



BEVERAGE INDUSTRY
ENVIRONMENTAL ROUNDTABLE

Context-Based Decision Guide for Water Reuse and Recycling

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January 2020



Acknowledgements

BIER members gather at the Fall 2018 meeting at PepsiCo headquarters in Purchase, NY.

This *Context-Based Decision Guide for Water Reuse and Recycling* document was developed through a collaborative effort of the Beverage Industry Environmental Roundtable (BIER). The global beverage companies which developed this guide believe that addressing the global water challenges of today and tomorrow requires transitioning “beyond reduction” through broader adoption of water reuse and recycling by all facilities, across all industries, in every location around the world. This guide is intended to accelerate this transition by making water circularity concepts more approachable to local leadership and operations.



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About this Guide

Who is the Target Audience for this Decision Guide?

While this guide has been developed by the Beverage Industry Environmental Roundtable (BIER), it is designed to be relevant to any facility, in any industry, in any location in the world. This guide is intended to accelerate internal conversations and decisions at the regional and facility level with regards to investments in advancing water stewardship. There is a specific focus on water reuse and recycling.

Why This Decision Guide, Why Now?

The reality we face as individuals, businesses, and society at large is that operating in a world with persistent water-related challenges is becoming the new normal. Nearly every operational location in the world, both company- and supplier-owned, faces business challenges related to too little water, too much water, and/or too poor quality water. As a result, companies face increasing internal business drivers and external pressures to manage water-related risks and opportunities, which are dynamic and variable throughout the world due to local watershed conditions. Individually these expectations might not define an immediate business case, especially from a local facility's perspective, but collectively they are powerful motivators for advancing water stewardship.

The following internal drivers and external pressures are expected to increase given projections on global water challenges. To achieve long-term business and environmental sustainability in all watersheds and communities, the time is now for industry to work towards optimizing the use of every drop of water by making the 3Rs – Reduction, Reuse, Recycling – standard practice across operational locations.

Internal Business Drivers		External Pressures
<ul style="list-style-type: none"> Lack of a reliable water supply to continuously meet production targets Incoming water quality degradation requiring higher treatment Limited to no viable back-up or alternative water supply options 	<p>Physical Risks</p>	<ul style="list-style-type: none"> Increasing demands on water supplies from domestic, industrial, agricultural, and environmental users Aging or inadequate water infrastructure Climate variability and extreme weather
<ul style="list-style-type: none"> Increases in water costs and/or sewerage fees, with potential to be abrupt and significant Changes or limitations to water allocations Wastewater fines or enforcement actions 	<p>Regulatory Risks</p>	<ul style="list-style-type: none"> Ineffective water governance leading to unsustainable regional water management Trends towards stringent regulations (e.g. Zero Liquid Discharge, full cost water pricing)
<ul style="list-style-type: none"> Community opposition to industrial water use and expansion Consumer loyalty impacted by water related concerns and negative publicity Poor water performance related to peer companies (e.g. Company Goals, Water Use Ratios, Sustainable Development Goal (SDG) 6) 	<p>Social and Reputational Risks</p>	<ul style="list-style-type: none"> Increasingly detailed investor disclosure (CDP, SASB, DJSI) and customer requests and surveys Ratings and rankings which are rapidly and broadly distributed by technology and social media Operating in a world of hyper transparency globally and locally

Why is this a ‘Context-Based’ Decision Guide?

As businesses, all investment decisions must be deliberate and achieve defined returns on investment. This is especially true for water-related investments which are often more challenging to justify compared with other aspects of a business. This is partly due to the perception that water is lower cost than other utilities such as energy. However, if companies consider the true cost of water they commonly find that the cost is 2-3x what they think they pay after considering embedded costs for pumping, moving, treating, heating, cooling, and operations.

In addition, companies and their local facilities also struggle with or overlook important considerations beyond just the operational costs versus returns. This is where the emerging idea of ‘context’ has gained attention. BIER has worked diligently towards making [Performance in Watershed Context](#) practical in helping operations make more informed, locally relevant water investment decisions. These decisions are based upon an understanding of unique local watershed conditions or ‘context’ around a given facility. To make informed decisions on water management, a company or facility must develop an understanding of the local watershed conditions and evaluate their operational impacts (positive and/or negative effects on the watershed) and dependencies (reliance on the local watershed, infrastructure, and governance).



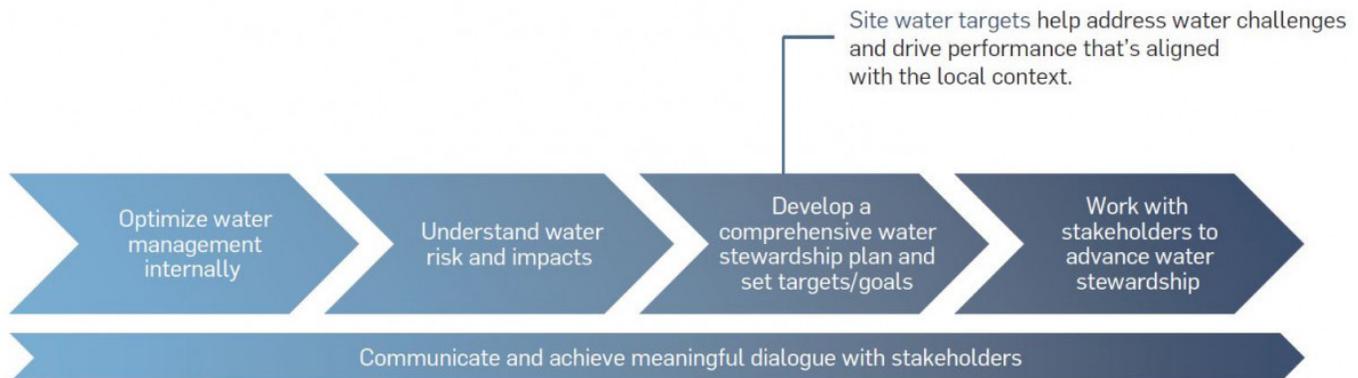
About this Guide

The idea is that for every impact or dependency a facility has, there could be an equal and opposite action made by the facility. Consider the following examples:

Category	Description	Example Action by the Facility
Impact (+ or -)	A facility is withdrawing groundwater from an aquifer that is overdrawn and experiencing declining water levels.	The facility implements actions to avoid, reduce, and reuse water to manage impacts on the aquifer. This facility could also decide to treat wastewater effluent and use the recycled water to safely recharge the aquifer if permissible.
Dependency	A facility is dependent upon the services of a local water utility to provide water supply with consistent flow, pressure, and quality at an agreed cost. The facility does not have control over the water supply until it reaches their facility.	The facility could engage with the local water utility to understand where the utility sources water from originally, their strategic plans, and how the facility can work collaboratively with them to protect water resources and manage any business risks. For example, would reducing a facility's water needs result in less revenues to the utility? Alternatively, does the utility have a program with incentives or performance recognition that the facility could participate in?

To further demonstrate the beverage sector's belief and leadership in the value of context-based decisions, BIER collaborated with the CEO Water Mandate in support of their [Setting Site Water Targets Informed by Catchment Context](#) guidance. The process outlined in that guidance (see Figure 1) further details the concept of decisions based upon watershed context and the progression from the foundation of optimizing water management internally, to the longer-term objective of broader engagement externally on water security within a local region.

Figure 1: Relationship between site water targets and a water stewardship approach



Making context-based decisions on water actions and investments is not only a growing expectation by investors and other external stakeholders, but also logical from a business perspective to drive locally relevant, timely, and effective investments in the 3Rs.

How is this Guide Structured?

This guide has been structured to promote use of the water stewardship hierarchy and the intuitive framework of the 3Rs. As these terms are not consistently defined and are often used interchangeably, BIER members developed the following terminology which is used to structure this Decision Guide:

Water Reduction

The process of avoiding or eliminating water use, then optimizing processes to minimize water consumption and manage water waste. Reducing water use is the baseline and should be standard practice by facilities today.

Water Reuse

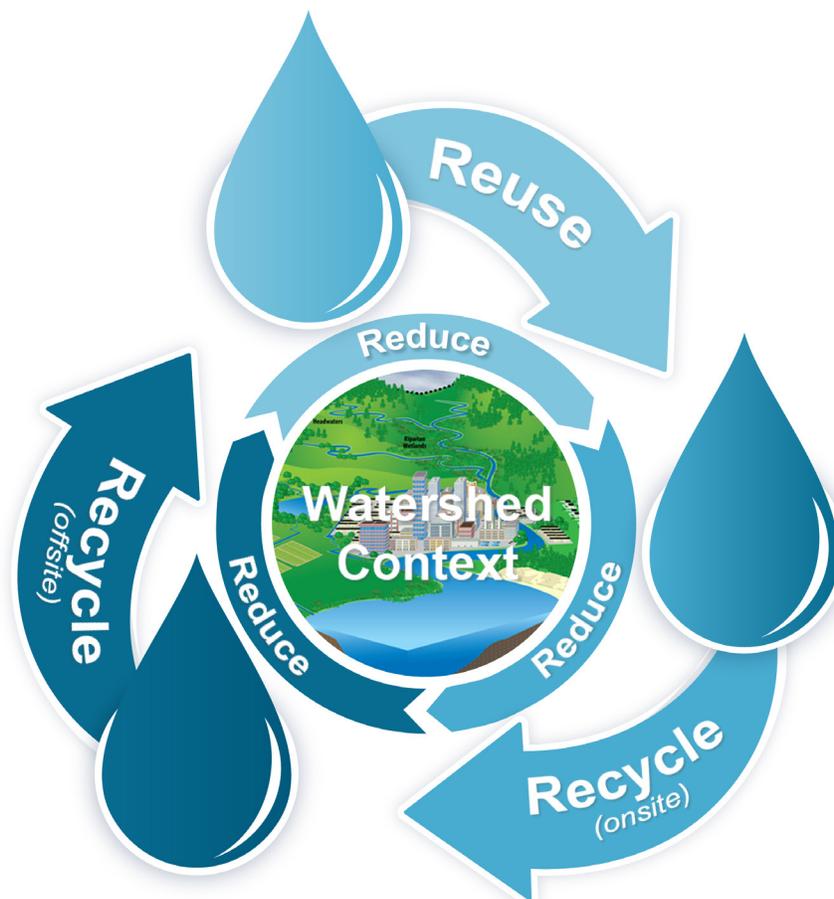
Water that does not require additional treatment or reconditioning to use more than one time/cycle in the same or different process(es) within a facility.

Water Recycling (Onsite)

Water that requires additional treatment and reconditioning to use more than once within facility processes and/or on-property (e.g. landscaping, washing, etc...), instead of or prior to discharging as industrial effluent to a receiving body, the environment or a third-party wastewater treatment provider.

Water Recycling (Offsite)

Water that requires additional treatment and reconditioning for beneficial use off-property by the company or a third-party (e.g. irrigation, green infrastructure, neighboring industry, etc...) as an alternative to discharging as industrial effluent to a receiving body, the environment or a third-party wastewater treatment provider.



Water Reduction

What is the Baseline of Water Reduction?

Water is fundamental to beverage production operations and, by volume, the most significant product ingredient. Given the importance of water to business and the water challenges faced globally, all industry should strive to use water responsibly, which starts with reducing water use as the baseline. Every facility in every location in the world should proactively reduce their water demand through avoidance and optimization where feasible. The following checklist may be a helpful exercise to confirm a baseline of water reduction:

- Is water considered a significant environmental parameter and business priority?
- Is your site in compliance with water intake related standards and regulations (e.g. borehole permits, abstraction limits and conditions)?
- Has your site developed and does it maintain a water balance for identifying and managing water losses, leaks (discrepancies), and inefficiencies? In other words, does your site track water intake, water used in process, water used in product, and water discharge (or wastewater)?
- Have the largest and/or most costly water using processes been prioritized through a True Cost of Water perspective?
- Has your site developed a plan to optimize your water use based upon prioritized actions? Has the plan been integrated into normal business operations?
- Are roles, responsibilities, and accountabilities for avoiding and reducing water clearly defined and followed?
- Have you assessed your water use and efficiency against similar facilities within your company and/or against peers in your industry?

Tools & Resources

BIER Water and Energy Use Benchmarking: <https://www.bieroundtable.com/work/benchmarking/>

GEMI Water Balance Calculator: <http://waterplanner.gemi.org/calc-waterbalance.asp>

BIER True Cost of Water Toolkit: <https://www.bieroundtable.com/publication/true-cost-of-water-toolkit/>

Ecolab Smart Water Navigator: <https://www.ecolab.com/sustainability/smart-water-navigator>

Why is it Important to Move Beyond Reduction?

The beverage sector is widely regarded as a leader in corporate water stewardship, but we recognize that further opportunities exist to move 'beyond reduction' within our own industry and to support similar progress in other industries. Achieving water security (e.g. sustainable watersheds and communities) throughout the world requires collective actions between all water users (industrial, domestic, agriculture, and environment), service providers (public and private water and wastewater utilities), and relevant governmental and non-governmental organizations. To work collectively on shared water challenges requires more than just a handful of leading companies being ready and willing to invest time and resources outside of their own operations. This 'readiness' is tied closely to operational water stewardship and their water stewardship maturity with regards to the 3Rs. Until an organization has reached a level of water maturity, their readiness to collaborate outside of their own operations will be fundamentally restricted by their inherent lack of experience, business case, and general comfort with the dynamics of water stewardship and security.

As BIER members have long believed and communicated (see Figure 2), optimizing water use and discharge within Direct Operations is the first principle of water stewardship. Similar to the foundation of a house, achieving advanced water stewardship within a company's operations establishes a base water culture, business value, and credibility by which a company or facility can build a more robust water program upon. Without this foundation in place, further efforts across the other principles cannot evolve at an accelerated pace and any efforts outside of operations will likely not be viewed as genuine by stakeholders if your 'own house' is not in order. For instance, how can a company drive water stewardship with suppliers if they're not implementing the same recommendations within their own operations first? Or campaign for greater water awareness and conservation within the local community?

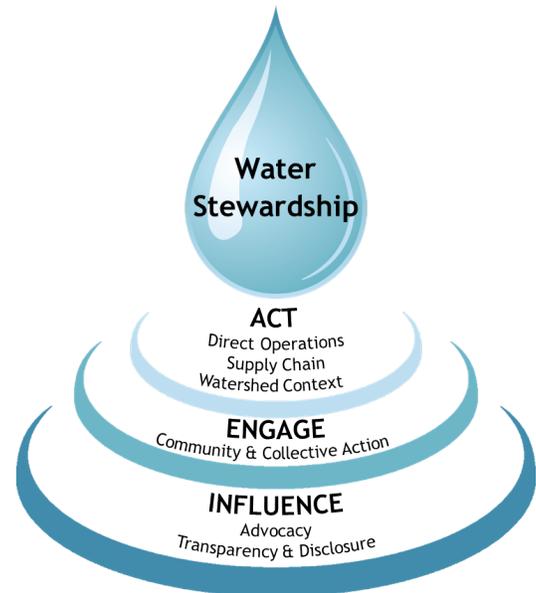
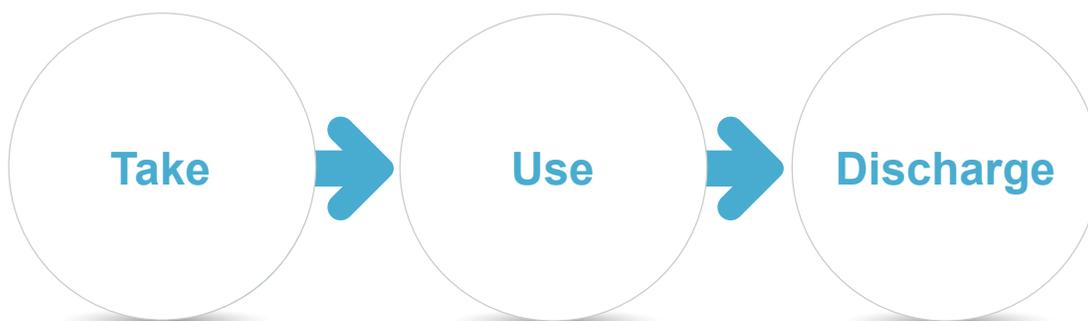


Figure 2: BIER's 6 Principles of World Class Water Stewardship

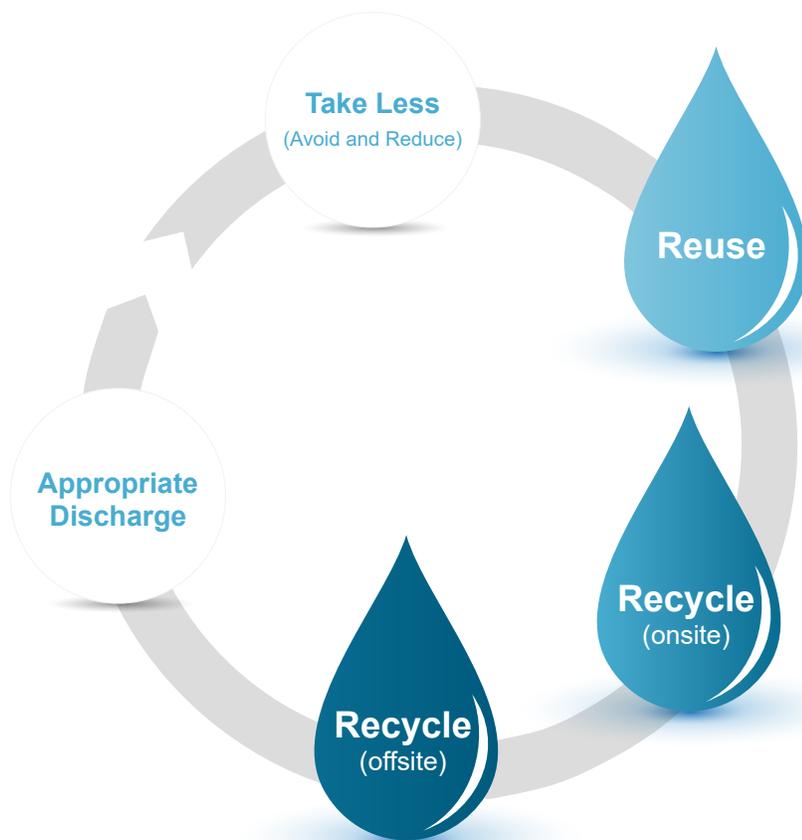
Direct Operations is also where a company has nearly complete control over their costs, operations, and investments versus initiatives focused on suppliers, customers, or other collective action with external stakeholders. While aggressively pursuing water stewardship does not insulate a company or individual facility from water-related challenges, it has wide-ranging business and societal benefits that have been well documented.

Moving 'beyond reduction' requires a shift in mindset by industry. Historically, industrial water management has followed a traditional linear philosophy of **Take-Use-Discharge**:



Water Reduction

It is imperative to break this traditional thinking by integrating water circularity techniques of water reuse and recycling where every drop is optimized:



The ultimate goal of a water circularity approach to managing water sourcing, use, and discharge is to reduce the facility's net water use and impact within the local watershed. This type of approach drives water use efficiency by using less net water for an equivalent purpose or volume of production, which results in decreasing the facility's Water Use Ratio (WUR). In addition, the use of the 3Rs has positive benefits to watersheds in local communities by reducing water demand and returning water for beneficial uses (e.g. recycled water for agriculture), resulting in a net water increase to local water supply.

Water Reuse and Recycling

When is it Appropriate to Consider Water Reuse and Recycling?

As a corporate water leader it is always appropriate to consider water reuse and recycling especially where a business case can be justified. The following are common triggers and opportune times for advancing water stewardship:

- ❑ *Water Source Challenges* – if your facility is experiencing water source reliability concerns (e.g. declining groundwater levels).
- ❑ *Water Costs or Financial Incentives* – if your facility's water costs continue to increase in terms of direct costs, electricity for motors (heating, cooling, transport), chemical and filter costs, etc. Also, if a local government or water provider offers financial incentives to reduce water use and implement water reuse and recycling.
- ❑ *Performance Metrics and Goals* – if your facility is pursuing continuous improvement with Water Use Ratio (WUR), other water-related company goals and objectives, and/or community goals such as Sustainable Development Goal (SDG) 6: Ensure availability and sustainable management of water and sanitation for all.
- ❑ *Reputation and Brand* – if your facility values maintaining a positive perception from local stakeholders and a social license to operate through being viewed as a water steward and leader within the community.
- ❑ *Regulatory Changes* – if your facility is facing increased regulation and limitations on water use and/or discharge.
- ❑ *Operational Changes* – if your facility is pursuing changes such as new build, retrofits, expansions, or other production changes (e.g. additional processing lines).

Water Reuse

BIER Definition: *Water that does not require additional treatment or reconditioning to use more than one time/cycle in the same or a different process(es) within a facility.*

After avoiding and reducing water use, the focus commonly shifts towards opportunities to reuse water within operations. Safely reusing water reduces the overall water demand on the local watershed, thus increasing water availability to other community users. This increases productivity per water input and lowers wastewater discharges and their pollutant load volumes, which reduces thermal energy consumption and potentially processing costs¹. Trends in water challenges throughout the world and a projected 40% gap between water supply and demand² will require greater attention towards reuse, with broader social and regulatory acceptance already taking hold.

1 Sustainable Sanitation and Water Management Toolbox - SSWM.info

2 World Economic Forum (WEF) 2030 Water Resources Group. <https://www.weforum.org/our-impact/closing-the-water-gap>

Water Reuse and Recycling

Reusing water does have quality, safety, and regulatory challenges that must be taken seriously through the planning, implementation and ongoing management of all water reuse applications. Most notably, facilities must comply with the Food Safety Modernization Act (FSMA) and Hazard Analysis & Critical Control Points (HACCP) requirements, which are further addressed in a later section of this guide.

The following are the most common barriers to pursuing water reuse at a facility. All of these are valid, but should be challenged periodically to confirm they are real limiting factors locally and if they can be overcome and properly managed given advancements in technology and process innovation:

Common Barrier	Alternative Perspectives
<i>“Our community is not facing water stress or drought so there is no business driver.”</i>	Very few places are immune to water challenges or will be in the future. Water stress is not only droughts and too little water, it also includes water quality and sustainable access for all users. Given the growing awareness of water challenges, it is imperative as companies with water as a main ingredient and individuals living in communities that we act as water stewards and use water responsibly at work and at home.
<i>“Water is inexpensive for us. It is hard to even justify straight reductions, so water reuse projects definitely do not meet ROI criteria.”</i>	Use embedded “true” costs in financial calculations, such as those to transport water, heat and cool, treat with chemicals and filters, etc. Also consider non-financial benefits in terms of positive public perception, risk avoidance, net benefits to community water supply, and alignment with national and global water commitments (e.g. SDG 6).
<i>“We looked at reuse a few years ago and there were no viable technology options.”</i>	Just because a technology may not have produced a positive business case in the past, don’t assume that holds true today or tomorrow. The water reuse technology space is rapidly advancing and as technologies become more widely used and demanded, the necessary investment will decrease. Additionally, many water reuse projects do not require advanced technology, relying on common tanks, pumps, and filters.
<i>“The risks of disrupting production during testing, installing, and maintaining reuse processes are too high.”</i>	Production risks if you don’t begin to reuse water may be even higher in terms of a reliable supply of water for current production and limitations on growth. Reusing water that is already within your ‘four walls’ provides complete operational and cost control.
<i>“Local regulations and social opposition will not allow us to reuse water.”</i>	Acceptance of water reuse has grown exponentially in recent years by regulators, water utilities, and the general public. Many geographies have realized that reactive measures during times of stress (e.g. water rationing during droughts) are not the long-term solution and that industrial water reuse and recycling should be supported as long as quality and safety risks are well managed.
<i>“We cannot risk even the remote chance of exposure to our products or people.”</i>	The protection of employees, consumers, and any person that may come in contact with water reused onsite or within products is paramount. First, there are many opportunities for non-contact reuse that should be explored first that are lower risk. There are also global and sectoral guidelines for managing exposure risks (e.g. FSMA, WHO, ISLI, USEPA) covering preventative measures, testing, monitoring, signage, etc.

Convinced to look at water reuse opportunities? If so, the [ISLI Water Recovery and Reuse: Guideline for Safe Application of Water Conservation Methods in Beverage Production and Food Processing](#) outlines an 11-step procedure for evaluating and implementing water reuse specific to the food and beverage industry and provides a wealth of detailed technical information. Here is a brief overview of action steps:



Complete a Water Survey or Mass Water Balance

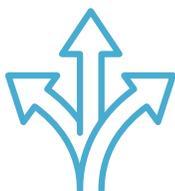
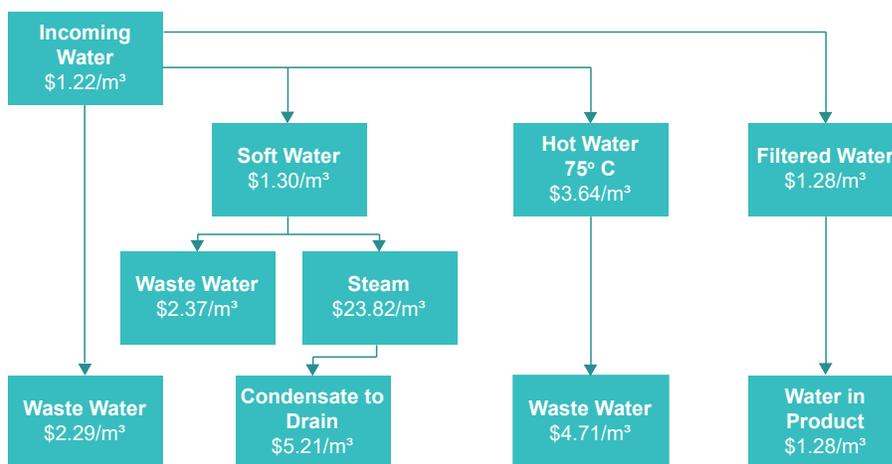
A critical first step is to complete a full water flow diagram to understand the quantity and quality of water flows into, through, and out of the facility. GEMI has developed a basic, user-friendly [Water Balance Calculator](#) which provides a good start.



Apply the True Cost of Water to Your Flow Diagram

A true or actual cost of water approach is essential for justifying water reuse investments. Consider purchase cost if externally supplied water, process chemicals, treatment, heating and cooling, transport, operations and maintenance, and sewerage fees. This will provide the embedded cost for all flows of water within your facility. Figure 3 below provides a Food and Beverage example of the true cost of water by stream. You can also utilize the [BIER True Cost of Water Toolkit](#).

Figure 3: True Cost of Water Example³



Prioritize Potential Opportunities for Water Reuse

Using the water flow diagram with embedded costs, the next step is to identify and prioritize potential opportunities for water reuse (sufficient volume, quality characteristics, and embedded cost) that could have a business case and be safely pursued. For instance, in the above example steam, condensate to drain, and hot water quickly grab your attention from a cost and heat recovery perspective. Many streams exiting a process will be clean enough to use in another application. The deciding criteria will be the quality, quantity, and location of water that could be recovered and its potential use, following appropriate treatment. Also, it is important to consider whether a given stream is fixed or variable in terms of water volumes relative to production.

3 True Cost of Water Example – Food and Beverage, ISLI 2013. <https://watereuse.org/wp-content/uploads/2015/03/OnsiteWaterReuseWebcast.pdf>

While reusing water for product contact purposes is technically feasible, it is not a widely accepted or allowed practice in most geographies at this point. However, there are a number of potential non-contact water reuse opportunities with each requiring water quality specifications appropriate for intended use:

Table 1: Examples of Water Reuse Options and Opportunities in Beverage Production⁴

Water Type	Water Sources	Common Reuse Options and Opportunities
Rain Water and Stormwater	<ul style="list-style-type: none"> • Roof, parking lot, all hard surfaces 	<ul style="list-style-type: none"> • Source water augmentation • Fire hydrants • Toilet flushing • Crate and vehicle washing • Landscape irrigation • Floor washing • Filters backwash • Facility (machinery) cleaning operations • Cooling towers • Boilers • CIP first rinse • Bottle washing • Package washing and rinsing • Bottle final rinsing
Utility Water	<ul style="list-style-type: none"> • Cooling pump seal • Instrumentation 	
Water Treatment System	<ul style="list-style-type: none"> • Membrane system reject • Carbon filter and multimedia backwash and forward rinse • Filter rinsing 	
Beverage Production	<ul style="list-style-type: none"> • Bottle washer waste, container final rinse • CIP Wash • Rinse waters (e.g. tanks cooling/warming tunnels, package rinse water, produce final rinse) 	

Upon prioritizing opportunities for potential water reuse, various considerations need to be made:



Regulatory Compliance

Regulatory compliance related to quality and safety is critical, including requirements of the Food Safety Modernization Act (FSMA). What local, regional/national, international, and company water quality specifications apply to the project? What will be the permitting, data monitoring, and reporting requirements?



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Water reuse regulations and incentives are rapidly changing throughout the world as regional water planners and governance realize the growing importance of embedding the 3Rs into strategies. This includes non-potable as well as indirect and direct potable water reuse. This [presentation](#) by the Water Research Foundation provides a useful overview of trends in the United States, including highlighting the USEPA release of a Water Reuse Action Plan in September 2019.

⁴ Table 5.1: Examples of Water Recovery Options in Beverage Production. ISLI Water Recovery and Reuse: Guideline for Safe Application of Water Conservation Methods in Beverage Production and Food Processing



Hazard Exposure

Can water reuse be implemented and operated safely and what are the associated hazards? Consider a Hazard Analysis Critical Control Point (HACCP) plan or similar to evaluate and manage the safe design, implementation, and day-to-day operation of a water reuse program and ensure no hazard exposure to products or employees. Adhere to the most relevant global, local, and sectoral guidelines for managing water reuse exposure risks (e.g. WHO, ISLI, USEPA) covering preventative measures, testing, monitoring, signage, etc.



Best Practices

What best practices and best available technologies exist for the relevant water reuse opportunity being evaluating? Has this been done within your company at another facility? By a peer company?



Cross-Functional Decisions and Stakeholder Engagement

What internal functions need to be involved and at what point(s) in the decision-making process (e.g. government affairs, legal, procurement)? How and when do external stakeholders need to be engaged (e.g. regulators, utility providers, trade associations, business groups)?

Water Reuse Opportunity Checklist	No	Yes
Has your site comprehensively evaluated water reuse options, including those listed in Table 1?	<input type="checkbox"/>	<input type="checkbox"/>
Does your site use a true or full cost of water when calculating the return on investment (ROI) for water reuse opportunities?	<input type="checkbox"/>	<input type="checkbox"/>
Has your site set a specific water reuse goal or target?	<input type="checkbox"/>	<input type="checkbox"/>
Is water reuse performance measured and documented, including performance against a goal or target?	<input type="checkbox"/>	<input type="checkbox"/>

If you answered “No” to any of the above questions, reference the following tools and implement relevant steps:

ISLI Water Recovery and Reuse:

[Guideline for Safe Application of Water Conservation Methods in Beverage Production and Food Processing](#)

BIER True Cost of Water Toolkit:

<https://www.bieroundtable.com/publication/true-cost-of-water-toolkit/>

WRF National Water Use in the Commerical, Institutional, and Industrial Sectors Benchmarks:

<https://www.waterrf.org/research/projects/developing-water-use-metrics-commercial-and-institutional-sectors>

What are the Opportunities with Water Recycling?

As introduced earlier in this guide, industrial facility wastewater or effluent is typically sent to a local municipal treatment plant, treated and safely discharged into water bodies, or applied to land. This is based upon a linear philosophy of **Take-Use-Discharge**.

An alternative, which is gaining attention in many geographies as the mindset of the value of wastewater is changing, is to treat and recycle water (also called wastewater reuse or water reclamation). This is the process of treating and converting wastewater into water that can be reused for other beneficial purposes onsite or offsite. Through advancements in technology, wastewater treatment can be tailored to meet the water quality requirements of a wide variety of beneficial uses including reaching drinking water standards. For a typical industrial facility, water to be recycled can be sourced by treating effluent from the facility's separate or combined system (industrial and sanitary wastewater).

Many geographic regions throughout the world are integrating water recycling into regional water strategies and public acceptance is growing. This changing mindset from a government and society standpoint opens greater opportunities and business cases to recycle treated effluent than ever before. According to the UN Summary Report on Wastewater, "... wastewater is no longer seen as a problem in need of a solution, rather it is part of the solution to challenges that societies are facing today."⁵ Un-tapping the potential of treated wastewater effluent requires a paradigm shift from the "treatment and disposal" approach to a "recycle and resource recovery" or circular mindset. Businesses and industries, especially those that source water from water-stressed regions, can tap into this new water source to build resiliency into their operations and/or the local community.



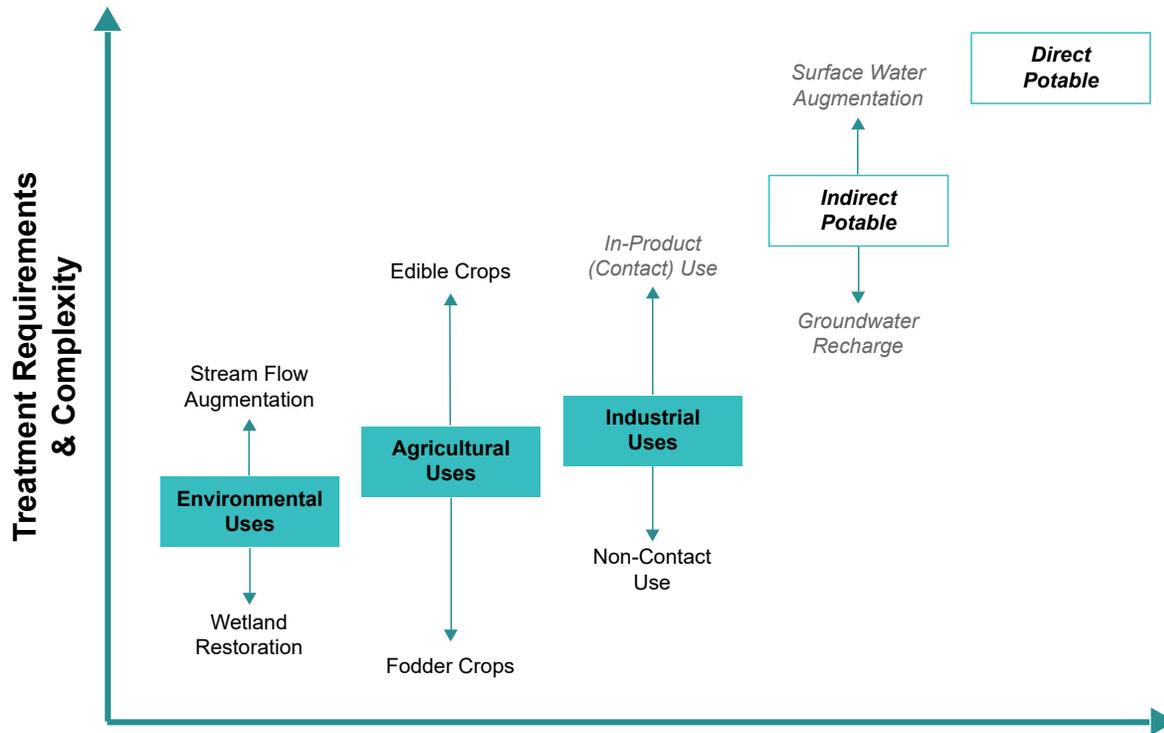
Did You Know...

Globally, it is estimated that over 80% of wastewater is released to the environment without adequate treatment. (UNESCO 2017)

While it is easier to maintain your site's current processes for discharging effluent, it is appropriate as a water leader and for longer-term business resiliency to consider options for water recycling onsite and/or offsite. Figure 4 on the following page provides a spectrum of common water recycling options and relative treatment requirements and complexity.

5 The United Nations World Water Development Report, 2017: Wastewater: The Untapped Resource

Figure 4: Spectrum of Common Water Recycling Options and Relative Treatment Requirements and Complexity⁶



While the options in italics are viable options for water recycling, they are yet to be widely accepted by regulators and external stakeholders for investment by industrial facilities. Within this section of the guide, we focus on the first three categories within the figure highlighted in teal, as these are the most common options considered by facilities for water recycling onsite or offsite due to the relatively low complexity and positive impacts on net water use.

When considering water recycling options at the facility level, it is logical to start with opportunities to use the recycled water onsite, followed by offsite use by a neighboring industry. These options directly support the business, while reducing net industrial water use within the watershed. Next, agricultural uses should be considered, as agriculture has a direct connection to the beverage value chain and commonly uses large amounts of water. The fourth option to consider, if no viable industrial or agricultural options are available, is to evaluate recycling water for environment and community use.



These four options are further introduced within the following sections.

6 Adapted from the Water Reuse Spectrum, page 13, Figure 1.1. The Water Reuse Roadmap. Water Environment Federation, 2018.

Water Recycling (Onsite)

BIER Definition: Water that requires additional treatment and reconditioning to use more than once within facility processes and/or on-property (e.g. landscaping, washing, etc...), instead of or prior to discharging as industrial effluent to a receiving body, the environment or a third-party wastewater treatment provider.



Recycling
(Onsite)

Option 1: Industrial Use by the Site

The Opportunity

Treated and recycled wastewater can be used by a business within their own property and operations as non-contact process water (e.g. cleaning, sanitation, cooling towers, boiler feed, landscape irrigation, firefighting, vehicle washing, dust suppression, and crate and pallet washing) provided that all company standards and all legal requirements and permit conditions are met. In addition, facilities in many geographic areas may have recycled water (reclaimed urban wastewater) available as an alternative water source from public or private water utilities.

Unique Considerations

- Operational controls to ensure that recycled water is not used, directly or indirectly, for activities involving human or food contact.
- Supplemental or back-up water supplies may be required in the case where water recycling volumes are insufficient, treatment fails or systems are shutdown (e.g. maintenance).
- Emergency preparedness and response plans should account for the water recycling system.
- Unique regulatory approvals and/or permits may be required to construct and operate a water recycling system, which could also require ongoing monitoring, laboratory analysis, performance measurement, and/or reporting.

Water Recycling (Offsite)

BIER Definition: Water that requires additional treatment and reconditioning for beneficial use off-property by the company or a third-party (e.g. irrigation, green infrastructure, neighboring industry, etc...) as an alternative to discharging as industrial effluent to a receiving body, the environment or a third-party wastewater treatment provider.



Recycling
(Offsite)

Option 2: Industrial Use by a Third Party Site

The Opportunity

Recycled water can be directed to use by an offsite neighboring third party industrial site. This type of collaboration is often termed industrial symbiosis, which is the exchange of waste products for the mutual benefit of two or more businesses. While such an exchange can be beneficial from a water stewardship perspective in terms of direct use of treated wastewater, there can also be other valuable exchanges such as heat, steam, organic material, nutrients, or biogas production. There are some examples of sharing the management of utilities or ancillary services between multiple proximate industries, especially in industrial parks. In addition, facilities in many geographies may have recycled water (reclaimed urban wastewater) available as an alternative water source from public or private water utilities.

Unique Considerations

- Often, regulatory and logistical barriers exist to resource sharing and considerable effort might be necessary to remove them.
- Long-term commitment from all partners required to benefit from initial capital and time investments.
- The business case may be challenging as the water supply and watershed benefits alone will not likely be sufficient, combined with a low cost of water. However, a facility may discover that they must treat wastewater to a higher standard due to permits and regulations for some recycling options, which could reduce overall costs.
- Industrial users of recycled water will have varying requirements regarding water quality as certain characteristics can cause challenges with clogging, scaling, biofilm growth, and aesthetic issues.

Option 3: Agricultural Use

The Opportunity

Agriculture accounts for approximately 70% of freshwater withdrawals globally (UN Water, 2014). To reduce dependence on freshwater and maintain a constant source of water for irrigation throughout the year, recycled wastewater from industry can be a viable water and nutrient source for agriculture. Direct uses by agriculture commonly include irrigation, aquaculture, and livestock. In some instances, the treated wastewater is used for managed aquifer recharge (MAR) which further filters pollutants, allowing the water to be usable for all types of crops⁷.

Generally, crops such as corn, alfalfa (and other feed), fibers (e.g., cotton), trees, tobacco, fruit trees (e.g., mangoes) and foods requiring processing (e.g., sugar beets) can be grown safely with properly treated and applied wastewater. Also, crops produced for energy and biofuel production present opportunities. There is a higher level of complexity, risks, and precautions for fruits and vegetables that may be eaten raw (e.g., tomatoes).

Unique Considerations

- Long-term use of poorly or improperly treated water may cause long-term damage to the soil structure and its ability to hold water. Soil quality can degrade over time (e.g., due to the accumulation of salts) if poorly treated wastewater is applied.
- Managing the dynamic of nutrients being good for plant growth, but harmful if there is too much runoff into waterbodies can be a challenge. This may require diluting or alternating application of the recycled water with another potable source.
- While application of the recycled water may be done in a safe and responsible manner, contamination can occur from other non-related influences (e.g. animal feces) making it falsely appear that the recycled water is the cause. There is also a significant amount of land irrigated with untreated or partially treated wastewater which fuels concerns and misperceptions.
- Water storage may be required for treatment purposes and/or because supply and demand for the project may not consistently match, because of the inherent seasonality of agriculture.

7 United Nations World Development Report, 2017. Wastewater: The Untapped Resource. Page 74.



**Recycling
(Offsite)**

Option 4: Environment and Community Use

The Opportunity

There are two main opportunities to consider with this option. The first is to use the environment as green infrastructure to provide wastewater treatment as an alternative to conventional treatment systems (grey infrastructure). There has been increased focus on natural treatment and a growing evidence base for using riparian buffers, natural and constructed wetlands, and bioretention ponds. The second option is directing recycled wastewater to the environment for volume, nutrient, and organic carbon benefits. Treated wastewater can be used to create or maintain lakes and wetlands, recharge aquifers, irrigate parks and gardens, and manage seasonal variability (e.g. droughts, summer months).

Unique Considerations

- These options require an understanding of local environment and watershed dynamics (e.g. ambient standards and assimilative capacity) and potentially detailed scientific studies to evaluate the social and environmental implications.
- Green infrastructure and natural treatment systems must be carefully managed and do have limitations in terms of adapting to varying flows and characteristics of wastewater to be effectively treated.
- Long-term horizons for many projects, requiring a commitment to maintain natural systems and monitor conditions on an ongoing basis.

When considering water recycling options, both onsite and offsite, it is important to follow a methodical step-by-step approach to minimize business risks and maximize positive outcomes. An example step-by-step approach is presented on the following pages.

Common Steps and Considerations for Water Recycling

Steps	Description
Step 1: Scoping	<ul style="list-style-type: none"> <input type="checkbox"/> Clearly define the project needs and drivers. Why does it make sense to pursue water recycling?
Step 2: Water Sources	<ul style="list-style-type: none"> <input type="checkbox"/> What volume of potential treated wastewater is available for water recycling? Is this volume consistent throughout the year? <input type="checkbox"/> Are there any business plans that could impact the volume (e.g. production increases or decreases)? <input type="checkbox"/> Are there any supplemental sources of water that could be included (e.g. stormwater, neighboring industry)?
Step 3: End Use Options	<ul style="list-style-type: none"> <input type="checkbox"/> What are viable end uses for the recycled water, in terms of Industrial Agricultural, and/or Environmental? <input type="checkbox"/> Do these end users need a sufficient volume of water and is their demand consistent throughout the year? <input type="checkbox"/> Are they able to commit long-term to the project (e.g. any risk of going out of business, moving their operations, downsizing, etc...)?
Step 4: Stakeholder Mapping	<ul style="list-style-type: none"> <input type="checkbox"/> Who are the most relevant stakeholders and what are their relative levels of interest in the project and potential negative or positive impact in terms of success? <ul style="list-style-type: none"> <input type="checkbox"/> Internal Stakeholders: Government or Regulatory Affairs; Procurement; Legal; Engineering; Community Relations <input type="checkbox"/> External Stakeholders: Regulators; Non-Governmental Organizations; Universities; Watershed Councils; Utilities (e.g. current water provider) <input type="checkbox"/> For priority stakeholders, what level of involvement and/or communication is necessary to ensure they are aligned with your objectives before, during, and after project implementation? <input type="checkbox"/> What is local public opinion on water recycling projects?
Step 5: Social and Environmental Impacts	<ul style="list-style-type: none"> <input type="checkbox"/> Will redirecting current wastewater flows have any negative (e.g. discharge river downstream flow or quality) or positive (e.g. wetland restoration) benefits that require consideration or studies? <input type="checkbox"/> Will redirecting current wastewater flows impact other water users in terms of water rights, allocations, and distribution?
Step 6: Regulatory Requirements	<ul style="list-style-type: none"> <input type="checkbox"/> Based upon the stakeholder mapping (Step 4), which regulatory agencies are relevant to the proposed project(s)? <input type="checkbox"/> Is there water governance alignment between regional water planning and regulatory structures in terms of integration between water, stormwater, and wastewater? Are objectives, policies, and financial mechanisms (incentives or disincentives) aligned or contradictory? Are political boundaries aligned with watershed boundaries? <input type="checkbox"/> What modifications are necessary to existing wastewater-related permits? <input type="checkbox"/> What new regulatory requirements and permits will the project trigger before, during, and after implementation? <input type="checkbox"/> Will the use of recycled water impact flows and/or water rights allocations (e.g. who has legal access to an existing effluent discharge and how much of that flow is allocated through the receiving water that is subject to appropriation)?

Common Steps and Considerations for Water Recycling (continued)

Steps	Description
Step 7: Financial Review	<ul style="list-style-type: none"> <input type="checkbox"/> What is the business case for recycling water in terms of CAPEX and OPEX? Does the project meet company Return on Investment (ROI) criteria? <input type="checkbox"/> If not, have you considered a True Cost of Water perspective in the calculations? Have you accounted for cost or risk avoidance? Business continuity benefits both short- and long-term? Reputational or brand advantages?
Step 8: Go / No-Go	<ul style="list-style-type: none"> <input type="checkbox"/> Based upon information collected through Steps 1-7, should the facility proceed with the water recycling project?

Water Recycling Opportunity Checklist	No	Yes
Is your site treating wastewater prior to discharging and do you have the capacity to treat to a level where the volume could be recycled for beneficial use onsite and/or offsite?	<input type="checkbox"/>	<input type="checkbox"/>
Are there viable options to recycle water for industrial, agricultural, and/or environment and community uses?	<input type="checkbox"/>	<input type="checkbox"/>
Has your site evaluated common drivers for water recycling and is there a sufficient business case?	<input type="checkbox"/>	<input type="checkbox"/>
Has your site engaged appropriate internal and external stakeholders to sufficiently validate positive and negative impacts or barriers for pursuing water recycling, including regulatory considerations?	<input type="checkbox"/>	<input type="checkbox"/>

If you answered “No” to any of the steps above, reference the following tools and implement relevant steps:

United Nations World Development Report, 2017. Wastewater: The Untapped Resource

<https://unesdoc.unesco.org/ark:/48223/pf0000247153>

EPA’s WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities

https://www.epa.gov/sites/production/files/2017-02/documents/watersense-at-work_final_508c3.pdf

LS&Co. Water Recycle/Reuse Standard

<https://www.levistrauss.com/wp-content/uploads/2014/02/LSCo-Water-Recycle-Reuse-Standard.pdf>

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About the Beverage Industry Environmental Roundtable (BIER)

The core mission of Beverage Industry Environmental Roundtable (BIER) is to advance the sector's environmental sustainability by developing industry-specific methods and data. In other words, we seek to create tools and methodologies that accelerate sustainability and its journey from analysis to action.

BIER is a technical coalition of leading global beverage companies working together to advance environmental sustainability within the beverage sector. Formed in 2006, BIER aims to accelerate sector change and create meaningful impact on environmental sustainability matters. Through development and sharing of industry-specific analytical methods, best practice sharing, and direct stakeholder engagement, BIER accelerates the process of analysis to sustainable solution development.

BIER is facilitated by Antea Group (<https://us.anteagroup.com>)

