit from their superior performance and favorable risk/return profiles. Companies are increasingly aware of societyôs interest in the measurement and reporting of environmental performance indexes. More specifically, customers are increasingly using environmental performance as a factor when considering product selection. While greenhouse gas emissions currently command much attention, there are many organizations that are also exploring the tracking of water use as an indicator of environmental responsibility.

Most Minnesota industries and businesses want to be in compliance with all environmental regulations/standards and, even more, to ñdo the right thingò environmentally. At the same time, global competition is fierce and speed to market is often critical. Accordingly, it would be most helpful if the following principles were followed:

1. Governmental approvals for projects that produce environmental improvements need to be more expeditiously processed. At times, not only are environmental improvements

delayed due to regulatory restrictions but important business opportunities can also be missed.

2. Projects that comply with regulatory requirements must be approved as quickly as possible. Regulatory delays cost money and can be the difference between success and failure.
3. Risk and uncertainty, while complicated and difficult to communicate to the public, are facts of modern life. It is essential that potential risks be appropriately assessed in a timely manner such that projects can proceed. Total risk avoidance and complete elimination of uncertainty are generally not options. Collecting data and studying issues to absolute certainty does not allow adequate progress.
4. Requirements should be fair, reasonable and practicably attainable. There are examples of waste stream restrictions being at below background levels. Industry should not be held accountable to clean up either what they did not produce or a disproportionate amount because societyôs non-point contributions are difficult to manage.
5. In a circumstance where applications of laws and rules require investments that have no acceptable return, especially with ñtriple bottom lineò considerations, there needs to be an ñout clauseò or ñoff ramp.ò This may be difficult to measure/implement but there needs to be consideration given to this option.
6. Industry cannot <u>always</u> be the innovator. Sometimes the challenge to achieve public policy goals requires outside resources of pure and applied research with some level of public support.

Laws, expectations or standards cannot and will not always drive technology. Onerous expectations placed on some industries can drive them out of business or out of the state. A strong manufacturing base has provided many benefits to the State of Minnesota and likely will be a key to continued economic and social vitality of the region. Besides the products required by society, industry provides good-paying jobs, contributes significantly to the tax base and has made major philanthropic investments. The view of this team is that significant erosion of Minnesotaôs traditionally vibrant manufacturing base, especially if it were to be triggered by ill-conceived environmental restrictions, would be a sad loss for the State. Now and in the foreseeable future, companies might benefit from positive public perceptions about environmental performance. They might strive to increase revenues from products with little or no environmental footprint. But, in the end nearly every company will succeed or fail based on their ability to reduce costs and increase the speed with which they can react to market needs. For many companies, access to water, access to reliable, affordable energy and access to fast and predictable government approvals when needed will be critical to their success.

ñSustainabilityò is a term that merits consideration in this context. Increasingly, manufacturing and energy production companies are adopting philosophies, strategies and initiatives that reflect an expanded spectrum of values and criteria for measuring organizational and societal success. Most commonly, this work becomes described as ñtriple bottom lineò or ñthree pillarsò with objectives to improve the balance or synergy between economic, environmental and social performance. While the Minnesota Water Sustainability Framework has adopted a definition of sustainability that includes commonly used terminology (e.g., ñeconomic, ecological and socialò and ñability of future generations to meet their own needsò), there may be many stakeholders

who may equate the term ñwater sustainabilityò with ñwater preservationò or ñrestoration to pristine conditionsò. Such a view would appear to weight ñenvironmentò over ñeconomicò and ñsocialò in the classic sustainability model and would be a concern to many in manufacturing. Fundamentally, making things involves consuming resources and the creation of waste. In todayôs manufacturing world, great care is taken to minimize these impacts. Nevertheless, it will be critical that future strategies and actions plans relative to sustainability consider carefully the complex balance (and hopefully synergy) between economic, environmental and social issues.

C. The Process

The manufacturing and energy team met four times. Our first meeting was April 27, 2010. We brainstormed the water issues that we had knowledge of based on our various backgrounds. We met again on May 12 and June 14 to flesh out and fill in the details of the six areas of concern that we developed at our first meeting. June 29 was spent on drafting the presentation and the organization and rough content of the white paper. Since then, items have been reviewed by email. This white paper concludes the teamôs work. Several members have a strong continuing interest in knowing more and watching the outcome of the water sustainability framework.

The following is a summary of the six critical issues identified in the course of this work:

1. Perception

In general, the public and other significant stakeholders (customers, regulators, legislators, etc.) do not understand manufacturing & energy sector water needs and uses and the issues associated with them. In many ways, this is understandable (the manufacturing world is complicated and why should the public concern itself with this knowledge) and a compliment to industry (ñno news is good newsò). However, this lack of understanding is also consistent with the broader issue of the public failing to connect how societal demands impact products and services they consume. For example, the trends towards larger homes filled with electronic appliances represent increasing demands on natural resources, especially energy. The more subtle impact is the water needs represented by energy production and some manufacturing.

From a manufacturing perspective, public stakeholders sometimes appear to hold to the following misperceptions:

a. "Quality and quantity are both achievable and mutually independent." While both quality and quantity of water resources are important and therefore goals and initiatives in these areas are warranted, in practical applications these two factors often must be balanced against one another. For example, water reuse and other conservation measures typically results in the concentration of chemical constituents in the water that ultimately must be discharged or disposed. Conversely, compliance with a wastewater discharge limits expressed in the form of concentration in the water is aided by the presence of greater quantities of water.

b. "Clean means absolutely nothing is in the water." This issue is aggravated by the fact that today's analytical capabilities allow measurement of a wide variety of chemical constituents down to incredibly low levels. Furthermore, the industrial age has resulted in the widespread distribution, albeit at generally very low levels, of certain compounds. This situation raises the need for effective risk communication and better understanding by the public. In essence, presence of a substance does not necessarily equate to risk, harm or resource degradation. Data of impeccable quality and sound scientific understanding and application of data is critical to prudent risk management and decision-making.

c. "Cleaning up the water can be done independent of other environmental impacts." Historically, the regulatory approach to driving environmental improvement has been media-focused, i.e., the Clean Water Act addressed water issues, the Clean Air Act applied to air emissions, the Resource Conservation and Recovery Act pertained to hazardous wastes, etc. While this strategy has been, and likely will continue to be, effective in bringing about many environmental improvements, there are increasingly situations that require a broad, multi-media analysis for prudent goal-setting and decision-making. As examples of this challenge: 1) new air emission reduction goals can result in increased water usage in air pollution control equipment and resultant wastewater discharge issues; 2) aggressive wastewater treatment goals can result in the application of treatment technologies with significant energy impacts, waste production and other cross-media effects.

d. "Industry is 'evil' and cannot be trusted to make sound environmental stewardship decisions." While such general stereotyping is clearly wrong, there have been limited instances where companies have made mistakes that have eroded the public's confidence. This misperception is aggravated by the nature of media coverage in today's world. Relative to use of water resources, these views can lead to several unfavorable outcomes:

(1) Unnecessarily burdensome, complicated and/or inflexible regulations created and implemented to address public perceptions.
(2) Industry being blamed exclusively and/or inappropriately for resource depletion and/or degradation.
(3) Failure to focus on the actual opportunities for improvement.

e. "Industry should use fewer resources." Use of water is essential to many manufacturing and energy-producing processes. More broadly, these industries are essential to a vibrant economy. While efficient and ever-improving utilization of resources is part of a sound business philosophy, there inevitably are limits to such opportunities. Related to this, care should be given to avoid viewing new and unproven technology as a panacea relative to meeting new, more stringent requirements. The concept of using regulations to "force" technology development needs to be carefully considered, especially in light of today's competitive global

environment. Overly far-reaching goals that cannot be reasonably met by current, developing or reasonably likely future technologies can have serious unintended consequences for not only the economy, but for the environment.

f. **"Life should be 'risk-free'."** While an incredibly broad issue, the publicôs lack of understanding in this area presents real challenges in developing policy, goals, and ultimately regulations. Dealing with uncertainty or probability in a risk setting is an exercise in balancing complex factors that are not easy to communicate.

g. In conclusion, perceptions are an important issue because they ultimately tend to drive actions and decisions. Far too often, they can be based on emotion rather than fact. Relative to water sustainability, misperceptions can drive excessive costs or unnecessary regulations and these ultimately impact all of society.

D. Competing Demands (Including Water Quality)

While historically (especially in Minnesota) water supplies have been taken for granted, there is a growing awareness that these resources are not endless. In addition, once impacted, their value can be significantly diminished, sometimes for extended periods of time.

The production of energy and the manufacturing of products often depend on drawing water from surface water and groundwater, including deep water aquifers. Most often, the resource is fresh water, but at times the water can be from a previously used process or gray water recovered from a treatment process (for example, reuse of treated sanitary wastewater for irrigation purposes).

Prioritizing and/or cascading the use of water (using water multiple times in the same application) in these competing demands is challenging and options might vary by region, production process, energy or product required and the initial source of the water. For example, the production of energy often draws from surface water, typically a river. That same water may be used for recreation (fishing, boating, swimming, etc.), human consumption or wildlife (plants and animals ï ecology). Deep water aquifers, frequently home to very clean water, are particularly valuable for human consumption uses but at times are sought by processes that could utilize alternatives like surface or gray water, if they were available. The location of a manufacturing or energy-producing facility in the future may need to be governed by the type and availability of water, much like a wind farm is dependent on the availability of sufficient wind.

Besides competition over use of water, there can also be competition for locations near water. A power plant that needs surface water to operate economically may find itself in a prime location for residential or recreational property. A business that might utilize river navigation may find itself in the same predicament. Historically, significant commerce has evolved around transport by rail and river. Although the trucking industry transformed this situation, environmental concerns, cost and availability of fuel are validating the value of these transportation systems.

Economic issues impact competing demands for water. Water costs vary widely by region and can impact establishment and location of industry. Such costs are impacted by water source (i.e. deep wells or surface), the level of required treatment of the water, the construction and operating details of the infrastructure providing the water, water use fees and final applicable wastewater disposal options. Depending on disposal options, reducing water use or increasing water efficiency can often result in increased concentration of pollutants. This, in turn, can make meeting permit requirements more difficult and result in increased costs for the industry.

Complicated interactions between economic and environmental considerations are abundant in water use policy decisions. The demand for products and energy can increase the demand on water. Decreasing the use of water in the production of goods or energy may increase the concentration or amount of contamination or pollutant in the water waste stream. There are times when the wastewater limitations on contaminant levels may be as high as, or higher than, the background levels of the water being used. A solution to water contamination may have an undesirable impact on other parts of our environment like air or soil. There are examples where air pollution requirements negatively impact the water effluent. Requirements to recycle water may increase problems elsewhere as more energy is needed to perform recycling tasks. Complex inter-relationships between all environmental considerations (multi-media) necessitate the consideration of the other environmental impact(s) of altered water consumption.

Choices made by manufacturing and energy production with regard to the types of water used (i.e., groundwater vs. surface water) and types of processes used (i.e., closed-loop vs. open-loop) can ultimately have an impact on communities and society. Access to water use, recreation, transportation and impact on the other surrounding environment will impact the way a community develops, grows and perceives itself. The community or society develops its own biases and impressions of what is acceptable or unacceptable - whether perceived or real. These factors merit consideration when assessing potentially competing use of water resources.

Water resources are not evenly distributed across the state. Therefore, water use will require environmental, economic, & social trade-offs varying by industry and processes under consideration. The goal should be to improve the water supply without undue hardship on the manufacturing and energy industries. This could have a direct impact on the stateôs economy.

E. Science, Research, & Data

In many respects, a quandary exists relative to the topic of Science, Research, and Data. On one hand, the lack of knowledge and data, as well as the potential for inappropriate application of science and research can lead to poor understanding of broad water sustainability issues in Minnesota. This in turn can produce ineffective and/or inefficient water use policy and practice and/or result in policy makers basing their decisions on perception rather than good science. On the other hand, seemingly endless quests for more information relative to specific projects and issues can be extremely burdensome and time-consuming. Too often, industry bears the brunt of these significant costs and oftentimes there is no real return on this investment in terms of meaningful increased knowledge. The real challenge in this regard is how science can be

appropriately developed and meaningful data gathered and used to produce policies and practices that ensure economically and environmentally wise water use.

Developing and evaluating good science and data requires significant resources (expertise, time, money, etc.) to close data gaps and make science-based water use decisions. Uncertainty in data or the lack of data often leads to suspicion and opposition to water use approaches. Too often government agencies expect individual companies to bear the cost of producing this data after a project is proposed. The lack of data can delay projects, decrease the usefulness of projects, and increase costs.

Since environmental media (land, water, and air) are interrelated, we need to know how improving water sustainability will impact other media. For example, in moving water or producing better quality and quantities of water, energy is expended and this may in turn generate wastes and air pollution. Additional science and macroeconomic analyses can lead water use strategists to evaluate the impacts and more effectively plan approaches to water use.

Expertise and properly focused funding are needed to consistently support valid studies and evaluate the results. Existing and developing data located in various sources should be integrated to better understand the interrelated issues and relationships surrounding water use. Another barrier to having effective science and data is the funding of the studies. Depending on the funding source, data and/or conclusions can be found suspect. Additionally, communication of the results to the subject matter experts and the public can be difficult to do such that the ideas are relayed correctly and reliably.

It is critical to understand that data alone has limited value. More data does not itself produce better information for decision makers. Available data collection resources must be spent wisely so that the data generated is used to produce helpful information for regulators and policy makers. Research and data collection must be properly conducted with consistent, established and acceptable procedures. It must be thorough, unbiased, and timely.

F. Technology

Technology will play an important role in future water sustainability issues. On one hand, new manufacturing and energy-production technologies may place increased demands on the stateôs water resources. Conversely, to the extent new technologies are developed that enable improvements in water quality and conservation, the stateôs resources benefit. In any event, predictability relative to technology development is quite uncertain.

There are many ways by which technology can bear on manufacturing, energy-production and water sustainability. The following highlights several facets to this issue:

1. Technology can be an engine for company growth. Bringing new technologies or processes ñon-lineò can require environmental reviews and the timeliness of these approvals can be a deciding factor in the success of a project. In any given application, possible sources of water and issues associated with them must be thoroughly

considered. Restricted access to specific aquifers can adversely impact viability of a project.

2. Technologies to promote water reuse and/or conservation may have unintended consequences in negatively impacted discharge concentrations. For example, reuse of water can build up pollutant concentrations and create discharge concerns.
3. Technologies to improve removal of contaminants in one media can result in adverse impacts in other media. For example, enhanced air pollution control can result in increased water usage and/or increased releases to surface waters.
4. Steps to improve water quality and/or conservation can come at the cost of increased energy consumption.
5. Technology development in the area of water analytical capability has enabled the detection of numerous constituents at very low quantification levels. Interpretation and communication of the meaning of such results is a tremendous challenge, especially with the public. For many, presence equates to risk. Many difficult issues are embedded in this topic.
6. Using new regulatory frameworks to ñdriveò technology development can be a risky proposition with unintended consequences. Without careful thought and reasonable prognosis that new technologies will actually be technically and economically viable solutions to new challenges, an alternative for companies can be withdrawal from the marketplace. If such initiatives are ñlocalizedò, this outcome may be especially likely. In other words, excessive and/or unreasonable expenses related to new technology requirements could put Minnesota businesses at a competitive disadvantage and result in shifts in manufacturing away from the state.
7. Minnesota has prided itself as being a leader in driving and developing valuable new technologies in many different fields. In some ways, there is a built-in incentive in this regard for water treatment/conservation technologies in that protection of an important state asset (its waters) may simultaneously be achieved. Again, as previously stated, great care should be taken to not attempt to ñforceò technology development ahead-of-its-time or beyond its capability. Nevertheless, use of technology for the protection of water resources could represent an economic growth opportunity.
8. Employment of new technology, whether in a manufacturing process or for water treatment/conservation, invariably carries with it numerous uncertainties. From this standpoint, certain risks may be involved. In order to move forward in a timely manner, and with consideration of the incredible pace of todayôs world, it may be necessary to grant approvals with a preponderance of evidence which points to success but with an understanding that certain questions remain. In other terms, needless ñparalysis in analysisò should be avoided.
9. Investment in new technology development tends to be a risky venture. Research expenditures can yield great economic success but failure is also a very real possibility.
10. Minnesota companies that do not have water treatment and/or conservation technology as part of their ñcore competenciesò today are unlikely to invest in development of such technologies based on technology-forcing regulatory initiatives in this area.

G. Regulatory

Protecting the water quality and quantity of our surface waters and groundwater requires the involvement of all Minnesotans. However, people do not always see a connection between their actions and their expectations for clean and plentiful water. There is a general lack of understanding regarding how much water is needed to produce energy and the products that people use or what it takes to deliver water to taps in their home. An expectation that regulatory agencies will protect our water resources may be a contributing factor for people that avoid changes in individual behaviors that are essential to achieve water sustainability.

The regulation of water quality and quantity are addressed by several state agencies. The primary state agencies responsible for regulation of water quality and public health are the Minnesota Department of Health, Department of Agriculture and the Minnesota Pollution Control Agency. The Department of Natural Resources is responsible for water quantity issues and regulates water withdrawals. In addition, the Minnesota Board of Soil and Water Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the Minnesota Pollution Control Agency and local government units have regulatory authority over wetlands in Minnesota. Water quality and quantity regulations exist and are intended to protect the health and welfare of Minnesotaôs citizens and ensure the sustainability of Minnesotaôs water resources for future generations.

Minnesota has a tradition of highly valuing environmental protection and public involvement in regulatory decisions. Those values remain but their implementation is occasionally at odds with modern expectations of timely decision making and intense regional and global competition for economic development. In addition, sophisticated analytical techniques that allow detection of substances at extremely low concentrations combine with continuous assessment of possible human health or environmental impacts from a variety of substances to create very complicated scenarios for making appropriate regulatory decisions. Regulatory agencies are expected to be enforcers of rules by using a stick approach. Water management issues are usually complex, but people focused only on water issues might only see and expect simple solutions.

Regulations can provide both incentives and disincentives for economic development proposals. Environmental review and permitting processes are intended to evaluate the adequacy of the water resources to support the intended use and regulate appropriations and discharges to protect water quality. However, rigorous review processes (some unique to Minnesota) involving multiple agencies and regulations also creates potential conflicts that can delay decisions.

The time and resources required to comply with environmental regulations can discourage business development. Meeting regulatory requirements and gaining regulatory approval for a project can result in increased costs, delayed decisions and relocation of projects to other states. These costs and delays can impact market share of Minnesota businesses and reduce the economic viability of Minnesota communities. Delays due to regulatory requirements can even impact projects intended to produce environmental improvements.

The most common reasons identified for delayed permit decisions included:

1. Unpredictable regulatory requirements and approval timelines
2. Failure to consider water resource issues during the site selection process
3. Lack of coordination between government agencies
4. Changes to project proposals due to issues arising during environmental reviews or permitting discussions
5. Regulatorôs requests for more resource data to make regulatory decisions

Regardless of the cause, delays in regulatory decisions can significantly impact the economic viability of current and future business development, particularly for projects that can be located in other jurisdictions with regulatory requirements and approval processes that are less stringent or more predictable. However, properly formulated, consistent regulations can also be a tool to motivate both economic and water resource sustainability. Using available water resource data to help identify the best locations for future business developments can help reduce regulatory issues. Early interagency coordination regarding data requirements for a project can help reduce the potential for conflicts and delays in decision making.

Water management and sustainable regulatory decisions often involve conflicting interests and the need to balance reasonable use and protection of natural resources. The public is not always informed or engaged, which can lead to special interests driving regulatory standards. Regulations may have conflicting objectives or goals. Agency resources are limited and the demands for timely responses are increasing. Not having adequate resource information at the appropriate scale can delay regulatory decisions and environmental review processes do not always provide for adaptive management.

There is a tendency to look for simple tools to answer very complex questions regarding water sustainability, which requires resource mapping and monitoring data to support water supply planning and regulatory decisions. Additional information is needed to form a good solution. Better information on best practices and total cost accounting may be useful for evaluating environmentally friendly alternatives. Water demand projections are needed to allow communities to plan for water supplies required for future development.

Regulations are intended to provide for the long-term sustainability of Minnesotaôs water resources for current and future generations. These regulations must recognize the interconnection of groundwater and surface waters and preserve the sustainability of the resource both in terms of quantity and quality. Limitations on water appropriations and discharges to protect water resources must be based on sound science and incorporated into land use planning decisions. Water sustainability is necessary for economic development and is supported by the business community, but regulations need to consider disincentives that may actually be detrimental to the resource. Application of regulations must consider cost impacts and impacts on other important environmental and community goals.

H. Economic-Industrial Growth

A critical issue for economic-industrial growth in Minnesota is using water in an economically and environmentally prudent manner that results in the growth of existing companies and encouraging new industries to locate here. Industrial growth stimulates growth in other sectors of our economy (service and construction industries for example) producing benefits that permeate our state. The cost of water in most of our stateôs communities may not solely drive conservation. Economic incentives may be more likely to drive the efficient management our water resource and its usage. In addition, appropriation and discharge permits must contain timely incentives for improved conservation while enticing industrial growth. The companies most likely to innovate and invest in practices that will improve water conservation and water quality are those that are successful and expanding. Business vitality is the key to access to capital and commitment to new investments that produce better environmental performance. While there is the potential for conflict between city, recreational, and industrial growth in terms of water management, economics of our state indicate growth must accommodate all interests and the incentives should strive to reduce conflict. A significant challenge to growth is planning for future water use and the difficulty in projecting such use for the long term.

The environmental aspects of water are dependent on the strain that other resources (land, air, and people) can accommodate from growth and the challenge to grow in a sustainable fashion. Water conservation practices can lead to other environmental impacts. For example, when water use is reduced by recycling water within a facility, water contaminants can increase in concentration and eventually require treatment that can be energy intensive and produce wastes that must be disposed of. Conversely, new water may actually require less energy consumption (therefore conserving more resources and reducing potential emissions) due to less pumping, water treatment and material handling.

Water conservation, on the other hand, makes water available for other uses like recreational and drinking. As a result, there might be a public perception that all types of conservation measures are good. The idea that all water conservation practices are good may be flawed and proper decision-making requires that other environmental factors, costs and competing interests be fully addressed. Limits on water could induce growth to occur elsewhere or inhibit expansion without any public gain.

The barriers to the water use and industrial growth issue are collectively woven around two areas: perception and incentives/disincentives. Again, the perception for some might be that water conservation is always good, conflict free and inexpensive so that industry does not need incentives to effectively and efficiently manage water. The challenge is to integrate incentives into both the regulations and business climate (e.g., through tax breaks or fee reductions). A relevant example is when a city or region builds infrastructure for growth and water treatment costs increase to account for the infrastructure. This scenario can result in less competitive water rates for growth compared to other states or nations or, if the economy declines as in recent times, a disincentive results through unsupportable water rate increases to accommodate decreases in water use.

The type of information needed to formulate better solutions to the issue is to understand and rank alternatives for water use and incentives for more effective water management among industry and other sectors of society. The consequences of incentives and the cost-benefit analysis of the options need to be clearly delineated and judged. Researching options and data from water-limited regions in the US could provide Minnesota with insights and approaches not otherwise known. Information may be found in water studies and ethanol water studies as well as western region studies.

I. Conclusion

The goal of this framework is to improve the sustainability of our stateôs water resources. At the same time, outcomes based on this framework analysis could increase the cost and limit availability and use of water in the state. Such results could profoundly impact manufacturing and energy production facilities, significant contributors to the Stateôs economic and social health. Careful consideration and balancing of economic, environmental and social objectives will be necessary to arrive at optimal strategies, policies and action plans relative to water resources.

Appendix A. Team Members

Co-Chairs

Gary Hohenstein, 3M
Jerome Malmquist, U of M

Manufacturing

Bob Anderson, Sappi, Cloquet Mill
Mike Faulk, Flint Hills Resources
Becky Kenow, Flint Hills Resources
Peder Larson, Minnesota Coalition for Ethanol
Deb McGovern, MN State Chamber of Commerce
Craig Pagel, Iron Mining Association
David Tieman, Faribault Foods
Eric Yost, Hutchinson Technology

Energy

Patrick Flowers, Xcel Energy

Agency

Christina Connelly, MN Dept. of Agriculture
Dave Hendrickson, U of MN Natural Resources Research Institute
Jim Japs, MN Department of Natural Resources
Mike Tibbetts, MN Pollution Control Agency