



# Water Tech:

The Metro Vancouver Region's  
Untapped Clean Tech Opportunity

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The Metro Vancouver water tech sector is an often overlooked asset that, if supported, could become an economic driver for the region while providing services and solutions to intensifying global water-related risks, such as droughts, flooding, and other extreme weather events.



# About Us

Invest Vancouver is the Metro Vancouver region's economic development leadership service, created to advance broadly shared prosperity for all residents of the region. This report has been prepared by Invest Vancouver's Data, Research and Policy function, which offers independent, objective research, analysis, and economic development and policy recommendations crafted to position the region for success in a rapidly evolving global economy, where capital is highly mobile and where firms have many choices about where to

locate. The aim of the report is to provide actionable intelligence that will better inform and guide the strategic work of Invest Vancouver itself, as well as the work of key decision makers.

Invest Vancouver is a service of the Metro Vancouver Regional District, operating on behalf of the Metro Vancouver regional economy and the 2.7 million residents who depend on it.

## Acknowledgements

With support from Metro Vancouver's Sustainability Innovation Fund, Invest Vancouver has partnered with Foresight Canada's waterNEXT network to strengthen the water tech sector in the region. This report is the first project milestone and will inform future phases of the work. Foresight contributed to the success of this report by drawing on waterNEXT's expertise as Canada's water technology network. BlueTech Research, in collaboration with Foresight, contributed

to this report by providing an analysis of global water markets, identification of global themes driving water sector investment, and their insights on Metro Vancouver water tech firms. Future phases of this project will aim to build capacity in the sector through acceleration activities and a global showcase of water tech firms, targeting key markets for the water technology sector.

# Water Tech Sector at a Glance

Water underpins all human activity; but in a region with adequate rainfall and a long track record of reliable water service provision, water is rarely top of mind in terms of either meeting an unmet need or adding to the region's economic activity. This lack of local concern and economic interest makes it easy to overlook the disparate collection of firms primarily within the Metro Vancouver region's clean tech sector, which are working on exportable solutions to address local, national, and global water-based risks.

Water tech is a subset of the broader clean technology ("clean tech") industry, as water technology firms develop technology that results, for example, in lower carbon intensity, more efficient use of resources, and reduced environmental impact, including fewer pollutants and less waste. Firms in water tech are developing solutions applicable to water treatment and management, i.e. drinking water, wastewater, and stormwater. They also develop solutions for water users, i.e. households and businesses, particularly those in water-intensive industries such as agriculture, mining, oil and gas, and pulp and paper. For the purposes of this report, water tech does not include fisheries, hydropower, or maritime transport, and should not be confused or conflated with the much broader "blue" or "ocean" economy.

The demand for innovative water tech solutions is being driven by multiple trends, including responses to climate change, environmental and human health regulations, and "circular economy" objectives.<sup>1</sup> The Metro Vancouver region has identifiable strengths in industrial wastewater treatment, resource recovery, decentralized treatment, and digital solutions and sensor technologies, and has the potential to become a significant global supplier of water technology solutions. Unlocking this potential begins with developing an understanding of what is already here. To that end, this report spotlights the Metro Vancouver water tech sector and its opportunities and challenges, and makes recommendations intended to capitalize on this untapped clean tech sector.



Image: Aqua Intelligent

<sup>1</sup> The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In practice, it implies reducing waste to a minimum or treating waste as a resource, as in resource recovery from wastewater.

# Water Tech: Addressing Water Risks

## Introduction

The World Economic Forum has identified global water crises such as persistent droughts, overdrawn aquifers, limited access to safe drinking water, and international disputes over water use as a “high impact, high likelihood risk”.<sup>2</sup> These risks, which are keenly felt in more arid climates, are rarely top of mind in the rainy Metro Vancouver region, which enjoys an adequate, renewable supply of high-quality water from three primary watersheds.

Nonetheless, a closer investigation reveals myriad local water-related risks linked to climate change, emerging contaminants of concern, and requirements for greater water sector sustainability and resilience. To illustrate, construction sites need to keep silt and contaminants out of riparian habitats; wastewater treatment is complicated by the presence of pharmaceuticals; and clothes made from synthetic fibers shed microplastics when they are washed, adding another pollutant to wastewater. Climate change will make it more likely that winter precipitation in the local mountains falls as rain, which would mean less water will be stored as snowpack.

More frequent severe weather events will create challenges when dealing with stormwater runoff and potential flooding. And transitioning to a greener economy will require the mining and processing of metals needed in battery electric vehicles; this contaminates water, which needs to be treated before being reused or returned to the environment.

However, water-related risk also creates local, national, and international business, investment, and export opportunities for firms whose products can lessen or remove that risk. **The Metro Vancouver region’s clean tech sector includes an easily overlooked water tech component poised to capitalize on these opportunities.**

The water tech sector in the region consists of a disparate, loosely connected collection of firms developing products and processes that mitigate water risk. They are using new technology, process innovation, sensors and the internet of things, software and data analytics, to improve water system monitoring and efficiency; to recover energy and nutrients from wastewater; to expand access to water treatment in remote locations; to provide more environmentally benign treatment options; to clean wastewater from mining, oil and gas, pulp and paper, and industrial activities; to manage green infrastructure for stormwater control; and much more.

<sup>2</sup> World Economic Forum, *The Global Risks Report 2020*

## Report Overview

The focus of this report is understanding the regional water tech sector: its strengths, competitive advantages, and opportunities for growth, export, and positive economic contributions. This first section lays out the key research questions and the methods to address them; describes global market trends in the water sector; and, elaborates on the collection of firms comprising the sector in the Metro Vancouver region, as well as the innovation ecosystem underpinning the sector's emergence. The second section outlines the findings identified in the interview process and highlights the challenges raised by firms operating in the region. The third and final section presents recommendations to address pressing gaps in the sector.

## Questions to be Addressed

Invest Vancouver seeks to answer two fundamental questions related to the water tech sector in the Metro Vancouver region:

1. What competitive advantages (if any) do firms in the industry enjoy by locating here?
2. What challenges or barriers (if any) keep the region from being a more attractive place for water tech firms?

Answering these questions is critical for economic developers, public policy decision makers, industry, and education and workforce development leaders. A purely statistical approach, such as an industry contribution analysis, only provides an estimate of economic, job, and fiscal impacts of firms in the

sector at a particular point in time without addressing competitive advantages or barriers. Indeed, there is no quantitative approach that will zero in on the answers to the two questions listed above. Qualitative research methods such as interviews, on the other hand, allow for a more nuanced understanding of regional competitive advantages and shortcomings based on the insights and experiences of players in the sector.

## Methods

Invest Vancouver conducted in-depth interviews with chief executives, founders, and senior executives from the region's water tech firms, i.e. firms in the region working in water-tech related innovation, research, or development in some capacity. Prospective interview targets were drawn from Lightcast (formerly Emsi Analyst), PitchBook, and waterNEXT's Canadian Water Technology Ecosystem Database of firms, augmented using industry resources, relevant news articles, and referrals from other interviewees.

Further valuable information was collected in interviews and discussions with government representatives, industry associations, academic institutions, accelerators, capital providers, and others providing support to the water tech sector. These included: Metro Vancouver; the BC Ministry of Jobs, Economic Recovery and Innovation; Global Affairs Canada; the BC Water and Waste Association; Simon Fraser University's (SFU) Pacific Water Research Centre; RESEAU Centre for Mobilizing Innovation; and clean tech and water-specific investors.

Each of these semi-structured interviews lasted an hour or more, and consisted of a number of predetermined topics to be explored, including:

- Business climate
- Supporting infrastructure
- Physical spaces
- Capital access and formation
- Workforce supply and labour markets
- Network organizations
- Research and development (R&D) competencies
- Supplier connections and concentrations
- Customer access and catchment

Interviews were allowed to unfold naturally in order to pursue an idea, line of inquiry, or response in more depth. This approach enabled the discovery and/or elaboration of information relevant to answering the research questions stated above, and also allowed for the uncovering of information that may not have been previously recognized as pertinent. Like firm names, findings in the report have been anonymized and, as such, were not attributed to specific individuals or firms to encourage candid responses and forthright discussion.

Additional material was gathered from secondary research, including a detailed summary of global trends in the water sector and an overview of regional strengths and opportunities prepared by BlueTech Research in collaboration with Foresight Canada.

The final phase of the study included the evaluation of the collected data, the formulation of findings, and development of recommendations. Recommended interventions and strategies aim to address identified issues, constraints, and opportunities for improvements.

## Understanding Water-related Risks

Risk is a useful lens for understanding the water sector because it highlights commonalities among seemingly unrelated activities, and underscores the scope and scale of the market opportunities for firms that can mitigate various risks. Water-related risks are a concern for three classes of affected actors:

1. Organizations, such as utilities, whose business is water, i.e. providers of water and wastewater services and solutions
2. People who use water, i.e. households and businesses, particularly firms in water intensive industries
3. Governments, insurers, and others at risk of financial loss when risk hardens from a probability to a disaster

The first two classes deal with risks related to water quality and quantity, inefficiencies, and regulatory compliance. The third class is exposed to risk arising from insured and uninsured damage to real, personal, and commercial property; infrastructure damage and supply chain and service disruption; and investment risk. These risks impact people, businesses, and governments all over the world. As such, expertise, products, processes, and services which aim to address and mitigate these risks are a business opportunity for the Metro Vancouver region's export-oriented water tech sector. To demonstrate the potential scale of this opportunity, the next section highlights global themes driving investment in the water sector.

# Global Themes Driving Investment in the Water Sector

Invest Vancouver focuses on industries where regional strengths can provide a competitive advantage in global markets. The export-oriented nature of these industries is critical.

Population-serving industries, such as retail and construction, while important, are necessarily constrained by the size of the local population; they are, in effect, an outgrowth of a strong economy, not a driver of it. Adding new firms in a population-serving industry, beyond the number required to meet the demand created by local population increases and

economic expansion, necessarily pulls activity from existing firms. (There is only so much local demand for bakeries, for example.)

The number of firms in export-oriented industries, on the other hand, is limited only by their ability to compete in global markets. New firms do not necessarily have to displace existing local ones, especially if the size of the overall market is increasing. Export-oriented firms bring investment, capital, and royalties back into the region, with marked spillovers into the rest of the economy. Thus, industries in which

<p><b>Resource Recovery</b></p>	<p>Resource recovery recognizes that wastewater can be turned into a source of nutrients, energy and clean water. Transitioning to a circular economy encourages this approach, i.e. recovery of substances and their commodification transforms waste streams into business opportunities for revenue generation. In addition to circular economy goals, regulations (such as those in Europe) are driving growth in this area.</p>
<p><b>Digital Solutions</b></p>	<p>Digital solutions for the water sector consist of software solutions to assist in asset performance management and predictive and prescriptive analytics, including artificial intelligence and machine learning. These solutions can be applied in utilities and industry to help maximize optimization and efficiency gains.</p>
<p><b>Sensor and Analyzers</b></p>	<p>Sensors and analyzers are used to monitor water and wastewater quality, pressure in pipe systems, and flow rates. Adoption is being driven by water scarcity; a shift from monitoring compliance to detecting threats, such as pharmaceuticals; and the possibilities opened up by advancements in sensor technologies and data analytics.</p>
<p><b>Stormwater Management</b></p>	<p>Stormwater management includes: infrastructure to divert and/or contain stormwater; equipment to remove pollutants from stormwater; and digital solutions to predict storm events and optimize infrastructure usage. As such, stormwater management has strong overlaps with trends such as digital solutions, sensors and analyzers, and water reuse and decentralization. Key drivers for this theme include ageing infrastructure and climate change-induced increases in storm frequency and severity.</p>
<p><b>Decentralized Treatment</b></p>	<p>Decentralized treatment encompasses wastewater treatment at the point of disposal (e.g., residential homes or commercial buildings), a subset of which includes in-home technologies such as smart toilets, shower water recycling, and residential leak detection. Decentralization is being driven by increasing stresses on ageing infrastructure for centralized treatment; increasing water scarcity, which will drive adoption of onsite rainwater harvesting and greywater reuse; and, for in-home applications, consumer concerns over drinking water taste, smell, and contaminant levels (e.g. microplastics).</p>

Figure 1: Global themes driving investment in the water sector

regional strengths can support globally competitive firms in rapidly expanding markets, i.e. those where demand is rising fastest, represent the greatest opportunity for propelling regional prosperity.

Water technology, in particular, offers many areas of opportunity due to rising global demand. Established markets exist in the U.S. and Europe, but there are opportunities in areas such as Latin America and the Middle East. BlueTech Research, a consultancy that helps large water users and institutional investors navigate technological trends in the global water

market, has identified and characterized ten themes, each representing a growing global market of at least one billion dollars (and most are multibillion-dollar markets).<sup>3</sup> Figure 1 summarizes the growth drivers in each of these themes.

These global themes describe areas of growing demand for water technology products and services. The next section of the report examines the correspondence between these themes and the water tech sector in the Metro Vancouver region.

<b>Industrial Wastewater Treatment</b>	Industrial wastewater treatment uses on-site modular treatment systems to treat industrial wastewater for either reuse or discharge into the receiving environment. While the treating of contaminants is driven by regulations, industrial reuse is driven by scarcity and corporate commitments to reduce freshwater withdrawals.
<b>Municipal Reuse</b>	Municipal reuse consists of non-potable reuse (such as reclaimed water for industrial uses, irrigation, and toilet water) and potable reuse, which includes direct (so-called "toilet-to-tap") and indirect (treated water passes through a buffer such as a local aquifer) potable reuse. The principal driver in this area is water scarcity and cost, with water reuse offering a reliable source that is cost-competitive with desalination and water imports. Direct potable reuse regulations are expected to drive this area, notably in California, Texas, Florida, and the southern member states of the European Union.
<b>Brine Management</b>	Brine management revolves around the disposal of high salinity water that is a by-product of desalination, mining and oil and gas drilling, and various industrial processes. This area is being driven by the lack of alternative disposal options and regulatory pressure, such as evaporator pond elimination in Australia and rules affecting U.S. power plants along the Colorado River.
<b>Agricultural Water</b>	Agriculture accounts for more than 70 percent of global consumptive freshwater use. Trends in this area consist of: (i) "smart" irrigation systems that are one way to reduce agricultural water use without reducing productivity; (ii) water and wastewater treatment for greenhouses and indoor farming; and (iii) the need to reduce the contaminant load of agricultural runoff. The second of these trends is expected to grow fastest, driven by the need to produce higher yields with less water, continued increases in global demand for food, and changing consumption habits in emerging economies.
<b>Advanced Drinking Water Treatment</b>	Advanced drinking water treatment addresses the need to remove specific challenging contaminants that are not removed by traditional wastewater treatment protocols. These include so-called "forever chemicals", as well as pharmaceuticals, microplastics, and pesticides. This area is being driven primarily by regulatory requirements and indirectly by water scarcity and the resulting interest in water reuse, which is problematic unless these contaminants are removed.

3 As part of Invest Vancouver's partnership with Foresight Canada, BlueTech Research provided Invest Vancouver with a detailed macro analysis of the themes in the global water sector.



Annacis Island WWTP

## Water Tech Firms in the Metro Vancouver Region

Invest Vancouver identified 59 Metro Vancouver-based, export-oriented water tech firms (i.e. they either sell or potentially could sell their products or services outside the region). These firms are involved in technology innovation, research, design, or development in some capacity. The median employment of water tech firms headquartered in the region is 12 full-time employees.

The list of firms reflects the twin influences of the region's innovation ecosystem, including the regional hydrogen cluster (as some hydrogen technologies, notably membranes, have applications in water), and the region's supporting role in the province's resource extraction activities, which allows water tech firms to draw on skills from the constellation of firms providing services to the mining and oil and gas sectors.

There are many additional players – water service providers, consulting firms, system integrators, and suppliers, to name a few – that support the sector but which are not themselves water tech firms. These range from specialty firms working on flood protection, such as ebbwater consulting, to global engineering design firms such as WSP. Engineering design firms can be de facto 'gatekeepers' for water technologies, as they design specifications for infrastructure such as new wastewater treatment plants.

Figure 2 matches the region's water tech firms to the water sector themes described above, based on the core type of solution provided by the firm (rather than the industry or sector served).<sup>4</sup>

<sup>4</sup> Firm were matched to BlueTech Research's themes by Foresight CAC.

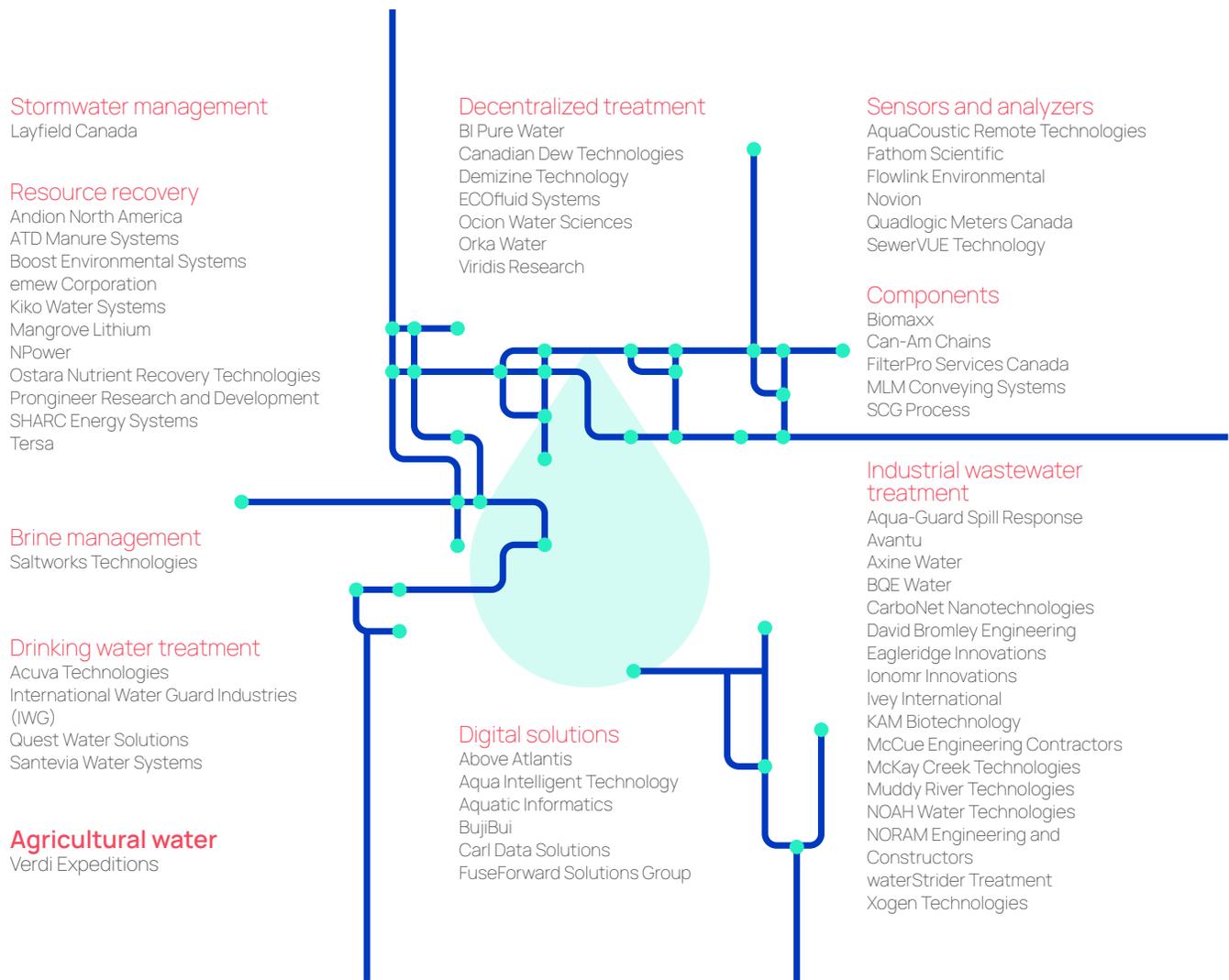


Figure 2: Metro Vancouver-based water tech firms (June 2022)

The largest functional area is *industrial wastewater treatment*, where, for example, Axine Water Technologies Inc. is mitigating the risk to the environment due to industrial activities through a wireless and remotely monitored industrial wastewater treatment system that utilizes catalysts and electricity to oxidize pollutants from industrial wastewater. The second largest area is resource recovery where, for example, Ostara Nutrient Recovery Technologies Inc. is recovering phosphorus and nitrogen from industrial, agricultural and municipal water treatment facilities and transforming them into a premium and sustainable fertilizer.

The region has the least representation among firms in *agricultural water*, *brine management*, and *stormwater management*.<sup>5</sup>

While Figure 2 serves as a snapshot in time of regional strengths and capabilities, there are longer-term opportunities to continue building on strengths in industrial, resource recovery, decentralized treatment, and digital solutions and sensor technologies.

<sup>5</sup> BlueTech Research has identified brine management and stormwater as areas growing globally, with the latter expected to generate considerable demand locally as climate change increases the frequency and intensity of rainfall events.



# Factors Supporting Sector Development and Growth

## Water Tech Innovation-Supporting Institutions

The region's innovation ecosystem, most notably the institutions highlighted in Figure 3, plays a key role in the water tech sector. Younger firms in the sector, especially, have strong ties to research universities and institutions conducting relevant applied research and generating valuable intellectual property, along with a mix of incubators, entrepreneurship programs, and accelerators. Some of the more established water tech firms also maintain close ties with post-secondary institutions as a source for both talent and emerging technologies.

One of the newer supporting institutions for water tech innovation, launched in 2020, is Foresight Canada's waterNEXT network initiative. A regional and national initiative, waterNEXT brings together stakeholders from across the water innovation ecosystem to accelerate the commercialization and adoption of technologies for the world's most pressing water challenges.

Two of the region's lesser known assets, Metro Vancouver Regional District's Annacis Research Centre and the BC Research Centre's Technology Commercialization and Innovation Centre, allow for testing and piloting of water technologies under



Figure 3: Water Tech Innovation-Supporting Institutions

real-time operating conditions. Physical spaces that allow for testing and piloting of new technologies, particularly that allow for water, are a rarity, and are crucial to the success of the sector. Firms need to be able to test their technologies, try novel approaches, and demonstrate proof-of-concept to secure funding or contracts necessary to advance into the next stage of development. This need is underscored by the

scarcity of large-scale industrial water users in the region that could serve as potential real-world test sites and first-time customers.

These innovation-supporting institutions could be building blocks for the development of a water tech cluster, as explained later in the report.



Metro Vancouver's Annacis Research Centre is a purpose-built facility, designed to showcase ways of reusing wastewater resources and provide academic researchers, private businesses, and utilities with the space and resources needed to innovate and conduct trials in a controlled environment.



The BC Research Centre's Technology Commercialization and Innovation Centre is a custom-built facility focused on supporting pilot plant operations and technology development. The facility includes a wet lab, analytical room, chemical storage room and is operated by a multidisciplinary team of professionals, including scientists and engineers.

## Water Tech Capital Formation and Investment

There is much less visible capital formation and investment activity in the water tech sector than in, for example, clean transportation or agritech, which were the last two industries examined by Invest Vancouver. Indeed, Metro Vancouver's water tech firms attracted \$333 million between 2017 and 2021.<sup>6</sup> The most notable deals in the first half of 2022 were a \$7 million Series A1 venture funding raise by Mangrove Lithium in a deal led by BMW I Ventures, and \$3 million received by Acuva Technologies Inc. through Pacifica's Business Scale-Up and Productivity program.

The level of reported fundraising activity is not indicative of the potential in this sector and is explained by several factors. First, the reported total is almost certainly incomplete. The fundraising activities of publically listed firms (such as SHARC Energy), as well as some privately-held ones (such as NORAM), are not necessarily captured in the

Pitchbook data. Second, and most surprisingly, many of the firms, particularly those engaged in process innovation serving the resource economy, are able to start generating revenue very early in their development and thus have access to more traditional forms of debt financing (i.e. commercial bank loans). Interviewees in this situation reported that they were not seeking outside investors and were not looking to raise additional capital.

In common with the broader technology sector in the Metro Vancouver region, water tech firms report benefitting from access to government grants and incentives for R&D activities. Firms specifically praised the Scientific Research and Experimental Development (SR&ED) tax incentive and noted it as an attractive reason to operate in Canada over the U.S.



Image: Viridis Research

<sup>6</sup> All dollar values in this section are from the PitchBook database of firms

# Findings

This section of the report characterizes Metro Vancouver-based water tech firms, including areas of focus and opportunities for development; describes their sector-specific challenges; and explains how they are affected by ongoing regional challenges.

## Water Tech Sector Characteristics and Trends

In general, firms developing solutions to water-related problems are part of the broader clean tech cluster, which can be loosely defined as technological products and services that reduce environmental harm, improve sustainability, and share, for example, supplier specializations, common inputs, specialized infrastructure, and labour market pools. With roots in both the clean tech innovation ecosystem and BC's resource extraction industries, however, the water tech sector in the Metro Vancouver region is not as easily categorized. Firms in the region are extremely varied and not simply identifiable as a part of the same interconnected industry segments sharing the same inputs, up- and down-stream channels, and complementary dynamics. Bottom line, there is a lack of cohesion within the region's water tech sector, and even within specific areas of focus, such as industrial wastewater treatment, as the firms can be working on quite dissimilar challenges.

This variety in firms is reflected in their relationships with technology development, capital formation, and talent acquisition. Some of the region's water tech firms focus on process innovation. These firms are applying already proven technological solutions in a novel way, thus improving various processes. In this group are businesses where, as one company founder explains, "there is not a lot of new transformative intellectual property; the 'magic' is in applying well understood science" to produce "simple, bomb-proof

solutions" in an innovative way. The primary challenge is "getting past the first 52 ways it doesn't work". Firms in this group generate revenue at an early stage, are more likely to finance their growth using debt (traditional lending from banks), and seek workers with skills to build, modify, and repair physical goods.

Aside from these process innovators, other regionally-based water tech firms look more like the rest of the Metro Vancouver region's technology sector, in that they are developing new technologies, raising funds from investors, and drawing from the regional talent pools in engineering, software development, machine learning and artificial intelligence. Firms in this area are emerging from the engineering and clean tech expertise within the post-secondary system. SFU and UBC both have research centres focused on addressing water issues, particularly those in rural and remote communities, some of which are Indigenous, where water technologies can help to overcome some of the unique challenges presented in these less connected communities.

Regional water tech sector strengths revolve around several areas of focus, as described in the above Global Themes section, including: industrial and decentralized treatment, resource recovery, and digital solutions and sensor technologies. These areas of focus are poised to benefit from multiple overlapping trends, which will result in increased demand for their products. For example, cost pressures are driving a shift in capital expenditures toward digital solutions and sensor technologies and decentralized solutions; both of which can extend the life of existing infrastructure or avoid the construction of new (traditional) infrastructure. Circular economy initiatives encourage resource recovery from wastewater, including energy (e.g., renewable natural gas from biosolids), heat (e.g., renewable district



heating), nutrients (e.g., phosphate), and metals (e.g., lithium). A trend toward modular technologies and alternative business models plays to regional strengths including digital solutions (software as a service, data as a service), resource recovery (off-take agreements), and industrial wastewater treatment (treatment as a service).

## Regulations as an Idea and Demand Catalyst

Environmental and public health and safety regulations, both those that exist currently and those that are projected to come online in the future, are stimulating growth and innovation in the water tech sector. Regulatory requirements create markets for a number of regional firms, such as Flowlink Environmental (Flowlink), Viridis Research Inc. (Viridis), and SHARC International System Inc. (SHARC Energy). Flowlink provides real-time effluent monitoring, primarily for construction sites. The firm's technology continuously checks compliance with applicable local water discharge regulations, and redirects water back to the site if allowable levels are exceeded. Viridis is developing decentralized treatment technology that will remove microplastics shed by clothing during washing before the water leaves the machine. Regulations requiring such capture are already under consideration in Europe. SHARC Energy provides sewage heat recovery that can be deployed in buildings and district energy systems to reduce energy consumption and building-related greenhouse gas emissions. The use of such systems is expected to receive a major boost from regulations to curb emissions from buildings, such as New York City's Local Law 97.<sup>7</sup>

## Specific Challenges for Water Tech Sector Firms in the Metro Vancouver Region

As noted, water tech firms in the region are not a particularly prominent part of the regional economy. Yet, this industry, and these regionally-headquartered water tech firms are deserving of more attention. One reason for this lack of recognition (and appreciation) may be the absence of a clear identity that would allow for formation of a distinct and tightly focused industry cluster. While there are many firms working in industrial wastewater treatment, for example, they serve multiple different sectors, markets, and applications. The result looks more like a collection of silos than a cluster, even in areas such as resource recovery, which has strong players in the region and a comparatively unified purpose (extracting valuable resources from wastewater).

Water technology development is very dependent on the ability to test emerging solutions. Despite the availability of valuable testing spaces at Annacis Research Centre and the BC Research Centre, firms are in need of more demonstration opportunities in the region. With one major utility handling water and wastewater treatment, i.e. Metro Vancouver, and very few large-scale water-intensive industrial operations in the region, the limited scope for end-user testing of real-world applications under operating conditions through pilot projects makes it harder to expand and further develop water technology solutions. Interviewees reported the challenge of not being able to showcase their technologies close to their own headquarters, but instead having to bring interested clients to demonstration sites hundreds of kilometres outside of the region.

<sup>7</sup> New York City's Local Law 97, part of the Climate Mobilization Act (2019), requires most buildings over 25,000 square feet to meet energy efficiency and greenhouse gas emissions limits beginning in 2024.

Smaller and newer firms have additional challenges. Potential customers, particularly those from the public sector, tend to favour commercially proven products from established firms, and prefer “turn-key” solutions, i.e. products or services that are sold as a complete package. A firm, especially a new one, would likely have greater appeal to municipal buyers and export markets if its technology were integrated into a larger system. To overcome this hurdle, tighter collaboration is needed between the water tech firms and engineering firms and those firms responsible for integrating systems.

Finally, water technology firms, as part of the broader clean tech cluster, lack an identifiable government ministry responsive to them. Complicating matters further, water touches everything and is a shared responsibility between multiple BC Government ministries, as well as other orders of government. Multiple interviewees brought up the lack of clear government responsibility, which impedes the sector in advocating for its needs, seeking regulatory clarity or accessing other forms of government assistance.

Image: Ostara Nutrient Recovery Technologies Inc.



## Regional Challenges: The “Usual Suspects”

Firms in the Metro Vancouver region face a litany of familiar challenges: (i) the high cost of living, particularly for housing; (ii) infrastructure-related mobility bottlenecks; (iii) scarce and costly industrial land; and, for those selling to government, (iv) innovation-averse public sector procurement processes. These challenges were raised repeatedly in interviews, and are worth recapping in this report because they undercut the business case for locating a globally competitive business in the Metro Vancouver region, rather than in Calgary, Portland, or Shenzhen, when firms have many choices about where to locate.

### I. High Cost of Living and Talent Attraction

The region has a critical mass and base of talent underpinning its global competitiveness; however, it will need to expand the number of highly skilled workers further as key sectors, such as water tech, grow and demand a larger number of employees. Unfortunately, housing costs give workers seeking affordable homes an incentive to leave, and make it much harder to recruit people from elsewhere. One water tech firm has adapted to this challenge by hiring exclusively from local universities because the students “are already used to living in a ‘shoebox’ and want to stay”. But, this approach just ensures a firm has enough talent, not necessarily sufficiently skilled or the best talent. Multiple interviewees praised recent immigrants (whether educated here or abroad) for their contributions to the overall talent pool and, in particular, to their firms. In addition to recent graduates, firms also need workers with,

according to one interviewee, “practical experience solving problems and fixing stuff, not necessarily book smarts”. Whatever the skillset, talent attraction and retention is undercut by high housing costs.

### II. Transportation & Congestion

Access to talent within the region can also be curtailed by transportation bottlenecks. The water tech firms in the North Delta/Tilbury Island area, for example, all reported significant problems created by the Massey tunnel bottleneck. For these firms, chronic traffic congestion makes it difficult to connect with customers and suppliers, and creates a challenge recruiting people who live north of the Fraser River. When firms are effectively cut off from part of the regional talent pool because potential hires are unwilling to accept an unpleasant commute, it undermines a core regional strength. To compete effectively with (often much more populous) global regions, Metro Vancouver needs a tightly integrated, efficient transportation network that supports seamless business-to-business interactions and customer development, as well as a region-wide labour market catchment area characterized by easy movement and convenient commutes.

### III. Physical Spaces

Even more pressing than the need for talent, for many firms, is the acute shortage of suitable industrial spaces. CBRE reports that vacancy rates for light industrial space have dipped to historic lows.<sup>8</sup> Comments from interviewees reflect a problem that afflicts multiple industries. Successful water tech firms are “bursting at the seams” in their current locations, with no local options for expansion. Finding a viable

<sup>8</sup> CBRE Vancouver Industrial Figures Q1 (June 1, 2022) reports that Metro Vancouver’s industrial vacancy rate was a record low 0.5%, with subsets of the market (larger properties, inventory with loading docks) in even shorter supply.

space can take many months, even upwards of one year or more. And, most new industrial properties coming online are spoken for far in advance. Specialized spaces appropriate for designing and testing novel processes and equipment that involve water – and thus might leak – are nearly impossible to find, particularly for the earliest stage firms; in fact, interviewees reported testing newly developed water tech “in my kitchen” and “in the back yard of one of the cofounders”.

The lack of light industrial space is shaping up as a potential regional Achilles’ heel, as growing firms are at risk of leaving if they can’t find a larger space, and established firms utilizing rental properties view the eventual redevelopment of their current space as “inevitable” and worry about finding a replacement site. Even firms that own their facilities, and which therefore appear insulated from the industrial land shortage, are feeling the pinch as the higher industrial land costs work their way into the supply chain and are passed on to them by their local suppliers. Against this backdrop, economic development agencies in jurisdictions with adequate, low(er)-cost industrial land are seeking to lure away successful local firms. For instance, one interviewee described receiving recruiting calls and offers – including tax incentives – from Texas and North Carolina. The Metro Vancouver region needs to protect its current industrial land base and pursue creative solutions to address the shortage.

#### **IV. Procurement**

Procurement is another frequently cited pain point. Embracing creative solutions may require a shift in thinking within the region; interviewees in water tech describe a “yawning gap” between ambitious policies to tackle climate change and a general unwillingness to embrace novel solutions developed in the region.

Echoing their colleagues in other areas of the clean tech sector, interviewees repeatedly raised the issue of not being able to secure government clients within the region without first securing dozens of contracts in other markets. The Canadian market was described as generally slow to embrace innovation, with BC specifically mentioned as a notable laggard in this area.

Interviewees from local water tech firms acknowledged that municipal procurement is necessarily conservative, given the need to maintain consistent delivery and regulatory compliance for drinking water and wastewater treatment. The process could be better, however, starting with a clearer delineation of authority. In particular, interviewees reported months of being passed from one department to the next, seeking someone with decision making authority. They expressed sympathy for municipal staff who faced “nothing but downside career risk” for championing a new approach or firm. The lopsided risk-reward equation for embracing innovation makes it much harder to find senior-level, internal champions, and as one firm discovered, losing such a champion (to a job change or retirement) can derail a scheduled trial.

It is easy to dismiss as sour grapes the interviewee who summed up the general perception of bidding on government contracts as “ponderous, bureaucratic, impenetrable”. Realistically, government procurement is probably going to be slower and more burdensome than working with a private sector client. Nonetheless, governments in the Metro Vancouver region should look to other examples, in Canada and abroad, regarding how local governments are doing a better job of embracing innovation.



# Recommendations

## Support 'Water Tech' Industry Clustering

### **Draw on lessons from WaterCampus Leeuwarden in the Netherlands.**

The water tech sector would be strengthened with increased profile. The public perception of the water sector begins with drinking water and ends with wastewater services. Local water abundance keeps water supply issues in the background unless there is *too much* supply, i.e. flooding. And as noted, the region's water tech sector is more a loose collection of firms than an interconnected industry cluster.

In spite of this, the region's supporting role in the mining and oil and gas sectors; its high tech innovation ecosystem; and its deep talent pools in science, technology, and engineering fields, have produced a bevy of firms in water technology, with collections of firms in industrial wastewater treatment, resource extraction, and digital solutions and sensor technologies. And with global trends driving growing demand for water-related products, processes, services, and technologies, including some already provided by Metro Vancouver region-based firms, there is an opportunity for further development of the region's water tech sector as an export industry.

The Metro Vancouver region should proceed cautiously as building an industry cluster is difficult. There are numerous examples of U.S. cities that have tried, and failed, to build a cluster of water-related firms. In Canada, Ontario's Water Technology Acceleration Project (WaterTAP), intended to promote and foster the growth of Ontario's innovative water technology companies, ceased operations in June, 2019 due to lack of support from the Ontario government. The failures seen in water cluster building were partly due to region-specific factors and the particular mix of firms involved, but are mostly attributable to the difficulty of building *any* industry cluster, as attested by the many unsuccessful variations on 'Silicon Somewhere'.

Despite the Metro Vancouver region's lack of concerted effort in building a water technology cluster, the beginnings of one has sprung up somewhat naturally here. To help the water tech sector reach its potential, the region should look to the Netherlands, a world-leader in water technology development, commercialization, and export, for ways to strengthen the sector by building on existing assets. The successful WaterCampus Leeuwarden ("WaterCampus"), in the Netherlands, offers a path forward based on similarities with Metro Vancouver in water tech themes (resource recovery, water re-use, problematic pollutant removal, and digital solutions and sensor technologies) and its mix of mostly small and medium water tech enterprises.

WaterCampus represents almost 20 years of effort in creating a Dutch centre of water technology innovation, education, and entrepreneurship based on collaboration among businesses, universities, and governments. WaterCampus was not an immediate success. Skeptics in the business community and government felt in 2011 that there was insufficient demand in the global marketplace; the campus would serve only firms seeking subsidies; cluster building lacked a compelling rationale and was seen to be cost ineffective; and Leeuwarden was neither sufficiently large nor geographically central enough for a hub.<sup>9</sup> Just over five years ago, academics concluded that Leeuwarden was not yet a vibrant example of a water technology cluster.<sup>10</sup> Today, WaterCampus appears to be thriving.<sup>11</sup>

Figure 4 outlines the three branches of WaterCampus and the various activities they encompass. Importantly, all of these activities are connected to create a robust water cluster responsive to the latest advances in science, real-world applications, and the current business climate.

WaterCampus has three distinct branches focusing on (i) science, (ii) applied research, and (iii) business. On the science side, WaterCampus fosters cooperation among 24 participating research institutes and 107 participating companies who share facilities for application-oriented research into sustainable water technologies, organized around research themes. On the applied research side, WaterCampus focuses on product development and real-world testing of water technologies.

The Water Application Centre is a WaterCampus facility where firms can conduct tests or contract to have the testing carried out on their behalf, and provides access to demo sites at hospitals, industrial operations, and other partner locations where firms can conduct larger scale trials of new technology. Finally, the business branch focuses on the global business promotion side of water tech, organizing conferences, attending trade shows, networking, and seeking potential partners and clients.

Some elements of the functionality of WaterCampus already exist in the Metro Vancouver region. With coordination, collaboration, investment, and promotion, the region could, over time, support a similarly robust ecosystem here.



Figure 4: WaterCampus Innovation Value Chain

9 Miranda Ebbekink and Arnoud Legendijk, "The sustainable water campus in Leeuwarden: towards an anchoring milieu or a 'hollow term'?" in Kebir et al., ed., Sustainable Innovation and Regional Development: Rethinking Innovative Milieus (Edward Elgar Publishing, 2017).

10 Ibid.

11 See, for example, World Trade Centre Association "Dutch Water Technology Conquers the World" (Sep 30, 2021) and Kira Taylor "Can Europe buck the trend of deprivation in rural areas?" (EURACTIVE.com, Dec 6, 2020).



### **Deepen connections between players in the water tech ecosystem**

To create broader understanding of and reduce fragmentation in the water tech sector, people with domain knowledge need a forum to inform and educate those with decision-making authority. Industry, academia and government often have broad agreement on values, but may lack the formal opportunity to meet and share experiences, ideas, resources, connections, and best management practices. This collaboration may yield needed policy supports, promotional activities, trade missions, and cross-functional intellectual property development to lay the groundwork for a water cluster, as part of BC's burgeoning clean tech sector.

### **Explore opportunities for collaborative research**

WaterCampus takes a deeply collaborative approach to water tech research. The research facilities are located in Leeuwarden, but the researchers hail from many European universities, funded in part by long-term agreements with companies. The Metro Vancouver region has the research capabilities, and examples of cooperative educational partnerships, such as the Centre for Digital Media, a collaboration between UBC, SFU, Emily Carr University, and the British Columbia Institute of Technology (BCIT). The WaterCampus approach to contract research and intellectual property rights is similar to the model adopted by 4D Labs at SFU in materials science. Institutions and firms in the region should start by exploring the possibilities for greater integration and cooperation on water tech research. Academic institutions are information and knowledge brokers and many academics are well positioned to identify policy changes that will enable the growth of the sector.

### **Maximize and expand existing assets**

WaterCampus' applied research arm focuses on product development, and testing. The Metro Vancouver region has similar capabilities. BC Research offers the same services and the Annacis Research Centre offers lab space, testing facilities and access to live wastewater streams.

The Annacis Research Centre is marketed primarily through water industry trade journals, and typically about 80 percent of the available space is rented. With industrial land vacancy rates at 0.5 percent and early stage water tech ventures consistently reporting difficulty locating appropriate spaces for testing and development, the Metro Vancouver region should aggressively promote the Annacis Research Centre to developing firms. The facility should be integrated into the regional clean tech innovation ecosystem by fostering connections with post-secondary research institutions (professors and graduate students), accelerators, and incubators. The short-term goal should be to quickly reach full utilization with a waiting list of potential clients. Longer term, there is room to increase capacity by expanding the outdoor research area on the site.

### **Promote the regional water tech industry**

For the water tech sector to reach its potential, it needs to be more visible to the public, government officials, potential investors, water industry mavens (e.g., recognized industry leaders, buy- and sell-side investment analysts) and connectors, large water multi-national corporations (e.g., Veolia, Suez), and overseas markets. The first step is celebrating regional success stories in the water tech sector.

Economic development, industry, and trade organizations, such as the World Trade Centre – Vancouver, BC Business Council, Surrey Board of Trade, Foresight Canada, Vancouver Economic Commission, and Invest Vancouver, must play a key role in promoting this sector and its interests both within the region and to an international investor audience. Additional activities must centre around developing deeper knowledge of local tech and applied research strengths relevant to water tech, and understanding the corresponding opportunities in international markets.

Highlighting and celebrating the water tech sector, as part of BC's burgeoning clean tech sector, will raise its profile, and remind decision makers, deal makers, and market makers that the transition to a greener economy and cleaner environment is a chance to increase regional prosperity by developing and exporting environmentally responsible solutions.



### **In the Spotlight: NORAM Group**

Vancouver-based NORAM group is a global leader in the fields of nitration, sulfuric acid and electrochemistry; provides wastewater solutions for oil refineries and petrochemical plants; and, through its ECOfluid Systems subsidiary, provides compact wastewater treatment bioreactors for remote and off-grid applications. NORAM contributes to the regional innovation ecosystem as the owner and operator of the BC Research facility, which offers contract research to help move early stage technologies from proof-concept to full-scale demonstration projects.

## Promote Government Engagement and Economic Development Role Sharing

### **Create a BC Clean Tech Concierge program to act as a champion, conduit, and primary point of contact for clean tech firms.**

Clean growth is a priority for the provincial government, which has made reducing greenhouse gas emission, developing low carbon goods and technology, and fostering innovation a major component of the [StrongerBC Economic Plan](#). Meeting BC's climate goals, while adding jobs, will involve changes that reach across the economy; much the way the widespread adoption of computers and information technology has affected sectors far removed from computer manufacturing and software design. As such, clean tech, which includes water tech, affects areas that are the responsibility of multiple provincial ministries. The BC government could promote the development of the clean tech sector by creating an office, modeled on the BC Agritech Concierge Program, to act as a champion, conduit, and primary point of contact for clean tech firms and the supporting ecosystem.

A BC Clean Tech Concierge Program would overcome multiple challenges raised by interviewees in the water tech sector, including problems that apply to the broader sector. Players throughout the ecosystem, which includes university entrepreneurship and incubation programs, accelerators, and firms, reported difficulty connecting with the correct person in government, whether the inquiry related to procurement, regulation and policy, or other issues. The Clean Tech Concierge could act as the first point

of contact, providing help directly or connecting non-government actors with the appropriate person in the right government ministry.

The concierge role would also include responsibility for keeping abreast of clean tech developments and their implications for public policy. This matters because innovative products and processes can sometimes be unwittingly excluded if rules are not updated as new solutions become available. To illustrate, a huge improvement in surveying endangered species by detecting trace DNA in water samples languished because it was not one of the approved methodologies for environmental assessments. To avoid similar occurrences, the Clean Tech Concierge should be charged with working with BC firms throughout the clean tech sector, having a role to clear unintended barriers and complications arising from rules and regulations written long before some of the newest innovations were commercialized and available as a solution to many issues the government is aiming to address.

The Clean Tech Concierge Program could also replicate for clean tech some of the services provided by the BC Agritech Concierge, including supporting navigating government processes and connections to municipal, regional, federal and foreign governments, as well as to potential industry partners and collaborators.



### In the Spotlight: Flowlink Environmental

Coquitlam-based Flowlink Environmental integrates water sensors, meters, valves and other sub-components with their monitoring and control software to provide effective solutions for environmental compliance and risk mitigation. Flowlink's effluent monitoring solutions can re-route non-compliant discharge back to a site for re-treatment or an alternative disposal, based on any combination of conditions, including dynamic parameters, to comply with the specific, local environmental regulations.

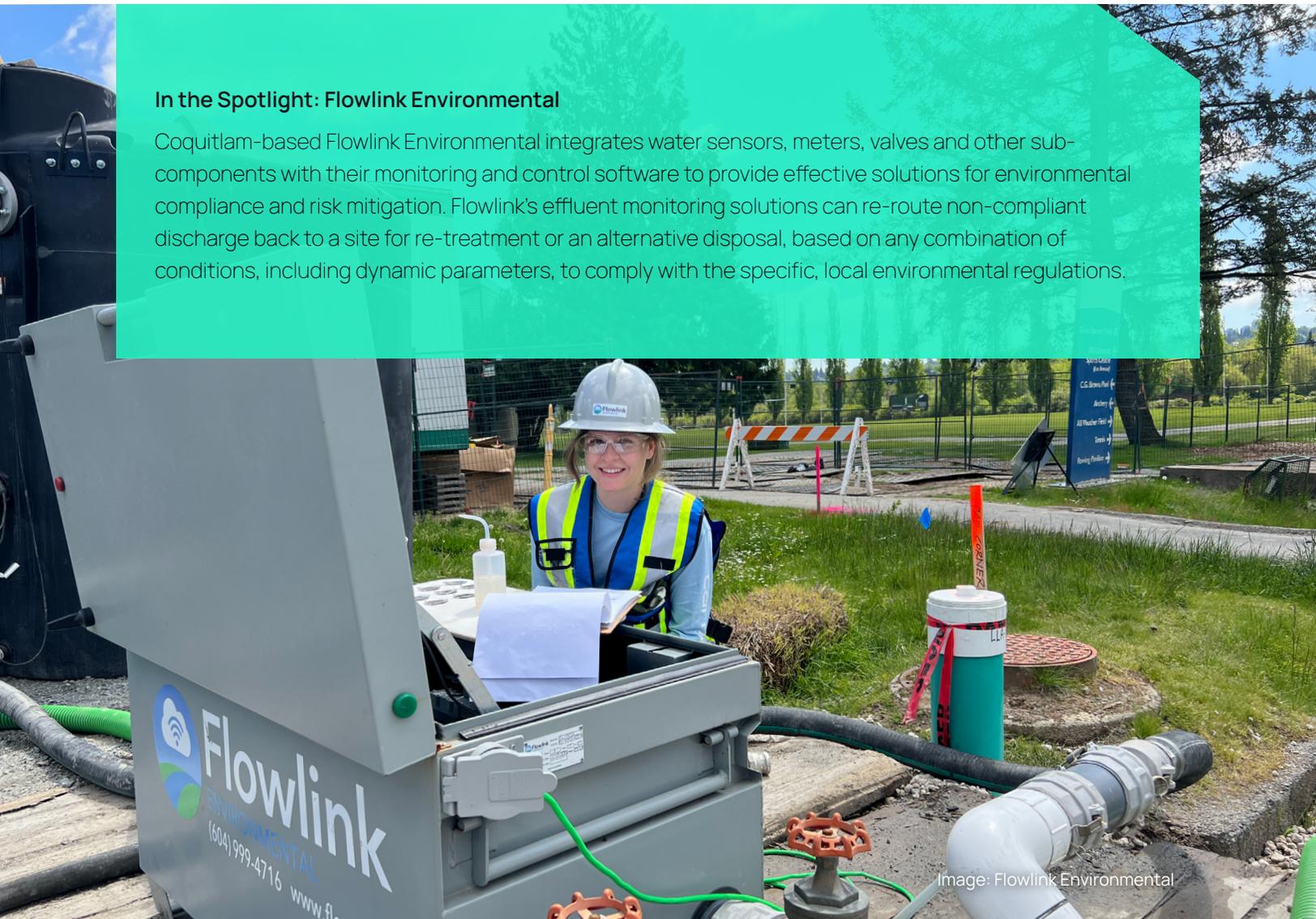


Image: Flowlink Environmental

## Stimulate Novel Technology Adoption

### **Develop a program to showcase best practices in water technology adoption for public utility staff.**

Public utilities, often risk-averse and conservative organizations, face barriers to adopting new technologies. Some utility providers simply lack awareness of the relevant technological options available. More acutely, interviewees shared concerns surrounding trialing new technologies that risk regulatory compliance or jeopardize public health and safety. They also shared that while big data analytics would be a beneficial tool, resources are lacking to put the systems in place to manage the large volume of data generated by utility systems. But without fully investigating the water technology opportunities available, barriers to adoption, such as risk or required resources, may be based more on perception than on fact.

To better inform decision making, municipal staff would benefit from a program highlighting best management practices from other jurisdictions on technological options to reduce risk in the water sector. Such a program should be delivered by a neutral third party, such as the BC Water and Waste Association. This program would assist in raising awareness of water technology opportunities available to public utilities, pave the way to deeper explorations of potential technological solutions, and ensure decisions are based on up-to-date information rather than conjecture. Not only would this program create potential opportunity for the local water tech sector, but it would also result in efficiencies and risk mitigation within public utilities.



### **In the Spotlight: SHARC Energy Systems**

SHARC Energy Systems, in Port Coquitlam, builds systems that recover energy from wastewater in buildings and sewer systems. SHARC Energy's closed loop system powers the Olympic Village renewable district heating system in Vancouver and the newly opened National Western Center in Denver, Colorado, the largest wastewater energy district in North America.

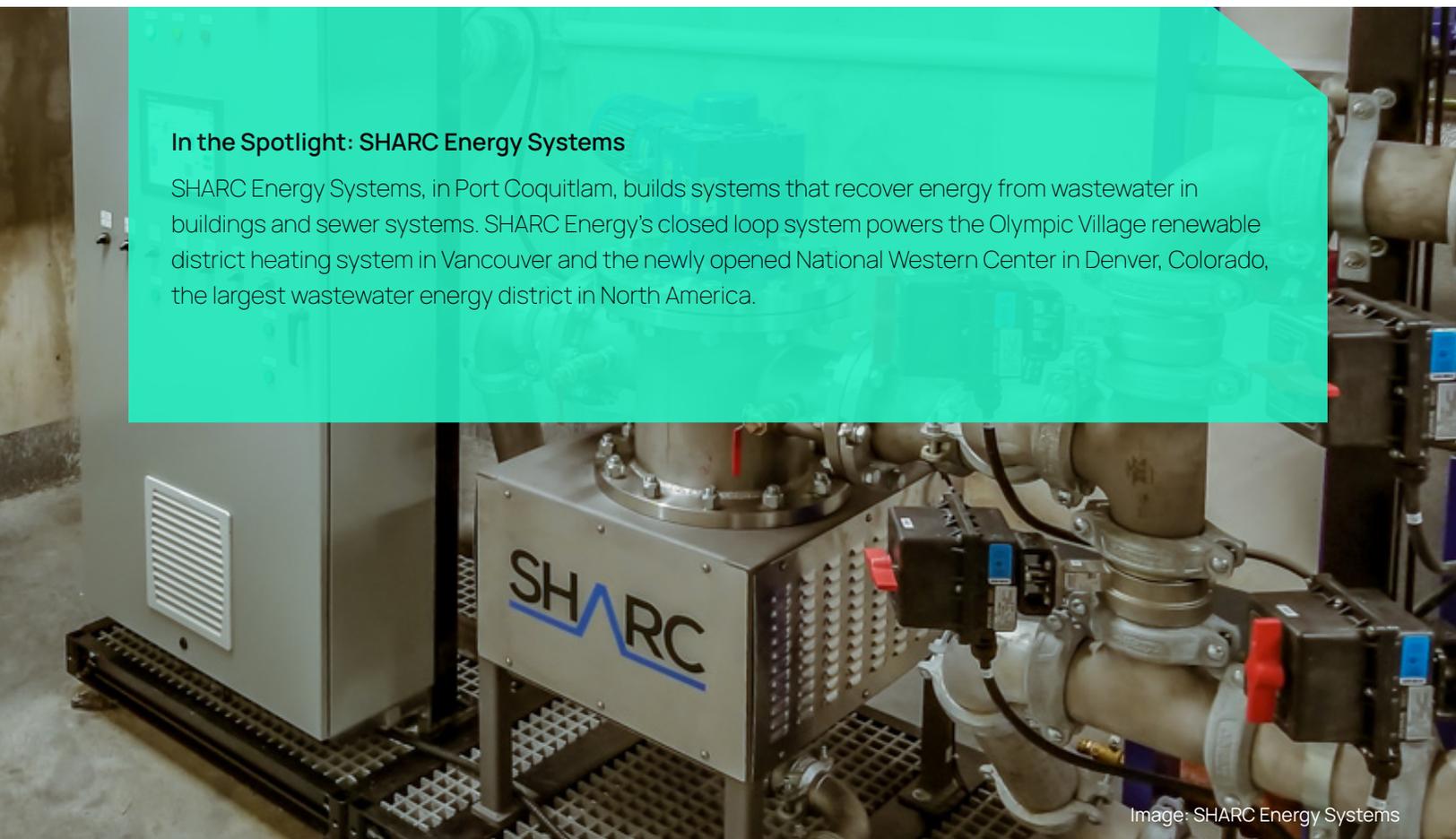


Image: SHARC Energy Systems

# Conclusion

In a part of the world where water is not generally perceived to be a risk, the number of firms revealed to be working in this sector was seen as worthy of investigation. Markedly different than the industries assessed in the previous Invest Vancouver-authored asset and gap analyses, i.e. the agritech and clean transportation sectors, the water tech sector does not have the same level of definition, recognition, or regional commitment behind it. Indeed, it seems somewhat invisible despite the central importance of water and the looming uncertainty around water use as climate change accelerates drought, flooding, and other extreme weather events. Intensifying water-related risks are matched with an increasing economic opportunity and a growing global, multi-billion-dollar market in 10 areas: resource recovery, stormwater management, brine management, advanced drinking water treatment, agricultural water, to name a few. In short, much like the hidden infrastructure that delivers fresh drinking water and removes wastewater, **the water tech sector is an unseen asset that, if supported, could become an economic driver for the region.**

The quest for new economic opportunities for the region should start by identifying and building on regional strengths. The broader clean tech industry cluster will represent a major, growing driver of BC's economic activity into the future. Within clean tech, water tech is an existing, underappreciated strength, making it a logical place to focus economic development efforts. To reduce fragmentation and unlock the value of this sector, those with domain knowledge need to educate decision makers and the broader public. Building on the strengths already present, the region can then look to the successful WaterCampus model in the Netherlands to propel the water tech sector to the next level and realize its full potential.

## Prepared by Invest Vancouver

This Invest Vancouver report was authored by Lejla Uzicanin, Vice President, Data, Research and Policy, Gregory Freeman, Senior Economist, and Megan Gerrits, Senior Policy Advisor.

The Data, Research and Policy team supports investment and job creation in key export-oriented industries, conducting research, discerning the factors driving their growth, identifying gaps along the product-service value chains, and articulating the underlying competitive advantages of the Metro Vancouver region. Through the identification of opportunities and challenges faced by firms in these industries, the team develops recommendations to inform policy and to influence decision-makers in strengthening the regional value proposition across key industries in order to increase the region's global competitiveness.

The work of Invest Vancouver is built around three integrated functional areas: Data, Research and Policy; Collaboration; and Strategic Investment. The work of Data, Research and Policy informs the Collaboration function, which then influences the Strategic Investment program. Additionally, the investment needs guide work done in Data, Research and Policy and Collaboration.

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