



# Park Foundation Water Investing Values and Sector Summaries

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## Overview

The goal of this project is to help provide the Investment Committee and Board of Directors of the Park Foundation with greater information about the subsectors of the water/water solutions industry that are most relevant to the Foundation. The areas covered in this paper were derived from a list created by KBI Global Investors of water industry “niches”, which we have called sectors or sub-sectors. This original list included 47 different areas of which we have selected 15 for initial analysis. These were chosen for their potential alignment with Park’s interests and values or substantial likely concerns for Park. The full list of niches is available at the end of the report.

Each of the summaries includes overview information including some factors related to how well the industry might fit the Park Foundation’s goals. The specifics are covered in the next section “analysis factors”. The text of each summary contains an overview, an identification of “the problem” that the sector is solving, the solutions that the sector offers to those problems, and then an assessment of the impact and potential problems of the sector. These assessments have been made with an understanding of the Park Foundation’s goals, but **remain my assessment alone and are open for discussion and interpretation.**

In addition to the sector summaries there are some visual graphics intended to help the Foundation to understand which subsectors best align with their values and are likely to have the most impact. One factor that may confound some of this analysis is that these are analyses of each subsector, not of the companies themselves. As you will note in the company analyses many of the companies have businesses in multiple sectors and also do business with other industries, especially fossil fuel and mining companies which use substantial quantities of water and also work with oil and other fluids.

### **A Note on Privatization**

Privatization efforts touch many parts of the water industry and vary depending on the country and the contractual nature of the agreements. While many of the sectors covered in this paper inherently work with both public and private utilities, this paper does not generally touch on these efforts and they have been excluded from the analysis as well. Where companies are engaged in privatization, I have attempted to note that in the company analysis, though it may not be exhaustive. There are a variety of different methods for ownership of and investment in the direct provision of water. In part because of the complexity of these agreements and the variation in countries, I believe these areas need further analysis if the Park Foundation is interested in getting more involved.

## Analysis Factors

### **Potential Impact**

This factor evaluates the potential for a particular investment (on a Low – Medium – High scale) to have a positive influence in some of the related areas Park Foundation cares about, particularly access to clean water, especially in the United States, but also around the world, climate resilience, pollution of clean water supplies. Overuse of clean water and infrastructure have been included particularly because of their relation to these areas. This area is intended to be independent of Park’s values broadly: for example, if product or service might have the possibility of having a major positive impact on pollution, this might be high even if it is cleaning water from extractive operations.

### **Values Alignment**

This point attempts to assess whether the work in the subsector as a whole supports or contradicts the values of the Park Foundation on a Low-Medium-High scale. If the primary role of the sector is involvement in the kind of work that violates Park’s values around extraction, fossil fuels, or pollution, for instance, it would score lower on values. To score a “high” the sector must strongly support Park’s goals. Additionally, some areas have been rated “Negative/Inherent Problems” where I have judged the area to be fundamentally at odds with Park’s values.

### **Direct Concerns**

This attempts to assess how the actual work in the area has the potential to cause or support the development of specific problems. Desalination, for instance, not only has the potential to enable freshwater access, it also creates the possibility that users will not reduce water usage or improve filtration, but instead continue expanding usage through a more fossil fuel intensive source. This is also on a Low-Medium-High scale.

### **Corporate Concerns**

This attempts to analyze whether many of the corporations in this subsector are involved in other areas that are areas of concerns for Park Foundation (i.e. have large relationships with the oil industry even if the particular technology is not intended for oil industry use). This is simply on a Yes/No basis and is highly variable because many sectors have a wide variety of companies involved. This analysis has only been applied to the sectors for which there are summaries—those for which I have done substantial research on the component companies.

## Possible Next Steps

This paper only covers one slice of possible investments in the water industry, those related to companies producing the equipment and technology necessary for the water industry and some services. This does not include utilities, or the ownership of water rights. While much of this analysis is of public companies, according to KBI, approximately 80% of the water industry is in private investments.

A large percentage of new investment activity related to clean water access and reduction in pollution is through various forms of infrastructure investment, including bonds (the most traditional), lending, mezzanine debt, and direct ownership of assets. For the Park Foundation, these types of investments have an intersection of possibility and concern. The investments have the potential to have clear, possibly measurable, impacts; yet, there is the concern about how the investments are structured with relationships to privatization. If the Foundation is interested in continuing down the path of making strategic impact investments in the water area with the goal of direct, positive, impacts, it is likely that it is important to further assess this area. In order to make these decisions the Foundation may find it useful to use this paper to help determine its broader goals for water investing.

Some possible next steps for the Park Foundation include:

- Further analysis of specific sectors that may offer opportunities for alignment and impact including green infrastructure (not included in KBI's list) and rural/underserved water.
- Developing broader goals and clearer values for investing in water that are more applicable across areas and investment types.
- Looking into a variety of different types of impact investment opportunities that exist in the marketplace to help the Foundation understand what is available and how they fit their values and goals.
- Analysis of specific impact areas that are of special interest to Park, i.e. Clean Water Access or Pollution Reduction.

## Sub-Sector Analyses

### Build-Own-Operate (Industrial)

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	High
<b>Values Alignment</b>	Low	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Water Efficiency	Pollution Reduction	

#### **Sector Summary**

There are many forms of outsourced water and wastewater treatment for infrastructure (municipal) and industrial projects. Build Own Operate (BOO) is one form outsourced provision that is typically related to corporate and industrial clients and not used in municipal infrastructure development<sup>1</sup>. BOO projects involve contracts where an industrial operator or facility will design, construct, and manage, an ultra-pure water or wastewater treatment plant. The capital is provided by the project owner and the project is financed based on the revenue streams from the facility. The owner of the project makes money from the sale of the water or sewer services.

#### **The Problem**

Industrial facilities in a variety of industries including power production, food & beverage, pulp and paper, and semiconductors, can require clean water for inputs and produce substantial quantities of wastewater. This water must be treated upstream and/or downstream of the production facilities. Yet many companies do not have the expertise to develop and manage these facilities and would prefer to invest their capital in their core operations.

#### **Positive Solutions**

Build, Own, Operate facilities give these industrial users an opportunity to buy water and wastewater treatment as a service, rather than investing in the physical and human capital for the construction and operation of facilities themselves. BOO companies take some portion of the risk of the project, are in charge of operating it, and own it in perpetuity. Theoretically these companies have an incentive, because they will own and operate the project for the long-term, to design the facility with the full life cycle costs taken into consideration. If this is done these facilities may be more energy efficient and reach higher environmental standards, then a facility owned by the company that would have built the project otherwise.

#### **Impact Assessment/Additionality (of Sector)**

If these projects end up doing a more effective job of treating water and wastewater they may have a high impact on contamination levels or amount of effluent returning to the environment.

#### **Possible Values Challenges**

Investments in these companies is essentially taking an ownership stake in water or wastewater treatment for industrial uses. This may be seen as supporting the facilities themselves. These companies also have the potential to shift responsibility from manufacturing facility owners, potentially hindering corporate accountability efforts.

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<sup>1</sup> Other forms of outsourced provision include concessions, Design-Build-Operate, Build-Operate-Transfer, and contract operations.

## Company Profile – China Everbright Water

<b>Headquarters</b>	Shenzhen, CN / Singapore
<b>Reach</b>	China
<b>Revenues</b>	~\$250M US
<b>Employees</b>	~400

China Everbright Water designs, builds, owns, and operates municipal and industrial water, wastewater, and water reuse facilities throughout Northeastern China. The company has the internal engineering, financing, and management capacities. Combined, China Everbright has the capacity to treat approximately 5 million cubic meters of wastewater per day (China Everbright Water Limited). The vast majority of the company’s projects are Build-Operate-Transfer (BOT) and Transfer-Operate-Transfer (TOT), municipal infrastructure management models where the municipality retains ownership of the project and eventually takes control. For industrial projects the BOO structure may be utilized. The Jinan Licheng Reusable Water Project, for example, uses the water processed by a wastewater treatment facility for pure water used in power plants.

Recently, China Everbright has begun to develop “sponge city” projects which use green infrastructure techniques to help cities reduce water flows and flooding. In China a major effort for developing new cities with this sponge design is taking place with a goal of limiting runoff and flooding problems that many older cities face.

### Concerns

The company owns wastewater treatment facilities around China and is also engaged in private management of these facilities serving municipalities. The company may have an interest in raising tariffs for wastewater treatment to consumers.

### Other Sector Participants

**GE Water** provides BOO services around the world and “currently owns and operates hundreds of industrial and municipal plants processing more than 360 million gallons per day” (“Build-Own-Operate Services”).

**Dynatec Systems** is based in Burlington, NJ and provides complete wastewater treatment systems for industrial facilities on a BOO basis. Dynatec charges per gallon for the amount of water treated. The company also provides wastewater treatment equipment through design-build options and simply through technology sales.

**Veolia, Suez Environnement, and American Water** also offer services on a similar basis.

### Financial Opportunities and Risks

According to KBI, this type of deal is happening more and more in industrial applications and is likely to continue to grow worldwide. Individual projects have risk related to performance and longevity of customer relationships.

**Additional Impact Investment Opportunities**

In the industrial BOO sector there may be opportunities for financing companies providing BOO with debt. It is unlikely Park would consider this an impact investment.



## Desalination Technology

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	Medium
<b>Values Alignment</b>	Negative/Inherent Problems	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Clean Water Access	Climate Resilience	Energy Efficiency

### Sector Summary

The desalination technology subsector develops and provides the technology for turning salt water, primarily seawater, but also brackish water from aquifers and other sources, into water usable for drinking. Providers of desalination technology provide the membranes for new desalination plants as well as technology for reducing energy usage in the plants, and are developing new methods for desalinations more efficiently and cheaply.

### The Problem(s)

Only 2.5% of the world's water is freshwater including ice caps, ground water, and surface water (USGS.) The rest is saltwater, primarily in oceans and seas. The global population is growing and people are getting richer. Together, there are increasing demands for fresh water for drinking, irrigating crops, and for many uses of an industrial economy including manufacturing technology and fossil fuel extraction. At the same time, drought, desertification, and unpredictable weather from climate change are straining existing water resources in many parts of the world including those that already have limited water resources. One way to provide access to water is to turn plentiful salt water into potable water. This technology is used in large applications for municipal drinking water supplies and smaller applications on islands and for private use.

Historically, desalination has been highly energy intensive and extremely costly. Desalination technology providers have developed more energy efficient and cost effective technology, particularly reverse-osmosis desalination, and are continuing to improve on this front.

### Positive Solutions

Theoretically, desalination can supplement existing freshwater supplies and help to relieve the pressure on aquifers and surface water in areas facing water stress, helping to ensure drinking water, agricultural supplies, and ensure water is left for ecosystems. Desalination technology providers enable drinking water to be produced from brackish water and seawater. The cost and energy requirements of this system have historically been very high but have begun to shrink. Multi-stage flash, an older method of desalination used extraordinary amounts of energy and is especially costly and energy intensive. This technology has been widely used in the Gulf-states. Newer methods including multi-effect distillation and reverse osmosis can reduce costs and can work well with concentrated solar power (CSP). MED in particular is suitable for use with solar power. Improvements in desalination technology may continue to make the process more energy efficient and cheaper.

### Impact Assessment/Additionality (of Sector)

Investing in technological improvements in desalination could make the technology cheaper and more energy efficient, enabling its installation in more places, and potentially helping to alleviate water shortages globally.

### **Possible Values Challenges**

Desalination has a substantial number of values concerns relating to its role in the water cycle, energy usage, and effects on ecosystems. President Emeritus at The Pacific Institute in reference to the use of desalination in California, says “either desalination is the right choice or isn’t. At the moment in California, it isn’t,” (“The Future of Desalination in California Is Still in the Future”) referring to the high environmental and financial costs of desalination and the much more effective and affordable opportunities for efficiency and reuse.

Another major problem with desalination is that it disincentives conservation. Currently the vast majority of freshwater is used for agriculture. Industrial uses also comprise a substantial portion of the usage. Rather than encouraging efficiency from all users, desalination may enable the continued overuse of water by creating the broader impression and implication that there are limitless supplies of water in the ocean without consideration of the associated costs.

Desalination plants are also very expensive to build and to operate. This means that it is primarily useful in countries with substantial financial resources and the ability to use energy to create water. Desalination is typically more energy intensive than other water sources, though when water requires substantial transfer across distance, it may approach parity in the amount of energy used by the time water reaches the end user. Desalination as an energy source can have substantial greenhouse gas and other emissions.

Finally, desalination can cause local environmental problems. Desalination, done improperly, can cause damage to local ecosystems by returning higher-salinity water to oceans damaging marine habitats. Providers of technology argue that newer technology, when properly utilized, can reduce these kinds of problems.

### **Company Profile -- Pentair**

<b>Headquarters</b>	Worsley, UK
<b>Reach</b>	Global
<b>Revenues</b>	\$6.4B (2015)
<b>Employees</b>	30,000

Pentair provides water, fluid, and thermal management for municipal, residential, commercial, and industrial clients. The company designs and manufactures equipment for fluid management across a variety of applications, including residential and commercial uses. This includes well water pumps, tanks, purifiers, and pressurization equipment for use in buildings. They also manufacture control systems for these uses. Aside from water Pentair manufactures products for electrical number of control and protection systems for use in electrical systems of various kinds.

Pentair’s filtration and flow management business includes the production of membranes for desalination. The company does not disclose revenues or sales for the desalination portion of the

business, but less than 20% of all sales are for infrastructure uses, and only half of revenue is from the flow & filtration portion of the business. It is highly likely that only a very small portion of revenues comes from desalination-related technology.

### **Concerns**

Approximately 25% of Pentair's sales are providing a variety of services to the energy industry for different uses.

### **Other Sector Participants**

**Energy Recovery Inc.** is a U.S. Based company that focuses on helping users in a variety of industries related to oil and gas, chemicals, and water, recover energy in order to reduce costs and environmental impacts. The company manufactures technology for recovering energy throughout the desalination process, saving money and energy. The company also manufactures pumps.

**Toray Membrane** is a subsidiary of Toray Industries, Inc. a public Japanese conglomerate with over 45,000 employees across all of its businesses and sales of ~\$19B US. The membrane subsidiary makes membranes for a wide variety of applications. One of their products is a membrane manufactured for reverse osmosis for sea water.

**Aquasource** is a subsidiary of Degremont, a French water company owned by Suez Environment. Suez Environment is involved in private water utilities around the world. This subsidiary manufactures membrane for use in a variety of different uses.

**Flowserve**, a U.S. based company with \$4.5B in sales and 18,000 employees, provides pumps and instrumentation for a variety of industries provides pumps and energy recovery devices for use in desalination operations. The majority of the company's business is in the oil & gas and chemicals industry.

### **Financial Opportunities and Risks**

As populations grow and risks from climate change increase, it is possible that there is substantially more investment in desalination around the world. Investors in desalination technology stand to benefit from the increase in demand as long as the companies they invest in are providing the technologies used by the newest plants. Reverse osmosis facilities in particular require regular servicing and replacement of filtration devices. The ability to easily use waste energy or renewable energy may substantially increase the growth of desalination.

Water efficiency and reuse, properly implemented, may substantially decrease the need for desalination in many parts of the world, although some drier regions may continue to use this method. Ownership structures and performance are also a financial risk—improperly constructed ownership structures and poor financial performance may turn consumers and governments against desalination.

## Dewatering – Muni (Sewer Bypass)

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	Low
<b>Values Alignment</b>	Medium	<b>Corporate Concerns</b>	Yes
<b>Impact Areas</b>	Infrastructure	Pollution Reduction	

### Sector Summary

Dewatering is the process of removing water from an area where it is not wanted. The municipal dewatering/sewer bypass sub-sector of the water industry is focused on 1) bypassing existing water and sewer systems for the purpose of repairs and reconstruction 2) temporarily removing water from areas during heavy rainfall, flooding. Companies in the sector are not just the makers of dewatering equipment, but the leasing of dewatering equipment to municipalities as well as contractors that actually implement the dewatering process. Although big companies may provide services from manufacturing to implementation there are also smaller, often private, companies that lease and/or perform dewatering services.

### Problem

Across the developed world infrastructure is aging. In particular water and sewer systems need replacement. While the population and demand for water is growing, and aging water systems are passing their useful lives, investment in municipal water systems has been declining. (Duquesne Article) Municipal sewer systems face similar challenges. In particular, many systems were built with combined sewer and storm water. Facing the effects of climate change, including more frequent or larger rainstorms, these systems face overflow, which can lead to the pollution of water sources. In countries in the Global South, cities face the challenges of the need for substantially expanding sewer systems to deal with an increase in population and to increase hygiene.

### Positive Solutions from Dewatering

Dewatering and bypass has two roles. First, they provide pumping systems and services to water utilities that allow the bypass of pipes in need of repair, including the replacement of lead pipes. This enables the continued operation of water systems while repairs to sewer or water delivery happens. This kind of system is necessary because it is not generally possible to remove utility services from residents and other customers for long periods of time. Second, dewatering solutions also allow for the pumping of storm water away from overloaded sewer systems. The addition of temporary or permanent dewatering facilities can enable the removal of storm water before it mixes with wastewater or help to prevent flooding by supporting the rapid removal of water from storm systems. For example, dewatering pumps are used to help move water away from Beijing's streets and prevent flooding (Xylem Case study). Done properly this can help save money for municipal systems. Possible improvements from dewatering include:

- Energy efficient pumps
- Cheaper pumps
- Enabling the upgrade of water/sewer systems
- Helping to make communities more resilient to increased heavy rainfall

### Impact Assessment/Additionality (of Sector)

Municipal dewatering enables the upgrading of water and wastewater infrastructure around the world. It is necessary for these kinds of upgrades to happen. The sector also provides for emergency dewatering for storm water. The former application is important and necessary but is happening already. It is not clear that there is substantial improvement related to water in this area. Improvements may be made in terms of energy efficiency. Storm water removal, may, on the other hand be able to help communities become more resilient to climate change. As certain areas face stronger rainfall new pumping systems and more efficient systems may help them to avoid damaging floods or costly upgrades to infrastructure systems.

**Possible Values Challenges**

There are limited concerns related with the specific municipal dewatering part of the industry, as it generally serves freshwater and wastewater treatment systems from consumer and business uses, rather than industrial or extractive industry uses. The major concerns here are corporate. The technology for municipal dewatering is similar to that used in a number of other applications. Companies may use this and similar technologies to address industrial issues. Especially those serving oil and gas, as well as power generation, are likely to cause concern.

**Company Profile – Xylem**

<b>Headquarters</b>	Ryebrook, New York
<b>Reach</b>	Global
<b>Revenues</b>	\$3.65B
<b>Employees</b>	12,500+
<b>Slogan:</b>	“Let’s Solve Water”

**Xylem Inc.** is an integrated water technology provider that provides services across a wide variety of different water solutions niches. The company helps customers globally transport, treat, and test water. Customers come from all sectors of water users and services include disinfection, desalination, and wastewater treatment. They provide equipment and services for a variety of different parts of the water industry. The company’s revenue primarily derived from water transport and building services (Fig. 1.), while industry is the largest end user of their services. Their services include transportation, treatment, and testing for oil and gas industries including hydraulic fracturing.

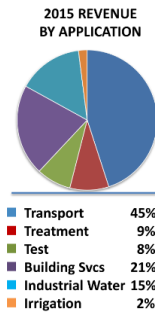


Figure 1. Source, Xylem Investor Presentation

It is not clear from an initial review what percentage of the industrial end market is oil and gas (Fig. 2) or other extractive industries.

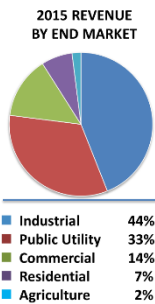


Figure 2. Source: Xylem Investor Presentation.

At the same time, Xylem claims to have a strong commitment to helping clients reduce water use and manage clean water—as well as a financial incentive to do so. Xylem is encouraging, and supporting more reuse of water in different arenas, improving wastewater treatment. In their sustainability report, done using the Global Reporting Initiative system. On the whole, Xylem is a complex company providing a variety of services to sectors that may have both long-term positive and negative water impacts.

## **Concerns**

Some of the business lines in which Xylem participates in this arena include supplying water equipment to the oil and gas industry and supplying impact monitoring for fracking wells. The company also highlights the use of Xylem pumps and technology for water and dewatering for use in oil sands other oil and gas operations. According to Xylem energy production is the second largest user of water after irrigation globally (approximately 25% of consumption) (Xylem).

## **Other Sector Participants**

There are a wide variety of other participants in this marketplace. Many manufacturers of pumps of different kinds include sewer bypass. These companies often also offer services for industrial uses including oil and gas. There are companies that offer contracting and engineering services, equipment rentals, as well as the manufacturing and production of pumps. Some companies, like Xylem, can serve all of the needs of some clients. Many companies in this sector of the industry are smaller privately held firms.

**Mersino** is an example of a service provider. They claim to offer “complete water solutions” and provide a full range of sewer bypass services to municipalities and other users.

**Griffin** is a service provider and smaller manufacturer serving the continental US. They offer a variety of dewatering options including bypass pumping. They manufacture pumps and will make custom pumps if necessary. Their bypass services serve a variety of sector including municipal sewer infrastructure. Their other lines of business include removing water from construction sites and selling pumps that serve to bring water to nuclear power plants.

## **Financial Opportunities and Risks**

There is a huge need for investment in water infrastructure in the global North that will require dewatering/bypass of old infrastructure enabling repairs, retrofits and upgrades. As climate change may increase flooding pumps will also be necessary for removing water from storm water systems. It is possible that these investments do not happen and upgrades are not made, limiting the growth of the sector.

## Disinfection, Separation, Water and Wastewater Services

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	High
<b>Values Alignment</b>	Negative/Inherent Problems	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Reduce Pollution	Water Efficiency	

### Sector Summary

The disinfection, separation, and water and wastewater treatment services sector provides on- and off-site water and wastewater treatment for industrial and oil and gas operations. Companies will either bring equipment onto an industrial or extraction site or pipe or truck wastewater to an off-site location for treatment. In extracting the water treated is either wastewater that has been used in operations or “produced water” water that comes from an operating oil or gas well. “Unconventional” oil and gas, particularly fracked shale gas, oil shale, and oil sands in particular has major water requirements. This briefing covers both the disinfection & separation services as well as water & wastewater disposal services because they have many similarities.

### The Problem

Industrial processes, and especially development of oil and gas resources often produce wastewater that has a wide variety of naturally occurring and added chemicals. This water can be either water used in a process—like fracking—or in oil & gas development—produced water that returns out of the well with minerals, sediments, and sometimes radioactive particles in them. This water may also have dissolved oil and gas. This untreated water cannot be reused or safely disposed of without substantial treatment.

### Positive Solutions

Contract water treatment enables companies to bring in experts to clean water for reuse or disposal. Reuse of water enables overall reduction in water inputs, and both may reduce pollution. This water can be piped or trucked off-site or treated directly on site. In particular, in oil & gas production, fossil fuel companies may not have the expertise or technology to treat water, and instead prefer to hire a services company to do so. Separation allows the recovery and eventual sale of some dissolved oil from produced water. These services are a positive development if these companies do a better job than would be done otherwise, especially if they help to reuse water and limit the amount of freshwater being used in extraction.

### Impact Assessment/Additionality (of Sector)

This sector may have a major impact if these companies provide more sustainable solutions that would not otherwise be used by customers. This is especially true if it limits water use and disposal above and beyond regulations.

### Possible Values Challenges

Much of this subsector treats wastewater from oil & gas uses and in many cases also helps to provision water for oil and gas drilling operations. Investors who believe that either these services cause more problems than they solve, or would prefer not to be involved in the extraction of fossil fuels, should not invest. Investors who believe that services substantially

improve management and that these companies do a better job than would otherwise be done may want to invest carefully.

### **Company Profile – Newalta**

<b>Headquarters</b>	Calgary, Canada
<b>Reach</b>	US & Canada
<b>Revenues</b>	\$328M
<b>Employees</b>	1200

Newalta is a Canadian company that provides a variety of oilfield services related to water and wastewater. Half of the company’s operations are related to heavy oil which includes oil sands. They manage, treat, and dispose of waste for the companies in these industries, helping them to recover the maximum amount of oil and to reuse wastewater in drilling operations. They offer on-site waste treatment as well as off-site treatment options. The company’s primary operations are in Western Canada and the Bakken oilfields though they also have operations in the Marcellus and Texas. The company particularly specializes in “recovering saleable products.”

### **Concerns**

The company only provides services to the oil and gas industry and specializes in cleaning water from extraction. Half of the company’s operations are related to heavy oil which is harder to extract and costlier to produce.

### **Other Sector Participants**

**Nuverra Environmental Solutions**, headquartered in Scottsdale, AZ, offers support for the development of oil and natural gas, particularly the provision, recycling, and reuse, treatment and disposal of water and solids from drilling operations. The company especially focuses on trucking water and wastewater. The company had \$493M in revenue in 2015.

**Select Energy Services** is a privately owned Texas based company with over 2,000 employees. The company provides a variety of water-related services including treatment and testing of water for drilling and after drilling.

**Halliburton** and **Schlumberger**, major oilfield services companies, also offer water related services to their customers.

### **Financial Opportunities and Risks**

These services are dependent largely on commodity prices especially in the oil, gas, and mining areas. As commodity prices increase companies drill more wells and operate mines at full capacity. In a decreasing price market companies close mines and reduce extraction operations.

### **Impact Investment Options**

If investors believe that these companies offer important services, investment and shareholder engagement may be one useful possibility.



## Disinfection Technology

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Low
<b>Values Alignment</b>	High	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Clean Water Access	Pollution Reduction	

### Sector Summary

Disinfection is generally the last step in the municipal water treatment process applied to surface water (“Water Treatment | Public Water Systems | Drinking Water | Healthy Water | CDC”) and is also one of the steps in wastewater treatment. Disinfection technology enables the removal of problematic pathogens and organisms, primarily in the drinking water supply. Companies in this sector provide a variety of different methods for disinfecting the water supply.

### The Problem

Water supplies around the world, especially surface water and water supplies that are overused or overdrawn, can have substantial amounts of pathogens and organisms, including viruses, that can be damaging for humans. Globally over 700 million people still lack access to “safe” drinking water (“WHO | Millennium Development Goal Drinking Water Target Met”). Many others around the world likely still have water that does not meet written developed-nation standards. Contaminated water can cause substantial negative health impacts. According to the WHO “3.4 million people, mostly children, die from water-related disease” and the same diseases are also a “serious challenge in developed countries” (Pandey et al.). In North America and Europe municipal water systems must treat their water for diseases including cryptosporidium and giardia which cause intestinal illnesses. As water supplies become more limited and taxed due to climate change, water treatment of all kinds, including disinfection will help to prevent contamination from wastewater and drinking water before it is consumed.

### Positive Solutions

Companies manufacture a variety of different technologies for use in disinfection. These methods are both chemical and mechanical and involve water treatment before distribution. Three common methods involve treatment with chlorine or chloramine, ozone which oxidizes the contaminants, or UV lights which inactivates pathogens by penetrating their DNA. Each method has its positives and negatives. Chlorine and chloramine, the most used methods in drinking water treatment can leave harmful “disinfection by-products” known as DBPs. They also can be expensive, according to some sources, and costly to handle because of their toxicity. Yet, because they remain in the water in small amounts they continue to ensure clean drinking water after treatment. UV lights are effective with clear water but less effective in more turbid waters. It leaves no harmful byproducts. Ozone is very effective at killing pathogens but can be expensive and leave potentially problematic byproducts. Membranes can also be effective at removing pathogens but can be expensive and require regular replacement or cleaning. Some of these systems can be implemented directly by end users.

### Impact Assessment/Additionality (of Sector)

Improving wastewater and drinking water treatment can help ensure continued access to safe drinking water. Improving cost and effectiveness of treatment technology of all kinds, as well as ease of use, may enable expanded implementation of treatment across the United States and

especially in the developed world. Some companies and organizations like the Center of Advanced Materials for Purification of Water with Systems (CAMPWS) at the University of Illinois are working on improving technology in this area. Additional or greater positive impact may be head from actually increasing the implementation of disinfection.

### **Possible Values Challenges**

There are potential side-effects to disinfection including environmental contamination from the production of chemicals and high energy use. Additionally, disinfection can leave potentially dangerous by-products which must be monitored and removed.

### **Company Profile – Calgon Carbon**

<b>Headquarters</b>	Pittsburgh, PA
<b>Reach</b>	Global
<b>Revenues</b>	\$535M (2015)
<b>Employees</b>	1100

Calgon Carbon is a relatively small U.S. based company that was one of the innovators of using activated carbon in the mid-20<sup>th</sup> century. Activated carbon is typically charcoal that has been treated to make it more absorptive. It can be used for the purification of many different elements including removing many contaminants in water. Activated carbon and its products make up 91% of Calgon Carbon’s sales. Calgon also was one of the innovators in UV treatment of water and offers a line of UV treatment products for water and wastewater treatment.

Calgon offers activated carbon and UV products for use in a variety of water-related uses that help to remove disinfection by-products, pharmaceuticals, endocrine disrupting compounds, and algal toxins. One Calgon UV system is in use in Los Angeles that treats approximately 600 million gallons per day of drinking water (Calgon Carbon, “SENTINEL UV Systems”). Approximately 24% of sales are related to drinking water and 21% to wastewater. 20% of sales are related to air pollution, particularly for scrubbers that remove mercury from coal-fired power plants (Calgon Carbon, “Calgon Carbon September 2016 Investor Presentation”). Calgon Carbon also was the supplier of the system to remove toxic PFOAs from the Hoosick Falls, NY water system in 2015.

### **Concerns**

The company has a substantial business selling mercury-removing scrubbers to coal fired power plants. This is in response to regulatory requirements and generally products water. It is not likely problematic. The company also has a small amount of business (13% is total of industrial uses) helping to remove metals from mining wastewater to increase recovery. This is applied to gold and other high-value products.

### **Other Sector Participants**

**Xylem** is the world’s largest supplier of UV disinfection and ozone oxidation systems. according to their website. For more information, see a full profile of Xylem in the municipal dewatering section.

**Miox**, is an Albuquerque, NM based subsidiary of Johnson Matthey, that makes on-site generators that produce a mix of sodium hypochlorite and hydrogen peroxide that they claim to be safer and more environmentally friendly than chlorine. Johnson Matthey is a U.K.-based public specialty chemicals company with about 13,000 employees that works across a variety of industries including environmental, recycling, pharmaceuticals, and oil and gas.

**Olin Chlor Alkali** is a subsidiary of Olin, a conglomerate based in Clayton, MO. The company supplies chlorine for water treatment systems as well as a variety of other chemicals. Olin also provides transportation for chemicals and owns Winchester which makes guns and ammunition.

### **Financial Opportunities and Risks**

As water challenges expand globally water treatment and disinfection will become more relevant globally. There are many opportunities for improving and expanding the use of disinfection technologies. There is technological risk as some technologies that are cheaper or easier to use may be winners.

### **Impact Investment Options**

There may be infrastructure investment opportunities in water and wastewater treatment globally. In the developing world there may be opportunities for private water treatment systems, which has clear values concerns for many philanthropic investors interested in water access for all people, but also the potential to offer clean drinking water.

## Efficient Irrigation – Agricultural

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Low
<b>Values Alignment</b>	High	<b>Corporate Concerns</b>	No
<b>Impact Areas:</b>	Water Efficiency	Pollution Reduction	Climate Resilience

### Sector Summary

The efficient irrigation sector of the water industry is the last mile of delivering water for agriculture, by far the largest user of water on the planet. Companies in the sector sell equipment and planning tools to help farmers reduce water usage and increase yields.

### The Problem

Agriculture accounts for the vast majority of water use globally. In the U.S. the industry accounts for 80% of all *consumptive* uses (those where the water is not naturally returned to its previous usable state) according to the USDA. Of the 57 million acres of irrigated agriculture in the United States (25% of the total acreage, ~10% in Europe), approximately 50% is irrigated using older, less efficient irrigation systems (37% in Europe), and many farms still use inefficient water management practices. These older systems lose more water to runoff and evaporation than more targeted systems. In 2013, over 88,000 farms reported spending over \$2.6 billion on irrigation, including over \$1.1 billion on scheduled maintenance and \$520 million on water conservation.

### Positive Solutions from Efficient Irrigation

Agriculture is a multi-billion-dollar industry globally. The efficient irrigation industry primarily aims to reduce the amount of water used in irrigation. Investing in efficient and state of the art irrigation technology can help reduce water usage substantially. Drip irrigation technology can, for instance, save from 20-70% as compared to older “flood” irrigation methods by delivering water directly to the plants where it is most needed. It also can increase yields. Additionally, better management plans can also save water—only ~20% of US farms currently use moisture sensing equipment or computer simulation models, but instead rely on their instincts and their neighbors practices to make decisions. (USDA 2013) Possible irrigation improvements:

- Drip irrigation
- Efficient center pivot irrigation
- Using technology to only use irrigation when necessary to prevent over watering

### Impact Assessment/Additionality (of Sector)

Implementing more efficient irrigation practices could substantially reduce agricultural water use—and it may be most likely to be implemented where it is most needed, in regions that are water starved. This may mean that water becomes available for other uses including for drinking water and environmental conservation, as well as preserving water sources. It is possible or even likely that new investments in the water space may enable the faster development or deployment of water saving methods around the world.

### Possible Values Challenges

While increasing efficiency in agriculture has the potential to safeguard water supplies, there are a limited number of possible challenges related particularly to the end uses of agricultural land.

**33% of the grains grown in the U.S. are used to feed animals, while over 38% of the corn grown is used for ethanol.** It may be strategic to both invest in efficient irrigation and also support advocacy for reduction in intensive uses of agriculture that are not used to directly produce food. Finally, some reports are that because drip irrigation can increase production levels, it may reduce recharge of water supplies and increase actual consumption in high pressure areas growing certain crops. The actual likelihood of this is not entirely apparent as it could have offsetting effects.

### Company Profile - Jain Irrigation Systems

<b>Headquarters</b>	India
<b>Reach</b>	Global
<b>Revenues</b>	~\$1B
<b>Employees</b>	10,000+

Jain Irrigation Systems is an Indian conglomerate that specializes in irrigation systems and claims to have a mission of sustainability. JIS was named as #7 on the Fortune “Change the World” list in 2015. JIS derives 47% of its revenues from irrigation but also has substantial holdings in other sectors including food production (20%) and piping (23%) as well as some other smaller sectors, including solar panels, some of which are used for powering irrigation systems.

### Concerns

The piping produced by JIS, is mostly used for municipal water and sewer as well as for telecom, is also used for distribution of natural gas (JIS Annual Report.) The percentage of the piping revenue used for natural gas is not reported, but appears small.

### Other Sector Participants

**Netafim** is a privately-held Israeli company with majority ownership by large European private equity firm Permira. The company supplies similar products to JIS irrigation business but is not diversified. Like JIS it also supplies irrigation management software. Netafim also targets irrigation services at heap leaching copper and gold mining.

**Lindsay** is a U.S.-based multinational that specializes in supplying irrigation systems to large scale agribusiness. They mostly focus on center-pivot irrigation systems but also offer drip irrigation, and also have revenues in the areas of water treatment, water lifting/pumping, and golf course irrigation.

### Financial Opportunities and Risks

There appears to be a major opportunity for growth in this industry as water becomes more scarce but need for food continues to increase. Farmland currently irrigated with other methods may get shifted to more efficient irrigation systems. One possible risk factor is the possible reduction in the use of irrigation. The USDA expects a decrease in the total amount of irrigated agricultural land in the U.S. 2020-2080, though it is likely that this will not affect the use of state of the art irrigation systems.

**Impact Investment Opportunities**

Development or support of financing mechanisms allowing the replacement of inefficient systems with newer, smarter, and more efficient systems may be the most effective way to reduce water usage through efficient irrigation.

## Environmental Permitting

<b>Potential Impact</b>	Low	<b>Direct Concerns</b>	Yes
<b>Values Alignment</b>	Low	<b>Corporate Concerns</b>	Yes
<b>Impact Areas</b>	Infrastructure		

### **Sector Summary**

The environmental permitting sector works with developers to request and receive the required permits for all kinds of projects. These may range from those for municipalities looking to improve water systems to companies building major industrial facilities. For instance, a utility may need permits to build a water treatment facility. The companies in this sector are generally also in the planning, consulting, architecture, and construction management business and serve these purposes for a wide variety of clients that are related to water and the environment as well as those that are not.

### **The Problem**

Clients of all kinds including governments and industry require permits for developing and improving a wide variety of projects from water to energy infrastructure. Many of these projects have water requirements that may include withdrawals from freshwater sources, creation of wastewater or the building on wetlands. These projects cannot go ahead without the necessary permits required by governments.

### **Positive Solutions from Environmental Permitting**

The environmental permitting sector works to help projects of all kinds get the permits necessary to allow the development of a wide variety of projects. Permits are often necessary for projects that may benefit the environment, or ensure that projects that otherwise may harm the environment do less harm. In some cases, permits could include substantial work for remediation or work on sensitive sites possibly improving watersheds, for example, as part of the construction process. On the other hand, permitting may be done to enable oil and gas projects. These project guidelines are typically required because of regulation, rather than having anything to do with the consultant. The company that provides support with permitting may in some cases be seen as simply helping a developer navigate the rules to their own advantage rather than supporting the environment.

### **Impact Assessment / Additionality**

The impact of the environmental permitting subsector per se seems limited. Unlike the design and construction of environmentally responsible projects, permitting is required by law. The permitting process may require projects to have improved standards, but the impact should in most cases be attributed to the regulations rather than the company doing the permitting. When projects have a high positive impact the party responsible is typically the developer requesting the project.

### **Possible Values Challenges**

The action of environmental permitting itself can have complicated implications. In some cases, support for the permitting process may enable necessary or critical projects to go ahead. Permits may also enable projects to use water that the Foundation and many other investors might

consider problematic including the development or improvement power generation facilities or exploration for fossil fuels. Environmental permitting may also support these types of projects even if they do not deal with water.

### **Company Profile – Tetra Tech**

<b>Headquarters</b>	Pasadena, CA
<b>Reach</b>	Global
<b>Revenues</b>	\$2.7B
<b>Employees</b>	16,000

TetraTech was founded in 1966 and is a consulting, engineering, and design firm that provides “services for the full water cycle.” The company provides a wide variety of services for the design and development of water and water management projects. These projects include engineering for almost all projects related to water including wastewater treatment, ground water remediation, usage modeling, and water quality assessment. The company also provides similar services for other development projects for energy development. Services in this area include permitting and environmental resource surveys, environmental impact studies, pipeline routing plans, and the management of nuclear materials. Tetra Tech also provides services to renewable energy projects including permitting and engineering, and was involved in the first offshore wind farm in the U.S. in Rhode Island. Many of these projects have some relationship to water. While the impact of “permitting” subsector itself may be minimal, these kinds of companies are critical to development of the development new systems of water and energy necessary for a sustainable future.

Tetra Tech’s Clients include the U.S. Federal government and state and local governments, as well as corporate clients and international government. Seventy percent of its revenues come from its traditional areas which include these large government projects. 45% of the company’s revenue is related to its Water, Environment and Infrastructure area, and 53% to its Resource Management and Energy area. The “smart water” management field is a new and emerging area that Tetra Tech is investing in. Smart water means using technological innovation and data to manage water across various markets more efficiently and effectively. Tetra Tech projects the market will grow to \$18B by 2020 and aims to be a larger player in the space. Client types by percent revenue include International 29%, U.S. Commercial, 32%, U.S. Federal, 27%, and State and Local Government, 12%. All numbers are from 2015.

### **Concerns**

Tetra Tech’s business lines have potentially positive and negative impacts. Their services are necessary and can make important infrastructure projects possible and can also lead to the improvement in management of vital natural resources. Some of their services may lessen some of the environmental impacts of harmful extractive operations. At the same time, they work with and help design services for oil, gas, and mining development, as well as for the development of nuclear and coal generation.

### **Other Sector Participants**

There are a wide variety of firms providing services around the world at small and large levels.



**Arcadis** is a Netherlands-based company that provides global design and engineering consulting. The company provides a wider array of services than Tetra Tech. Their services include those related to water and the environment as well as urban planning and architecture. The company also works with mining and oil and gas development. The net revenue breakdown is Infrastructure, 27%, Water 14%, Environment 20%, Buildings 39% (2015 year-end investor presentation, Feb 2016.)

**AMEC Foster Wheeler** is a UK-based global engineering firm with over £5,455M in revenues that focuses on four areas: Oil & Gas, Mining, Clean Energy, and Environment and Infrastructure. Environment and infrastructure includes road design, environmental remediation, and planning and monitoring, among other projects. 55% of its revenue is related to oil and gas, ~27% clean energy, with mining and environment and infrastructure making up the remaining amount. (2015 investor presentation)

**CH2M** is a privately held Colorado Based company with \$5.8B in revenues that is owned by 20,000 of its former and current employees. The company is an engineering and design firm that operates globally. The business has limited disclosures but works on water, energy, environment, and transportation and on a variety of different planning areas.

### **Financial Risks & Opportunities Related to Environmental Permitting**

The environmental permitting sector stands to grow substantially if there continues to be an increase in infrastructure redevelopment and growth in the global North and development in the global south. Many of the related sectors also have the potential for tremendous growth under a new, sustainable, economic paradigm.

## Leak Detection & Infrastructure Diagnostics

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Low	
<b>Values Alignment</b>	High	<b>Corporate Concerns</b>	Yes	
<b>Impact Areas:</b>	Clean Water Access	Water Efficiency	Climate Resilience	Infrastructure

### Sector Summary

Companies in this sector deliver a wide array of equipment, technology, software, and services to help water and wastewater transportation utilities better manage infrastructure, monitor for leaks, and find leaks when they happen. They do this using a variety of different technologies. Over the last few years there has been a move towards using a variety of “smart” technology to find, diagnose, and even predict leaks. This brief covers the older “leak detection” as well as the newer “infrastructure diagnostics.”

### The Problem

The U.S. alone has over 1.2 million miles of water supply mains which does not even consider many more mile of pipe branches. This infrastructure in the U.S. and the Global North is aging. These older pipes are more prone to breaks, to losing precious water, and to failure; on average “every mile of water pipe suffers a break every six years,” and nearly 15% of water is lost to breaks before it is delivered (Fishman). There are an estimated 240,000 water main breaks per year in the U.S. (“ASCE | 2013 Report Card for America’s Infrastructure | Drinking Water”). Utilities struggle to find leaks, to repair them, and to improve the system so that they are less likely to leak in the future. In addition to the substantial amount of water lost, repairing leaks can be costly and time intensive.

### Positive Solutions

A variety of different methods exist for finding leaks. The oldest methods involve digging and visual inspection or at a minimum dewatering the pipes for analysis. Newer methods involve ground penetrating radar, acoustic devices, gas sampling, and wave detectors. In helium leak detection, for example, utilities inject helium gas into the water system and then over several days monitor the system for escaped gas, helping to identify leak locations. Inline methods involve sending devices through the water or wastewater system that report back in real time or after testing on any pipeline problems. Some of these methods allow for ongoing monitoring of important water mains to quickly identify leaks and allow for repair.

Ongoing monitoring methods are part of the transition to a “smart” technology ecosystem—or infrastructure diagnostics. Water utilities are beginning to use a variety of different technologies, including smart water meters, continuous audio listening systems, and satellite monitoring to allow for smart systems management. Leak detection, flow monitoring, and metering systems can generate substantial amounts of data. Software solutions help manage and process the information to enable the finding and management of leaks and intelligent, long-term management of the water distribution system.

### Impact Assessment/Additionality (of Sector)/Value Added

Detecting leaks can save substantial amounts of money by limiting replacement costs and ensuring all water that leaves the system is paid for. It can also help prevent water loss. These make water systems and regions able to deliver water more affordably, possibly prevent depletion of water resources, and invest money improving the infrastructure that needs it most. Continuing improvements in technology should substantially improve monitoring and detection.

**Possible Values Challenges**

The primary values challenge associated with leak detection and diagnostics is that many of the same or similar technologies can be used for oil and gas pipelines, therefore many of the companies also work with those industries supporting pipeline leak detection and prevention.

**Company Profile – Pure Technologies Ltd.**

<b>Headquarters</b>	Toronto, CA
<b>Reach</b>	North American Focus
<b>Revenues</b>	\$77.8M (2015)
<b>Employees</b>	~500

Pure Technologies is a Canadian company specializing in the “inspection, monitoring and management” of water, sewer, and pipeline infrastructure as well as buildings and bridges. The company offers a variety of different inline technologies for evaluating and monitoring the integrity of water pipelines many of which work while systems are in operations. The vast majority of the company’s revenue comes from inspection and consulting services (>85%) while smaller portions come from ongoing monitoring and equipment sales. The company also offers some ongoing monitoring systems and engineering for improving and managing pipelines. 83% of the company’s revenue comes from the water and wastewater infrastructure sector, 15% from oil and gas infrastructure sector, and 2% from buildings, bridges and structures.

**Concerns**

15% of the company’s revenues come from the inspection and monitoring of oil and gas pipelines and the company plans to expand in the area.

**Other Sector Participants**

**Mueller Water** is another major player in the leak detection and infrastructure diagnostics space. Their subsidiary **echologics** offers leak detection and pipe assessment technology for water pipes, primarily using sophisticated acoustic technology. Mueller Systems offers a networked smart system that gathers information meters, distribution sensors, and control devices and provides real-time monitoring across the distribution network. This system is essentially a software platform that enables utilization from a variety of Mueller’s (and other companies) products and helps to sense leaks throughout the system. While Mueller is a leader in these advanced systems they make up less than <8% of revenues, Mueller’s primary business remains the production of water and gas valves for municipal and commercial uses and fire hydrants (over 90% of sales).

**SPX subsidiary Radiodetection** provides a variety of equipment for acoustic and tracer-gas methods for finding leaks for use by utilities and contractors. SPX is a Charlotte, NC based corporation with operations in HVAC, infrastructure detection, and power generation business and has about \$1.7B in revenue in 2015 and 6,000 employees. This is a small business line for the company. The portion of the revenues from the water industry is not clear.

**Syrinix** is a private U.K.-based private company that provides “intelligent pipeline monitoring solutions” to utilities around the world. Their technology allows for networked real-time monitoring of pressure, flows, and leak detection.

**HydroPro Solutions**, a private company based in Texas, is a local provider of leak detection and other water and wastewater infrastructure services to the U.S. South. They install advanced metering and other technology for management of infrastructure.

**Gutermann** is a Switzerland Based private company that provides acoustic microphones, leak loggers, and software for finding and monitoring leaks.

**TaKaDu** is an Israeli startup that provides software to water utilities to monitor pipes, water flow, and meters. The software helps to find leaks, pressure problems, and other challenges in the infrastructure.

**Itron, Microsoft, and IBM**, provide “smart cities” software for working with Internet of Things connected water utility apparatus as well as other water apparatus.

Other players in the field include Utilis, which uses satellite imagery for leak detection, Visenti, and Halma.

### **Financial Opportunities and Risks**

There is likely to be extensive growth in infrastructure diagnostics, “smart” technology, and the “Internet of Things” or a network of physical devices with two-way communication capabilities. Yet it is still a new market and remains substantially unclear what companies and technologies will be most successful.

### **Impact Investment Options**

It is possible that there are opportunities to finance leak detection monitoring and smart cities through lending or other infrastructure investments. Investments in new technology are risky but may help speed up the development of this high-growth area.

## Irrigation Pumps & Filtration

<b>Potential Impact</b>	Low	<b>Direct Concerns</b>	Medium
<b>Values Alignment</b>	Low	<b>Corporate Concerns</b>	No
<b>Impact Areas:</b>	Clean Water Access	Energy Efficiency	Infrastructure

### Sector Summary

Companies working in this subsector provide pumps primarily to agricultural users but also to other users of irrigation. These pumps enable water to be moved from freshwater sources including lakes, rivers, and groundwater, through irrigation systems and onto fields. Filtration is necessary to protect irrigation systems.

### The Problem

Agriculture accounts for the vast majority of water use globally even though many farms crops are watered only by rain. According to the USDA in 2013, over 88,000 farms reported spending over \$2.6 billion on irrigation. This water for irrigation must come from somewhere. In many cases the water is from nearby rivers or lakes, and in other cases from water systems supplied by major dams like those in the American West. Groundwater supplies approximately 42% of the water for irrigation. (“How Important Is Groundwater? Water Science Questions and Answers, from the USGS Water Science School”) In most cases, other than in certain flood irrigation systems, in order for this water to reach fields, it must be pumped at pressure on the farm.

### Positive Solutions

Changes in weather patterns related to climate change mean greater possibility of droughts and the need to apply water through irrigation systems. Pumps enable farmers to apply the right amount of water effectively through their irrigation systems, enabling them to be more resilient to these changes. Pumps and the accompanying filtration systems, when sized properly, ensure that only the lowest necessary pressure which helps to prevent leaks and save water. New, variable frequency pumps, allow operation at different pressures automatically depending on the quantity of water and the amount of irrigation happening. This helps to reduce over-usage of water and save energy.

Additionally, fertilizing and applying pesticides and herbicides through irrigation systems (known as fertigation and chemigation) can enable more targeted and limited applications of these chemicals reducing environmental and health problems. Special pumps enable farmers to incorporate these during the pumping process. Innovative pumping solutions also allow ongoing monitoring of water and energy usage. Together all of these systems can help ensure that farmers protect soils, which can be damaged by overwatering, uneven watering, and over-application of chemicals. Certain pumping systems are also specifically designed to work well with solar energy.

### Impact Assessment/Additionality (of Sector)

Improvement of pumping systems, especially the monitoring and variability of these systems, can help improve water management and reduce stress on water sources, as well as saving farmers’ money and reducing energy usage. This may mean that water is available for drinking and can reduce pollution. Investment in the field may enable the development of better

monitoring systems or more energy efficient pumps, as well as increasing the availability of variable pressure pumps. Investment in pumping systems based on renewable energy may make the entire agricultural sector less emissions intensive.

### **Possible Values Challenges**

In the face of climate change, more irrigation may make farms more resilient while reducing societies' overall sustainability. Pumping manufacturers may not be directly responsible for increases in pumping groundwater or other water supplies for farming, but may benefit from this expansion of irrigation. Values-driven investors may prefer to avoid investments in these types of companies if they believe that it is enabling the unsustainable extraction of water resources by irrigating more acreage. If they believe that upgrading existing systems and improving pumping efficiencies effect is an overall positive, they might find this to be less of a problem.

### **Company Profile – Franklin Electric**

<b>Headquarters</b>	Fort Wayne, Indiana
<b>Reach</b>	Global
<b>Revenues</b>	\$925M
<b>Employees</b>	4300

Franklin Electric is primarily a pump manufacturing company that provides pumps for water in agricultural, commercial and residential HVAC, graywater pumping, and a variety of submersible uses. The company also provides pumps for fuel pumping, containment, and monitoring systems, particularly for use in gas stations. The company's revenues are approximately 80% from water pumps and 20% from the fuel pumps (2015 10-K, p 5.) Approximately 40% of the revenue from the water comes from "developing markets." The company does provide solar pumps but does not specifically focus on sustainability in its materials. A CDP Water report has never been requested.

### **Company Concerns**

Franklin Electric's primary markets are related to water and do not appear to have major concerns. It's fuel services pumps are primarily used in gas station applications, not by the fossil fuel extraction industry. These may pose minor concerns but do not rise to the level of the extraction, transport, or production of fuels.

### **Other Sector Participants**

**Grundfos** is a privately held global company based in Denmark. The company, which has approximately 18,000 employees and revenues of €3.3B (2015) manufactures pumps for a wide array of uses including agriculture, wastewater, and water distribution. Grundfos has not responded to CDP Water.

**Xylem** is a public company that provides pumps and other water services for a wide variety of applications. The company has approximately 12,500 employees and \$3B in revenues. For more information, please see the company profile in the municipal dewatering section. Xylem's

communications focus on sustainability. Xylem has been a CDP water respondent since 2012. For a full profile on Xylem please see municipal dewatering.

**Pentair** is a U.K. -based public company with 30,000 employees that provides equipment and services to a wide variety of different industries including food and beverage processing, desalination, and oil and gas separation systems. In agriculture they provide pumps, spray equipment, and irrigation management systems. The company's communications discuss sustainability and safe water. Pentair has not responded to CDP Water.

**Lindsay**, an irrigation systems company, also has subsidiaries working in this area. A CDP Water report has not been requested.

### **Financial Opportunities and Risks**

As more farms use irrigation it is likely that more, and more efficient, pumping mechanisms will be sold. It is possible, though probably unlikely in the short-term, that a shift towards more sustainable agriculture or a reduction in irrigated acreage globally predicted by the USDA between 2020-2080 limits sales of new pumping systems. One non-sustainability related financial concern is that some investors believe pumps have become commoditized leading to lower margins because of new, less specialized, manufacturers entering the space.

### **Impact Investment Opportunities**

If they exist or are possible to create, opportunities for directly financing pumping systems may be the best way to increase usage of the most advanced systems.

## Municipal Water Pipes

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	Low
<b>Values Alignment</b>	High	<b>Corporate Concerns</b>	No
<b>Impact Areas:</b>	Clean Water Access	Water Efficiency	Infrastructure

### Sector Summary

Companies in this sub-sector manufacture and provide the variety of different pipes used for repairing, improving, and expanding the world's access to clean water and sewer systems. Pipes transfer water from municipal systems to end users and sewage from end users to wastewater treatment operations.

### The Problem

Centralized water systems, no matter the size, rely on a network of pipes to transport water and wastewater from to and from end users. There are approximately 54,000 community water systems serving around 264 million people in the U.S. alone. Much of the drinking water infrastructure across the U.S. is reaching or beyond the end of its "useful life." These Older pipes are more prone to leaks and failure. There are an estimated 240,000 water main breaks per year in the U.S. Older pipes also may contain lead and other toxins that especially when they are not properly maintained can leach into drinking water. The EPA estimated an approximately \$334B need for investment in water and wastewater systems between 2007-2027, including \$199B for transmission infrastructure. The American Water Works Association, a trade association for water and wastewater professionals, put that number at \$1.7T including \$1T for pipes alone. ("ASCE | 2013 Report Card for America's Infrastructure | Drinking Water") The OECD estimates that globally \$1.3T needs to be invested annually in water infrastructure in general ("Required Infrastructure Needs").

### Positive Solutions

Municipal water pipe manufacturers provide a variety of different types of pipes and fittings for water systems. Different types of pipes can be used in different situations depending on soil type, pressure, and quantity. Some of these types include ductile iron, steel, vitrified clay, concrete, HDPE, and PVC. Each type has relative concerns and benefits related to longevity, chemical use, leaching, and vulnerability to seismic activity.

### Impact Assessment/Additionality (of Sector)

Pipes are necessary for municipal water and sewer providers to maintain and improve their operations and for developing countries to build water and sewer systems. The availability of high-quality pipes can determine the pipes that utilities use to deliver water. At the same time the existence of higher quality or lower cost pipes may facilitate these decisions. Even so pipe manufacturers, unlike some of the other sub-sectors, do not appear to be innovating substantially to help utilities. Some kinds of pipes may also be considered commodities and relatively interchangeable.

### Possible Values Challenges



Some pipes may be more vulnerable to leaks and leaching from outside the pipes. Some pipes—particularly PVC, may leach chemicals into water systems, though these claims are contested. More investigation could be done to evaluate the challenges with different pipes.

### Company Profile – Advanced Drainage Systems

<b>Headquarters</b>	Hilliard, OH
<b>Reach</b>	North America
<b>Revenues</b>	\$1.29B
<b>Employees</b>	~3700

Advance Drainage Systems is a pipe manufacturer based in Ohio. The company specializes in the manufacturer of HDPE pipes, especially corrugated HDPE pipes, for various types of drainage systems. These plastic pipes are used for sewers, culverts, erosion control, and storm water drainage. They are also used for drainage for farm fields. While pipes make up approximately 90% of the company’s revenues the company also manufactures pipe fittings and a few other products related to erosion and runoff control.

#### Concerns

The company had substantial governance issues and was forced to revise its financials in 2015. The company continues to faced regulatory and legal challenges for these reasons.

#### Other Sector Participants

**American Cast Iron Pipe Company** is a privately held company based in Birmingham, AL with approximately 2,600 employees. The company manufacturers ductile iron pipe, steel pipes, and fire hydrants, and valves, for waterworks as well as special steel pipes for the oil & gas industry.

**Oldcastle Precast** makes precast concrete, including pipes, for a variety of applications. Some of these are related to water, including concrete filtration systems, manholes, and retention systems. Other uses include oil & gas, fuel storage, and electrical and communications infrastructure. Oldcastle is a subsidiary of CRH, a global materials company, selling concrete, glass, and fencing products, with 89,000 employees €24B in revenues. CRH is based in Dublin. There are also many smaller companies in the concrete casting business.

**Diamond Plastics**, based in Grand Island, NE makes PVC pipes for municipal, agricultural, and industrial uses in a wide variety of sizes. The company is privately held and has over 200 employees. They claim to be one of the largest producers of PVC pipe globally and has locations throughout the Central and Western U.S.

**Mission Clay** based in Corona, CA makes vitrified clay pipes for use in water and sewer industries. The company is family owned and has four locations.

Around the world small companies manufacture pipes of various. **General Industries Ltd.** of Kenya is an example of a plastic pipe manufacturer in in the Global South. The company makes a variety of PVC and HDPE pipes for water delivery and drainage.

**Financial Opportunities and Risks**

There is likely to be continued need for pipe manufacture of various kinds throughout the world to support the growth and repair of municipal water, sewer, and rainwater runoff systems. There may be technological choices that effect financial outcomes as purchasers decide to buy plastic or other types of pipes for different uses. The commoditization of pipes—basically that manufacturers produce similar products—may mean that manufacturers must compete on price, limiting long-term profits across the industry.

**Impact Investment Options**

Rather than investing in the manufacture and distribution of pipes themselves there is more likely to be opportunity for impact in financing the expansions and upgrading of water systems.

## Separation Technologies

<b>Potential Impact</b>	Medium	<b>Direct Concerns</b>	High
<b>Values Alignment</b>	Low	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Clean Water Access	Pollution Reduction	

### Sector Summary

Separation is the broad term for separating different components of a water or wastewater stream. Companies in this sector typically provide methods for separating water from oil and gases as well as from other waste, generally using methods other than filters. Unlike disinfection, separation actually goes beyond killing particular organisms but removing their components. Technically, filtration, when components are separated by a barrier, is a type of separation, but for the purposes of this paper filtration falls into other categories. Separation technology of this kind is used in treatment of wastewater, and especially in industrial wastewater as well as for industrial processes. Often the removal of oils and gases are required by statute before discharging water to municipal or other wastewater treatment facilities. A number of different technologies are used for these purposes. Separation technologies are also used in a variety of other industrial processes including pulp and paper processing and the processing of dairy and food processing.

### The Problem

Oil and gas extraction, mining, and industrial processes often use substantial quantities of clean water. This water returns from these processes contaminated and then needs to be discharged or reused but contains contaminants that make it not quality enough to use and problematic for environmental discharge. In many cases this includes oil and particles of solid material that need to be removed from water streams of different operations. Additionally, these returned liquids may contain uncaptured extracted resources from operations.

### Positive Solutions

Separation technologies help ensure that wastewater is clean before discharge. In particular, it helps ensure that wastewater from various commercial uses, like fracking and other oil and gas development, is as clean as possible. It also enables companies implementing the technology to reuse water and other fluids, and in some cases to recover more of their product. Separation technologies are often, used to recover metals from mining liquids; higher recovery rates enable the companies to capture more of the extracted product.

### Impact Assessment/Additionality (of Sector)

Separation technologies can substantially help reduce pollutants and possibly increase recovery of resources, incentivizing use of the technology. Separating oil, a harmful contaminant, and other problematic leachates, also helps to ensure less pollution of the environment and clean water sources. Improvements in technology and uptake of this technology could reduce pollution and ensure greater access to clean water supplies.

### Possible Values Challenges

Separation technology is primarily used in commercial and industrial applications. An array of these technologies have large markets in energy and mining sectors. Investors who believe that it

is best to invest in ensuring these sectors have as little problematic output as possible may want to invest in companies with revenues from separation. Investors who prefer to avoid supporting these industries because they believe it enables their continued existence, expansion, and profitability, may, when possible, prefer to avoid investing in companies heavily focused on separation, or at least to be very cautious of a particular company's markets.

### Company Profile – Alfa Laval

<b>Headquarters</b>	Stockholm, Sweden
<b>Reach</b>	Global
<b>Revenues</b>	~\$4.5B (2015)
<b>Employees</b>	17,486 (2015)

Alfa Laval is a Swedish multinational that focuses on supplied products relevant to fluid handling, heat transfer, and separation. The company manufactures equipment used in industries including food and agricultural, pharmaceutical manufacturing, power production, wastewater treatment, as well as mining and oil and gas exploration. The company claims to be the world leader in separation technology broadly, holding 25-30% of the world market (Alfa Laval). Their offerings in the separation market include high-speed separators used for “separating liquids from one another” and decanter centrifuges used for removing sludge in wastewater treatment plants. The company also sells membranes and filters, some of which are used in municipal wastewater treatment.

The company's three division are Equipment, which sells various supplies through third parties (28% of orders), Process Technology (35%) which customizes solutions and includes energy and water and wastewater, and Marine and Diesel (37%) which provides components for marine equipment and diesel engines. 11% of total revenues come from sales to oil and gas extraction as well as manufacturing of plastics, sugar, and many other products, which includes water treatment for these industries. Water and waste treatment municipal treatment only makes up ~1.5% of company revenues. A portion of the marine & diesel sales also are related to water treatment. The company claims to take sustainability seriously and provides a substantial amount of sustainability information in its annual report. Alfa Laval has replied to CDP Climate survey but not the CDP water survey.

### Concerns

Alfa Laval provides technology to a wide variety of industries that includes cleaning wastewater from oil, gas, and mining uses, that will eventually be discharged into the environment. This enables these companies to continue operating. Their separation and fluid process technologies are also used for oil and gas refining.

### Other Sector Participants

**Pentair** is a U.K. based company that provides separation technology for a variety of different operations especially in the oil and gas sectors. Their technology removes oil and gas from wastewaters and remove contamination from hydrocarbons. They also provide technology to separate water and other fracking fluids. Approximately 20% of sales comes from the energy industry. See desalination for a full profile of Pentair.

**Seital Separation** is an Italian subsidiary of SPX Flow, a Charlotte, NC multinational with \$2.5B in annual revenue and approximately 8,000 employees. Seital provides separators to industrial, energy, and food service applications. SPX does not serve municipal water clients.

**Andritz Separation** is a segment of Andritz, which is headquartered in Graz, Austria and has over 24,500 employees and €6.4B (2015) in annual sales. Andritz offers a variety of technologies for use in food & beverage, mining and minerals, and chemical uses. Their products include centrifuges for cleaning water and wastewater in municipal and drinking water uses.

### **Financial Opportunities and Risks**

Separation technology is primarily used in commercial and industrial applications and is tightly linked to the filtration industry. It is possible that certain technologies, like membrane filtration, will become winners while other technologies will not be used as heavily.

### **Impact Investment Options**

Supporting technological improvements for industrial water reuse may be the best way to create impact in this field, enabling companies to limit pollution. Shareholder engagement with companies on water cleaning and reuse options may help to encourage best practices.

## Treatment Chemicals & Media - Municipal

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Medium
<b>Values Alignment</b>	Medium	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Clean Water Access	Water Efficiency	Reduce Pollution

### Sector Summary

Companies operating in this sub-sector supply municipal water and wastewater treatment with their ongoing inputs. These include chemicals like coagulants and flocculants, often the first step in the water treatment process. Sands and activated carbons of varying sizes, are then used to filter the water and, helping to remove other particles and contaminants. Some water and wastewater treatment systems also include membranes.

### The Problem

Water supplies can have substantial numbers of pathogens and organisms, as well as chemicals and various other particles. The problems can make drinking water less safe and less appealing. Globally over 700 million people still lack access to “safe” drinking water (“WHO | Millennium Development Goal Drinking Water Target Met”). Wastewater also contains many contaminants that are problematic for both humans and the broader environment. As water supplies come under more pressure from continued withdrawals and contamination, it becomes more crucial to ensure wastewater is clean and can even be reused. Many of the methods for treating wastewater require ongoing addition of chemicals or replenishment of materials in the filter systems.

### Positive Solutions

Chemicals are an important part of the water and wastewater treatment process. Flocculation and coagulation, processes induced by the introduction of chemicals, make it easier to settle out suspended particles and allow other parts of the water treatment process. Sand and activated carbon both serve to filter water. Sand is used to help remove smaller particles, and in some applications can lower bacterial counts. Many municipal water treatment facilities use sand filters of different kinds. Granular activated carbon is used to remove certain organic chemicals and to improve the taste and color of water for drinking.

### Impact Assessment/Additionality (of Sector)

These inputs are needed for the water treatment. Improvements in the products available might help improve the quality of water or wastewater treatment, as well as the pollution or problems from the manufacture of these chemicals. Lowering the cost of these inputs, and increasing expertise in how they are properly used, might also help enable more water and wastewater treatment globally.

### Possible Values Challenges

While this industry simply provides the ongoing materials needed for water treatment by municipal users, many of the same chemicals are used in industrial and oil & gas uses. The production of chemicals themselves can also cause pollution and other environmental problems.

### Company Profile -- Kemira

<b>Headquarters</b>	Helsinki, Finland
<b>Reach</b>	Global - 40 Countries
<b>Revenues</b>	€2.4B
<b>Employees</b>	4,700

**Kemira** is a Finnish multinational that uses the slogan “where water meets chemistry.” The company focuses on providing chemicals for use in applications that use water as well as in the direct treatment of water itself. The company claims to be the largest provider of chemicals for water and wastewater treatment in North America. They provide a variety of chemicals for use in different applications including both proprietary chemicals—those they have developed for specific uses-- and commodity chemicals that users might be able to find from other companies. These chemicals enable flocculation and coagulation as well as sludge treatment and color removal. 25% of the company’s revenue comes from water and wastewater treatment. Approximately 60% of that market is municipal and the rest industrial. According to the company, many of its competitors in this market are smaller, local companies.

Outside of this industry the company’s other primary business areas including providing chemicals for use in the pulp & paper (60% of revenues) and oil & gas and industries (15%). These chemicals help to make equipment last longer, improve efficiency, and enhance yield extractive processes like fracking.

### **Concerns**

Although it is a relatively small portion of their business Kemira provides chemicals for use in oil and gas exploration and development as well as mining. Some of their chemicals are friction reducers and biocides for fracking uses and helping to enhance recovery and provide water management for oil sands operations.

### **Other Sector Participants**

**Calgon Carbon** is based in Pittsburgh, PA and is one of the largest manufacturers and distributors of activated carbon for use in water treatment and a variety of other applications. See disinfection technologies for a full profile.

**Kleen Industrial Services**, a Danville, CA, based private company manufactures and sells a variety of sand for use in sand filters for water filtration in different uses. The company also sells sand for sand blasting and cleaning operations as well as for golf courses.

**ISC Water Solutions** is private company, based in South Holland, Illinois and offers chemicals for wastewater treatment as well as a variety of other industries including chemical processing, metalworking, and pulp & paper.

**Hawkins** is a public company based in Roseville, MN, manufactures chemicals and distributes chemicals from other manufacturers across the Central U.S.. Their Water Treatment Group provides chemical products for use in municipal drinking and wastewater and other water treatment applications. The company has ~600 employees and \$400M+ (2015) in sales.

**Koch Membrane**, a subsidiary of Koch Industries, offers a variety of different membranes for municipal and industrial water treatment.

**BASF & Dow Chemical** also offer a variety of chemicals for use in municipal and industrial applications.

**Financial Opportunities and Risks**

As water treatment grows there is likely to be continued demand for these products. The most likely risk related specifically to this area is which technologies will be used for water treatment. If products, like membranes, which use less inputs, become more prominent there may be less demand for these chemicals.

**Impact Investment Options**

N/A



## Wastewater Treatment Technology

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Low
<b>Values Alignment</b>	Low	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Clean Water Access	Pollution Reduction	Infrastructure

### Sector Summary

The wastewater treatment equipment industry develops and manufactures the equipment and inputs to build, operate, and improve treatment facilities which clean sewage and water used by industrial processes. Wastewater treatment equipment is used by municipal water and wastewater treatment industry as well as industries including food and beverage, pharmaceutical, pulp and paper, and oil and gas. The industry is closely related to the providers of disinfection and separation technology which are used in wastewater treatment as well.

### The Problem

According to the UN Development Program approximately 90% of all wastewater in developing countries is untreated, and two million tons of wastewater from various sources is discharged without treatment annually. This leads to contamination of drinking water, illness, and even death for people, as well as destruction of ecosystems, loss of biodiversity, and other environmental problems (Corcoran and GRID--Arendal). In the global South these trends are driven by continued urbanization and industrialization. As cities and industry grow, larger and more efficient wastewater treatment plants are necessary to improve health and ensure drinking water supplies. In the global North, where wastewater is largely already treated, water can still carry chemicals, nanoparticles, and other contaminants into the environment. Drought and lack of freshwater is also a major concern in many parts of the world and any water returned to the environment contaminated can be considered to lessen the amount of available freshwater.

According to the Freedonia Group the Global Water Treatment equipment and supplies market was valued at \$50 billion in 2012 and expected to grow to \$65 billion by 2015 (Andrew David and Mihir Torsekar).

### Positive Solutions from Wastewater Treatment

Wastewater treatment equipment can substantially reduce water pollution, improve sanitation, and improve human health. It can also help to preserve the environment and the ecosystems that support human life. Reducing the pollution of freshwater can ensure quality drinking water supplies for generations to come. Improved wastewater treatment can also ensure that industrial chemicals are removed from water before it is discharged. Discharge from a wide variety of different applications can be treated and improved before returning to the environment. As the world deals with water scarcity globally treatment may also enable reuse of water that is treated to high standards. Innovation in the water treatment industry can make wastewater treatment cheaper, more effective, and more energy efficient.

### Impact Assessment/Additionality (of Sector)

The manufacture and provision of wastewater treatment equipment, especially new, more efficient and more effective equipment may substantially reduce pollution, improve human health, and protect ecosystem functioning. New investments in the space, especially those targeting improvements in management and lower cost could support the adoption of new

treatment solutions. The implementation of membranes, for instance, can reduce the amount of chemicals needed for water treatment. Companies ensuring that water treatment is implemented globally can also have a major impact.

### **Possible Values Challenges**

Wastewater treatment for human waste is necessary. Wastewater treatment equipment is also used in many industrial and extractive applications. In many cases it would be better to reduce usage or not perform these operations at all, limiting the need for water, instead of investing in water treatment. At the same time, wastewater treatment, properly done, could limit the impacts of a variety of industrial applications. Wastewater treatment in these cases may also insufficiently bring water back to its natural state. The perspective of an investor may lead them to different conclusions on whether treatment following these processes is a positive or negative impact. For the Park Foundation, the treatment of water related to extractive or other screened industries is likely a negative impact that is enabling the continued existence and expansion of these companies.

### **Company Profile -- Danaher Corporation**

<b>Headquarters</b>	Washington, DC
<b>Reach</b>	Global
<b>Revenues</b>	\$20.6B
<b>Employees</b>	59,000

Danaher is a US-based conglomerate that owns dozens of brands across a variety of businesses. The company's business lines cover four primary areas Life Sciences (~32% of revenues), Diagnostics (29%), Dental (17%), Environmental and Applied Solutions (22%). Their businesses related to wastewater treatment include Trojan Technologies and Chemtreat. Trojan technologies manufactures filters to separate solids from municipal waste as well as for other uses in the water treatment space. ChemTreat specializes in industrial wastewater treatment and works with a wide variety of customers including food and beverage companies, mining companies, as well as oil and gas refineries. Danaher subsidiaries also provide other services related to water including technology for purifying water for industrial and drinking uses. In 2016 Danaher bought Pall Corp. which has a research facility in Cortland, NY. Also in 2016 Danaher spun out Fortive, which included most of its oil and gas extraction-related services.

### **Concerns**

Danaher's water related services touch a wide variety of end users. For the most part, these industries do not seem to be particularly problematic, although many of the company's environmental brands have some relationship to the oil and gas industry or mining. These appear to be in a limited fashion.

### **Other Sector Participants**

**Schreiber Water** is a small company providing wastewater treatment pumps and filtration equipment primarily in the U.S. There are a large number of smaller providers of wastewater treatment services globally.

**Evoqua**, formerly Siemens Water, is the largest water process company provides a number water and water treatment services to municipalities and industry with a particular focus on biological process equipment for wastewater treatment. The company works with major oil companies, food and beverage, as well as government entities. It is privately held by AEA, a major private equity manager.

### **Financial Opportunities and Risks**

Wastewater treatment is a potentially enormous growth industry as demonstrated by the amount of people globally without access to good sanitation and the detrimental effects globally. There is the risk that investments necessary will either not be made or they will be made in an ad-hoc fashion without a focus on using the best technology. This may limit the ability for growth of the most advanced equipment providers.

## Water Metering

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Medium (Privacy)
<b>Values Alignment</b>	High	<b>Corporate Concerns</b>	Low
<b>Impact Areas:</b>	Water Efficiency	Infrastructure	Climate Resilience

### Sector Summary

Metering companies provide the hardware and software for utilities and companies to monitor the use and flow of water. Municipal utilities use these meters to bill customers for the water they use. These companies provide the actual metering hardware as well as the equipment and technology for reading the meters and analyzing usage throughout water systems. These companies can also provide services to support these installations. Global spending related to water metering is \$3.5B and is expected to grow to \$4.2B by 2021 (Itron).

### The Problem

Water utilities provide clean drinking water and often sewerage services to people around the world. This water use has a financial and environmental cost. Water utilities have limited resources to spend and must pay for the management and upgrading of infrastructure. More importantly there are limited water supplies. It is impossible to know how much water a particular customer uses without meters, and difficult to control their usage. Water meters make it possible to charge users for the amount of water that they use, sending a “price signal” and incentivizing them to limit or reduce their usage. Sacramento, CA, is one of many cities where substantial portions of customers do not pay a metered rate for water and instead still pay a flat fee for unlimited use (“Water Meters - City of Sacramento”).

Water meters can also help water utilities to find and manage leaks. Water meters provide data about usage throughout the system—without them there is limited information that can help utilities understand and target these leaks (“ASCE | 2013 Report Card for America’s Infrastructure | Drinking Water”). The meters in use for many years must be hand-read, which is labor intensive and makes gathering data to use this way nearly impossible.

### Positive Solutions

Research shows that simply charging for water by the unit can substantially decrease the amount of water that customers use. While reductions vary, one example is illustrative. When Davis, CA installed water meters it reduced water use by almost 18% (Pacific Institute). Beyond simply installing meters and charging for water, meters allow municipalities to implement different charging systems that include increasing pricing at higher levels of usage. Done correctly this could support household use but discourage overuse for watering lawns and gardens or make commercial water prices more expensive.

Two newer kinds of meters support greater reductions in water use and improvement in water systems more broadly. Automatic Meter Reading or AMR technology allows for meters to be read using radio receivers or through one-way communication over electric lines. These systems, first developed in the 1980’s, can provide more accurate billing information and more up-to-date information to utilities and save on fuel costs from meter reading teams. Advanced Metering Infrastructure (AMI), which began to be developed in the mid-2000’s, is the next generation of

meters and are also known as smart meters. These systems allow for regular two-way communication between utilities and meters using the internet. This regular communication allows ongoing monitoring of water usage and problems that can help identify leaks throughout the system and by individual users. It can also provide users with up-to-date water costs—possibly encouraging conservation.

### **Impact Assessment/Additionality (of Sector)**

Increasing usage of meters, and especially smart meters can help water utilities to substantially improve infrastructure, reduce leaks, and encourage conservation by consumers. This is especially important with growing constraints on water from population growth, pollution, and climate change. Continued improvements in the technology can make it easier for utilities to effectively use the data provided by these systems. While water utilities are the buyers and implementers of this technology, technological innovation enables performance improvement.

### **Possible Values Challenges**

There are substantial privacy and security concerns related to smart meters in particular. Water utilities, and possibly their technology vendors, are able to gather specific information related to water users’ lifestyles. One article demonstrates this privacy challenge with a quote from a utility customer service representative saying to a consumer when discussing billing “you are an early riser. I see you take a shower at 5 AM” (“Advanced Metering Infrastructure”). There are also security challenges that if not secured properly can be exploited to control networks, to compromise other devices, and gather data about consumers (Skopik et al.).

### **Company Profile -- Itron**

<b>Headquarters</b>	Liberty Lake, WA
<b>Reach</b>	Global
<b>Revenues</b>	\$1.88B
<b>Employees</b>	7,000+

Itron produces metering and management equipment and technology for water, electricity, and gas management by utilities and commercial users. The company also provides the software and service to support clients using this equipment. The company controls 8% of the global meter market across all sectors, making them the largest meter provider globally, and 26% of the North American water “communications” market—related to newer metering technologies. Electricity metering and technology makes up nearly half of sales (44%), while water (23%) and gas (29%) are relatively smaller percentages. While the company bills itself as a “technology company” and as investing in the “internet of things” –connected devices of various kinds, the company still shipped more than twice as many standard meters (17,560) as smart meters (7,290) in 2015.

### **Concerns**

There are limited concerns about the company related to meters. The major concerns in the space are broadly related to privacy and data security mentioned above.

### **Other Sector Participants**

**Elster**, is a U.K. based subsidiary of Honeywell, and is another large player in the water meter market. They have a global market for meters and smart meters for water and gas. Honeywell is a major multinational that specializes in aerospace, controls, and materials and chemicals. Honeywell has \$40B in revenue and 127,000 employees.

**Ningbo Water Meter** is a Chinese company that controls 6% of the global water meter market and distributes its products globally. The company claims to have the world's largest "production base" of water meters. No further information is available.

**Master Meter** is a private company based in Mansfield, TX, that manufactures and sells meters and metering technology primarily in the U.S. and Canada. Their offerings include both AMI and AMR systems.

**Sensus** is a global water and energy metering and management company based in Raleigh, NC, that provides services very similar to Itron for both water and energy management for utilities and commercial customers. The company, is owned primarily by funds managed by two private equity firms The Jordan Company and Goldman Sachs.

### **Financial Opportunities and Risks**

It is likely that smart metering technologies will continue to proliferate as utilities look to take advantage of the monitoring and performance capabilities that it makes available. Security and privacy may be a constraint on growth of the market if consumers or governments become concerned about these issues. Technology also presents a potential problem as some types of systems may be winners and losers. There are efforts to promote inter-operability between manufacturers which seem to be happening but the end result remains unclear.

### **Impact Investment Options**

Aside from investing in companies and promoting technological development, investing in the the implementation of smart metering technology can help to reduce water usage, and done properly may help to influence the shape of the market technologically and with regard to data issues for years to come.

## Water Reuse Technologies

<b>Potential Impact</b>	High	<b>Direct Concerns</b>	Medium
<b>Values Alignment</b>	Medium	<b>Corporate Concerns</b>	Yes
<b>Impact Areas:</b>	Climate Resilience	Water Efficiency	Pollution Reduction

### Sector Summary

The water reuse technology sector provides the equipment and knowledge that allows for the reuse of wastewater from various sources including residential, commercial, and industrial markets, typically not for drinking water but for agricultural and industrial purposes. This process is known as “planned water reuse.” Wastewater, once it has been treated is typically pumped back into rivers and streams downstream of the original source for use. In some cases, it is then again drawn into water systems, unlike that addressed in this article, this is “unplanned water reuse.”

### The Problem

Only 2.5% of the world’s water is freshwater. That number include ice caps, ground water, and surface water (USGS) and much of that water is not available for regular use. The rest is saltwater, primarily in oceans and seas. The global population is growing including the need for fresh water which is not only used for drinking but also growing food and industrial uses including computing and fossil fuel extraction. At the same time drought, desertification, and unpredictable weather from climate change are straining existing water resources in many parts of the world. The average American family of four uses 400 gallons of water per day (EPA). That water gets sent to a wastewater treatment plant and then into freshwater waterways including rivers, streams, and lakes, as well as sometimes into saltwater which cannot be reused. This water is in almost every case only used once, at least intentionally.

### Positive Solutions

Water reuse takes wastewater from these different sources, either at a municipal or an industrial level, and cleans it further than it would be cleaned as typical effluent, often using a reverse-osmosis system to remove additional contaminants. Rather than being simply discharged, the water can be reused for a variety of different purposes. This water that has been cleaned and reused is often used to irrigate agriculture, in industrial uses including for cooling water, and to replenish aquifers. Occasionally the water is added back into drinking water systems as a portion of a much larger water system. In a couple of systems in California this has been done for many years.

This reuse of water reduces the use of potable freshwater for non-drinking water sources. In Israel, over 80% of household wastewater is recycled in irrigation and for other uses (“Arid Israel Recycles Waste Water on Grand Scale | Agricultural Commodities | Reuters”). This water can also be used in this cleaner state to recharge overused aquifers, mixing with much larger freshwater resources, and to support water systems that have faced over withdrawals, as well constructed wetlands. Reuse, like efficiency, helps to decrease usage from sensitive ecosystems and reduces potentially problematic effluent of treated wastewater into these same ecosystems. Often reuse, simply adding an additional step in the wastewater treatment cycle, is cheaper and more energy efficient than moving fresh water from distant sources.

### **Impact Assessment/Additionality (of Sector)**

Properly done, water reuse technology can enable municipalities to substantially decrease the amount of freshwater withdrawn from natural sources and the energy used and other problems associated with those withdrawals. Increasing the amount of places using reuse methods could substantially augment the water access and limit withdrawals at a time when water is becoming more scarce.

### **Possible Values Challenges**

There is little evidence to suggest that water reuse, when properly regulated, even as drinking water, causes risk to humans. Regulation and monitoring of wastewater reuse is essential to ensure that it remains safe. Another potential challenge is that it might reduce incentives for efficiency. Ownership structures of water reuse facilities also need to be carefully considered. Values-driven investors who believe that reusing water can be safe and that it does not reduce incentives for efficiency might cautiously invest in these technologies and in water reuse infrastructure.

### **Company Profile – Veolia Water Technology**

<b>Headquarters</b>	Paris, France
<b>Reach</b>	Global
<b>Revenues</b>	€25B
<b>Employees</b>	174,000

Veolia is a major multinational that is vertically integrated in the water area. They operate globally in water, wastewater, and energy sectors. The company provides technology, services, construction, and contract services across the water (45% of revenues), waste (35%), and energy sectors (20%). 56% of Veolia’s revenues come from municipal/government clients and 44% from industry. The waste segment includes 10% of revenues from hazardous waste disposal. The company owns a substantial number of water utilities and works on public-private partnerships globally. Its Veolia Water Technologies division and subsidiaries (€2.3B in revenues or ~9%) provide technology for all kinds of water and wastewater treatment including reuse to municipal and corporate clients.

### **Concerns**

Veolia is also a private water company that through a variety of agreement types including management agreements, concessions, and utilities, serves 145 million people globally. Food and Water Watch has called them the “world’s largest water service corporation” and says that they have “targeted long-term control of municipal water and sewer systems.” According to the same report their concessions business was shrinking as of 2010 (Food and Water Europe).

### **Other Sector Participants**



Many of the companies involved the production of water reuse technology are similar to those in the desalination industry because much of the technology required for the advanced treatment of water is similar.

**Pentair** is a U.K. based global company with services across water sub-sectors. The company provides ultra-filtration membranes and membrane bioreactors for water reuse solutions in industrial and agricultural uses including oil and gas. A longer profile is available in the Desalination overview.

**Pall Corporation** and **Trojan Technologies**, both subsidiaries of Danaher offer technologies used in water reuse systems. Pall sells membranes while Trojan offers UV and UV-oxidations systems that are in reuse systems. A longer profile of Danaher is available in the wastewater treatment equipment section.

**Nalco**, a subsidiary of **Ecolab**, a U.S. based company with provides “integrated water management” services primarily for corporations. This can enable corporations to reuse their industrial water in their processes to prevent water waste and pollution from effluent. Ecolab is a signatory to the Alliance for Water Stewardship’s International Water Stewardship Standard an industry-nonprofit consortium.

### **Financial Opportunities and Risks**

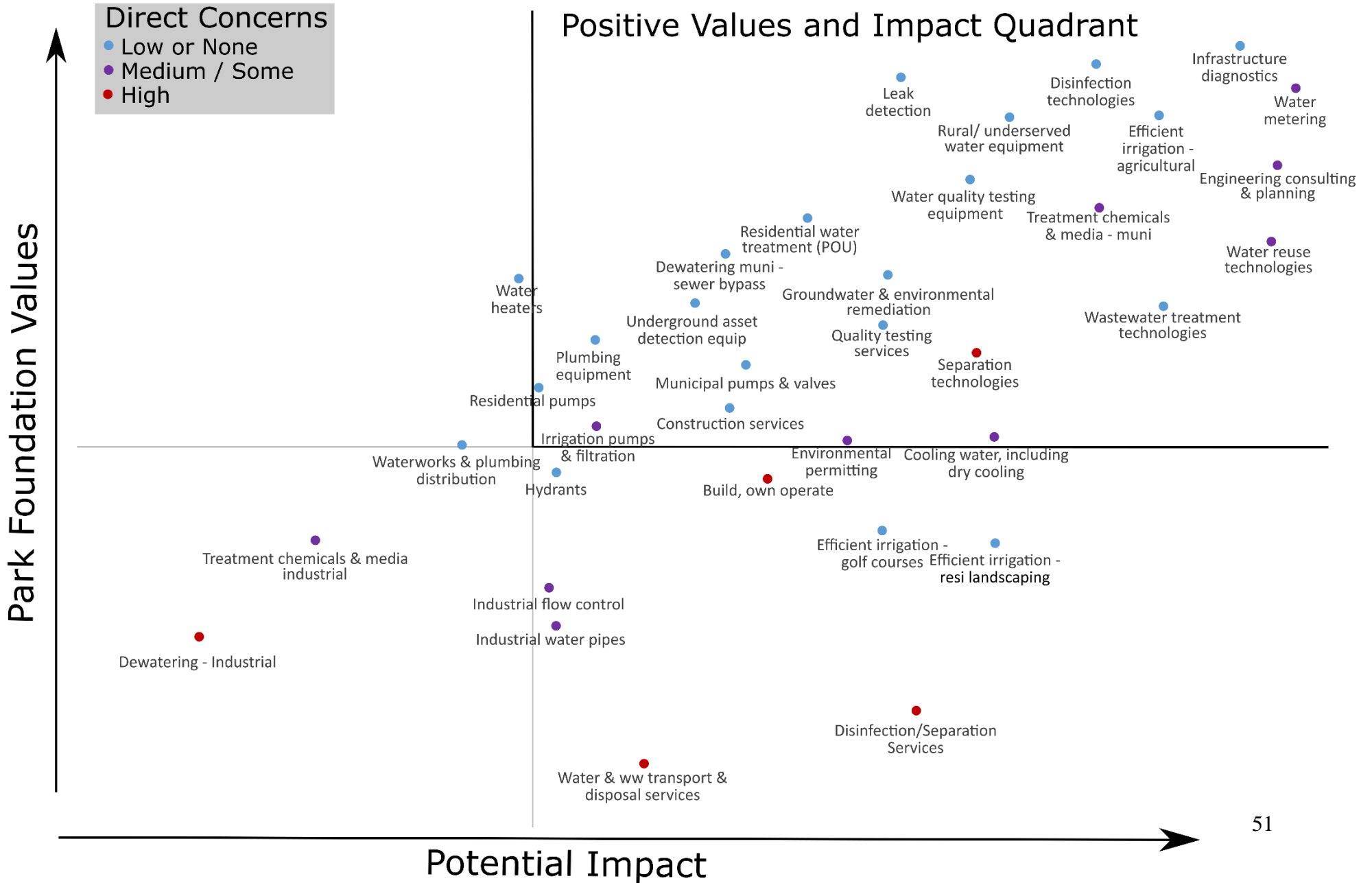
Water reuse is likely to rise because of growing population and the challenges of climate change. Overall, technologies and manufacturers, as well as designers and installers, of reuse equipment, are likely to be successful. The increase of desalination or other similar methods for increasing water resources are unlikely to, but could, compete with water reuse. Public awareness and distaste for water reuse, done improperly, could also cause problems for the industry.

### **Impact Investment Opportunities**

Impact investors who support the reuse of water for drinking and non-drinking water purposes might invest infrastructure projects for reusing water for various purposes depending on how they align with their values.

# Analysis and Comparisons of Water Industry Sub-Sectors

Overview of Relative Impacts, Values, and Concerns



## List of Sub-Sectors with Summaries

Niche	Values Alignment	Potential Impact	Direct Concerns	Corporate Concerns	Example stocks	Description (From KBI)
Build, own operate	Low	Medium	High	Yes	China Everbright Water	contract model incorporating private financing and engineering
Desalination technologies	Negative/Inherent Problems	Medium	Medium	Yes	Pentair	Technologies to enable salt water to be converted to drinking water.
Dewatering – muni (sewer bypass)	Medium	Medium	Low	Yes	Xylem	pumping water/wastewater for municipalities, a sewer bypass option may be required during routine maintenance periods or at times of flooding
Disinfection technologies	High	High	Low	No	Calgon Carbon	UV, chemicals and other techniques part of ongoing water treatment
Disinfection/Separation Services	Negative/Inherent Problems	Medium	High	Yes	Newalta	out-sourced industrial side involved for clean up, disposal, re-use
Efficient irrigation - agri	High	High	Low	No	Jain Irrigation	crucial to manage water use and increase yields
Environmental permitting	Low	Low	Medium	Yes	Tetra Tech	most projects, whether industrial or municipal, require environmental permitting
Infrastructure diagnostics (Combined w/ Leak Detection)	High	High	Low	Yes	Mueller Water	technology to assess and measure water related infrastructure for targeted maintenance
Irrigation pumps & filtration	Low	Low	Medium	No	Franklin Electric	tied directly to agribusiness and food production
Leak detection (Combined with Infrastructure Diagnostics)	High	Medium	Low	Yes	Pure Technologies	standard analog technology to assess and measure water related infrastructure for targeted maintenance
Municipal water pipes	High	Medium	Low	No	Advanced Drainage	Pipes for water and drainage systems
Separation technologies	Low	Medium	High	Yes	Pentair	Providing technologies allowing the separation of water from oil, gases, wastewater etc
Treatment chemicals & media – muni	Medium	High	Medium	Yes	Kemira	activated carbon or sand filters to remove particles and assist clean up
Wastewater treatment technologies	Low	High	Low	Yes	Danaher	UV, membranes, clarifiers etc used by WW plants to clean water
Water & ww transport/ disposal services	Negative/Inherent Problems	Low	High	Yes	Nuverra	mostly seen in relation to upstream energy markets
Water metering	High	High	Medium	No	Itron	industrial and residential both- key for control
Water reuse technologies	Medium	High	Medium	Yes	Danaher	Technologies to enable waste water to be cleaned and re-used
Engineering consulting & planning	Medium	High	Medium	Yes	Arcadis	critical role in project development

## List of Sub-Sectors Without Summaries

Niche	Values Alignment	Potential Impact	Direct Concerns	Corporate Concerns	Example stocks	Description (From KBI)
Rural/ underserved water equipment	High	High	Low	Only Analyzed for Sector Summaries	Rotoplas	Equipment designed to supply clean water to remote communities
Groundwater & environmental remediation	Medium	Medium	Low		Arcadis	EPA mandated clean-up projects from historic contamination
Residential water treatment (POU)	Medium	Medium	Low		AO Smith	either counter top or under sink water treatment for clean drinking water (Point of Use)
Water quality testing equipment	Medium	Medium	Low		Danaher	providers themselves for various reason to ensure quality
Under-ground asset detection equip	Medium	Medium	Low		SPX Corporation	Equipment to locate underground pipes etc, helpful to prevent leaks caused by construction activity
Quality testing services	Low	Medium	Low		ALS Limited	service providers that serve at outsources solutions as above
Construction services	Low	Medium	Low		Aegion	construction of municipal projects and new construction
Municipal pumps & valves	Low	Medium	Low		Xylem	needed for movement of Water and waste water by municipalities
Plumbing equipment	Low	Medium	Low		Rexnord	residential or commercial from kitchen/bathrooms to fire suppression systems
Cooling water, including dry-cooling	Low	Medium	Medium		SPX Corporation	often related to power production, industry and commercial buildings
Water heaters	Low	Low	Low		Enercare	big residential exposure
Efficient irrigation – resi landscaping	Low	Low	Low		Toro	CA drought example of importance of water efficiency for homeowners
Efficient irrigation - golf	Low	Low	Medium		Toro	large users of Water with mandates to control
Residential pumps	Low	Low	Low		Franklin Electric	submersible & sump pumps to manage wells and water overflows
Hydrants	Low	Low	Low		Mueller Water	clear fire suppression use
Waterworks & plumbing distribution	Low	Low	Low		Wolseley	middlemen that distribute above equipment
Industrial flow control	Negative/Inherent Problems	Low	Medium		SPX Flow	pumps and valves for industrial processes
Industrial water pipes	Negative/Inherent Problems	Low	Medium		Georg Fischer	obvious use to move water and upgrade historic systems
Treatment chemicals & media – industrial	Negative/Inherent Problems	Low	Medium		Ecolab	same as above for industry
Dewatering – Industrial	Negative/Inherent Problems	Low	High		Xylem	mostly relates to pumping water from where it is not wanted, such as a mine or construction sites
Developed markets regulated utilities	Not included in any analysis.				Severn Trent	monopolies with regulator
Developed markets contract operations		Suez	external utility operator			
Developed markets concessions		Veolia	long term contract to operate and invest in utility			
EM regulated utilities		Sabesp	same as above for EM			
EM contract operations		Suez	same as above for EM			
EM concessions		Manila Water	same as above for EM			
China muni water & ww treatment		Beijing Enterprises Water	Typically utilities operating (sometimes with PPP's) to treat waste water			
China industrial water and sludge		CT Environmental	high priority for the government to clean up industrial related waste			
			these are complicated legal designations, but essentially a legal right to use			
			water for a specific purpose			
Water rights & credits		PICO				

## Areas of Impact for Industry Sub-Sectors

Niche	Clean Water Access/Quality	Water Efficiency	Pollution Reduction	Climate Resilience	Infrastructure	Energy Efficiency
Build, own operate*						
Desalination technologies*						
Dewatering – muni (sewer bypass)*						
Disinfection technologies*						
Disinfection/Separation Services*						
Efficient irrigation - agri*						
Environmental permitting*						
Infrastructure diagnostics*						
Irrigation pumps & filtration*						
Leak detection*						
Municipal water pipes*						
Separation technologies*						
Treatment chemicals & media – muni*						
Wastewater treatment technologies*						
Water & ww transport/ disposal services*						
Water metering*						
Water reuse technologies*						
Engineering consulting & planning*						
Construction services						
Cooling water, including dry-cooling						
Dewatering – Industrial						
Efficient irrigation - golf						
Efficient irrigation – resi landscaping						
Groundwater & environmental remediation						
Hydrants						
Industrial flow control						
Industrial water pipes						
Municipal pumps & valves						
Plumbing equipment						
Quality testing services						
Residential pumps						
Residential water treatment (POU)						
Rural/ underserved water equipment						
Treatment chemicals & media – industrial						
Under-ground asset detection equip						
Water heaters						
Water quality testing equipment						
Waterworks & plumbing distribution						







### Sectors with Pollution Reduction Impacts

#### Potential Sector Impact

