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The Need for a Sanitation Revolution in LAC

Conclusions from World Water Week

David Sparkman
German Sturzenegger

Infrastructure and Energy Sector

Water and Sanitation Division

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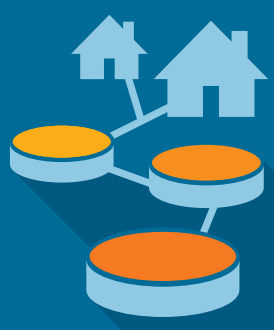

David Sparkman & Germán Sturzenegger

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Executive Summary

Sustainable Development Goal #6 (SDG6) set ambitious sanitation and wastewater treatment targets. Latin America and the Caribbean (LAC) countries have committed to achieving them by 2030. Conventional, business-as-usual approaches will not achieve SDG6. The region must go through a sanitation revolution that will require not only creative and innovative ideas, but an overall revolution in thinking within the sector. It will also require the collaboration of all public and private stakeholders. This paper makes a case for that revolution, and how to best make it happen.

As part of World Water Week 2017 (WWW), the IDB organized, in coordination with several partners, a set of four sessions (referred to as "Eye on LAC") highlighting the challenges accompanying SDG6 targets for the region.

Following the Week's overall theme on "Water and Waste: Reduce and Reuse," Eye on LAC focused primarily on the challenges and opportunities for LAC related to Targets 6.2 and 6.3. Namely: i) how to halve the proportion of untreated wastewater by 2030; ii) the need to understand sanitation as a full service chain and how to ensure that populations not only have access to a viable toilet, but that those facilities are effectively connected to a sewer network or have sound FSM services available to manage waste transport and treatment; iii) innovative ideas surrounding wastewater reuse financing and how to overcome the barriers that are currently inhibiting finance towards wastewater reuse models; and iv) how linear economy models will not be effective or cost-efficient enough to meet SDG6 by 2030, and the need for an increased focus on circular economies in the WASH sector, particularly as it relates to industrial uses and stewardship of water resources.

This paper summarizes the discussions, findings and conclusions reached from those WWW sessions, and provides recommendations on strategies that will help LAC launch the sanitation revolution it needs, in order to meet SDG6 Targets 6.2 and 6.3 by 2030.

The overarching recommendations for beginning this revolution include:

- Mainstream Non-Conventional Approaches
- Change the Water and Wastewater Organizational Culture
- Establish Innovative Financial Models
- Increase Overall Investment in the Sanitation and Wastewater Treatment Sector

It is now 2018, with just 12 years to go, now is the time to act—¡Que viva la revolución!

Introduction:

Ambitious and challenging goals often require a revolution. Key elements of Sustainable Development Goal #6 (SDG6) aim to provide "equitable and adequate sanitation for all" (Target 6.2) and "improve water quality by… halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally" (Target 6.3). All countries within the Latin America and Caribbean (LAC) region have agreed to work towards SDG6, representing an extremely ambitious challenge for the region over the next 12 years. Guaranteeing safely managed sanitation services and reducing by half the proportion of untreated wastewater will not only require creative and innovative ideas, but an overall revolution in thinking and practice within the sector across the region.

Key leaders, practitioners and other representatives from the global water, sanitation and hygiene (WASH) sector convene annually in Stockholm, Sweden, for the World Water Week (WWW) conference. For the entire conference, the overall theme of WWW 2017 was "Water and Waste: Reduce and Reuse," which has a great deal of relevance for the specific WASH-related challenges facing LAC under SDG6. [1] The Inter-American Development Bank (IDB) was responsible for organizing —in coordination with several partners— the "Eye on LAC": a set of four sessions focused primarily on challenges and opportunities for the LAC region related to Targets 6.2 and 6.3 of SDG6 [2]. All of these sessions were rooted thematically in LAC regional aspirations surrounding the achievement of these two targets, namely [3]:

1. **Halving the proportion of untreated wastewater by 2030**, focused on challenges and strategies to address SDG6 Target 6.3 specifically;

2. **Before and after the toilet: Sewer connectivity and fecal sludge management (FSM)**, focusing on two elements related to both SDG6 Targets 6.2 and Target 6.3: i) If people do no connect to sewers networks; and ii), If FSM is not adequately managed, Targets 6.2 and 6.3 will be very challenging to achieve comprehensively;

3. **Innovative and new ideas surrounding wastewater reuse financing**, focused on financing the "reuse" element of SDG6 Target 6.3, which will arguably be necessary for achieving the reduction in untreated wastewater that is aimed for;

4. **The Circular Economy of Water in the Industrial Sector**, with implications for sustaining any progress achieved across SDG6 Targets 6.1-6.3. Conventional models that primarily rely on linear economies will not be effective or cost-efficient enough to meet SDG6 by 2030, highlighting the need for an increased focus on circular economies in the WASH sector, particularly as it relates to industrial uses and stewardship of water resources.

The transition from WASH-related objectives under the Millennium Development Goals (MDGs) to SDG6 represented a potentially alarming shift with respect to understanding the true extent of WASH challenges across LAC. While the region made very significant progress towards achieving the MDGs around both water and sanitation, now that the focus is on "safely managed" WASH services, it is clear that there is still much work to be done, particularly with respect to sanitation [4]. Based on baseline figures published in mid-2017, UNICEF/WHO's Joint Monitoring Programme (JMP) reports that 77% of the population (approximately 480 million people) in LAC lack access to safely managed sanitation services including not only access to improved sanitation infrastructure, but also safe and adequate transport, treatment and disposal of fecal waste and wastewater [5]. These new coverage figures not only reflect the true scope of the sanitation challenge facing the region, but point to the urgent need for resource-

mobilization and adoption of creative and innovative strategies to meet SDG6 effectively and efficiently by, or before, 2030.

It has been estimated that approximately US$ 14 billion will need to be mobilized annually across the LAC region to cover solely the initial capital costs associated with meeting SDG6 Targets 6.1 (access to safe and affordable drinking water), and 6.2 (access to adequate and equitable sanitation and hygiene) [6]. Looking just at safely managed sanitation under Target 6.2, including not only capital costs but operation and maintenance expenses, approximately US$ 160 Billion total will need to be invested across the LAC region between 2015-2029 [7]. Given that between 1990-2015 on average US$ 4.063 billion was spent annually in LAC on WASH services, these potential investment needs imply a significant increase in resources that will need to be allocated to improving WASH services [8]. Furthermore, in addition to necessary financial resources, if business-as-usual was not sufficient to meet the MDGs, it will certainly not be sufficient to meet SDG6 by 2030, and increased innovation is strongly needed.

The purpose of this technical note is to summarize and synthesize findings, conclusions and recommendations from presentations and discussions held during the aforementioned LAC-focused WWW sessions, with a primary objective of outlining steps the LAC region can take to initiate the sanitation revolution needed to meet SDG Targets 6.2 and 6.3. The following sections discuss key takeaways from each of the sessions, followed by a concluding section with overarching recommendations for better understanding and responding to LAC WASH challenges innovatively, effectively, efficiently, and arguably most importantly: sustainably. With only 12 years to go, the challenge is enormous, and business-as-usual practices will not be sufficient—nothing short of a sanitation and wastewater treatment revolution will be needed across the region.

Audience and Methodology

The primary audience for this report is intended to be development practitioners, public and government sector representatives, and/or any other stakeholder interested specifically in sanitation sector challenges and opportunities around the achievement of SDG6 in the LAC region, as well as those interested in specific discussions and conclusions reached from LAC-related sessions at WWW 2017. To analyze findings and establish the conclusions presented in this report, the authors participated in all relevant sessions during WWW 2017, including a review of any relevant literature as appropriate. It is beyond the scope of this paper to suggest specific country-level recommendations for achieving SDG6; the primary objective of this report is to discuss overarching and preliminary recommendations for expanding and sustaining WASH coverage throughout the LAC region.

Chapter One: The Need for a Wastewater Treatment Revolution (Halving the Proportion of Untreated Wastewater by 2030)

Target 6.3 of SDG6 aspires to: "By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater [9] and substantially increasing recycling and safe reuse globally," with indicator 6.3.1 specifically focusing on tracking progress towards the proportion of wastewater safely treated [10]. According to the JMP, in 2016, of the approximately 505 million people across the region who have access to a *basic* sanitation facility (previously classified as "improved" under MDG criteria), only 22% of them had access to effective wastewater treatment. This implies that nearly 395 million people do not have access to adequate wastewater treatment across the region.

In urban areas, only 38% of the population has access to a sewer network with adequate wastewater treatment [11]. From the perspective of actual wastewater treated, only 28% of *collected* wastewater is treated across the region, with only 18% of overall wastewater *generated* receiving adequate treatment [12]. This gap in wastewater treatment is the largest factor contributing to the relatively much lower numbers of "safely managed" sanitation service coverage across LAC. To meet wastewater treatment objectives under SDG6 Target 6.3, wastewater treatment services will need to be extended to at least 200 million people, including not only those that currently lack access to adequate services, but also future households as population grows across the region.

Despite an improvement from 10% to 22% (between 2000 and 2015) regarding the proportion of wastewater treated among the population using improved sanitation facilities, fulfilling Target 6.3 will be a significantly greater challenge, over less time. Business as usual involving conventional approaches to wastewater treatment will not be sufficient, and now is the time not only for increased action, investment and innovation, but for a "revolution" with respect to how the region addresses wastewater treatment challenges. Despite the need for increased financial investment (potentially exceeding US$ 160 billion between 2015-2029) [13], money alone will not be enough.

LAC decision-makers are often inclined towards either significant and continued investment in new but conventional infrastructure, or a bias towards expensive new technologies when focusing on innovation [14]. Simply "buying" more traditional treatment plants and other wastewater treatment infrastructure will be insufficient and inefficient for meeting Target 6.3 under SDG6. Overall, and notwithstanding the need for innovation (particularly around wastewater reuse and resource recovery), wastewater infrastructure should be fit-for-purpose within a particular context, and more assessment should be done beforehand prior to investing significant resources in a particular technology, whether innovative or conventional.

In addition to this inclination towards conventional and expensive infrastructure, the region is also characterized by: (1) Poorly developed legislation that often leads to policy and regulatory frameworks that do not allow for gradual improvements to wastewater infrastructure, nor to treatment models that involve resource recovery; (2) A lack of control around industrial discharges, which can have a strong impact on treatment processes; and (3), A reliance on conventional financing, which translates into a reliance on conventional models.

To start addressing these issues, LAC country governments can begin by clearly understanding and articulating a plan—with adequate budget—for addressing their specific wastewater treatment challenges. A key first step in this process is a detailed inventory and assessment of existing wastewater treatment plants across the region, especially those in intermediate and smaller urban areas that are currently not functioning optimally or not functioning at all [15]. Furthermore, institutions (public and private) responsible for supporting wastewater treatment need to make capital investment needs and operation and maintenance (O&M) expenses associated with wastewater treatment transparent and clear to customers, so that tariffs are optimized and being invested in the most effective and efficient way possible. Other key strategy and policy changes should include [16]:

- **Appropriate Regulation**—Improved regulations, including specifics for public, private, or public-private operators are needed [17]. These regulations should not only distinguish between potential operation and management arrangements, but should be flexible and adaptable to specific contexts as needed, such as differentiating between the variety of wastewater streams (e.g. industrial, agricultural, household, etc.) and their respective treatment and discharge requirements. This is particularly important with respect to regulating adequate treatment of industrial discharges. Furthermore, regulations, including environmental, should not be unnecessarily complex or so rigid as to stifle innovation—they should be as simple as possible, appropriately strict, and have the flexibility necessary to incorporate creative and new treatment processes, as well as novel management structures.

- **Focus on *Services*, not just Infrastructure**: Often, disproportionate emphasis is put on static elements such as infrastructure and facilities, and not enough focus is placed on including ongoing wastewater treatment *services* into planning. This incomplete and incomprehensive planning can lead to fragmentation in wastewater treatment service provision, and more importance should be given to the ongoing wastewater treatment *service*—a dynamic process—when planning for wastewater treatment expansion across the region [18].

- **Effective Demand Generation**: For any service offering to function and be sustainable, the "social" dimension must be considered, and demand must be adequately generated and tariffs aligned with customers' capacity to pay. Efforts should be carried out to generate and sustain demand through creating improved awareness among the citizenry around the benefits and importance of effective wastewater treatment. This demand will not only generate some of the revenue necessary to financially sustain wastewater treatment services, but will also contribute to improved quality and effectiveness of wastewater treatment generally.

- **Emphasize Sustainability**: Holistic and in-depth life-cycle cost assessments should be carried out to best understand not only ongoing O&M expenses, but also future capital investments such as large-scale repairs and replacement of wastewater treatment infrastructure. In addition to understanding these costs, improved water resource management and innovations around resource recovery should help streamline longer-term expenses and contribute positively to the overall sustainability of wastewater treatment services.

While all of the above elements will be critical to meeting Target 6.3 of SDG6, what is really needed is a new revolution in thinking across the entire region with respect to wastewater treatment. This revolution will have to encourage innovation, creativity, new financial models, and most importantly: inspire the effort necessary to mobilize resources and energy towards addressing this challenge. There are many countries and cities leading the charge, please see Box 1 for an example of some of the innovative wastewater treatment ideas currently occurring in Mexico. There are 12 years to go and an enormous amount of work ahead, but by joining this revolution, we can address not only the wastewater treatment challenges facing LAC, but potentially serve as a sustainable model to other regions as well.

Box 1: On the frontlines, a wastewater treatment revolution in Mexico

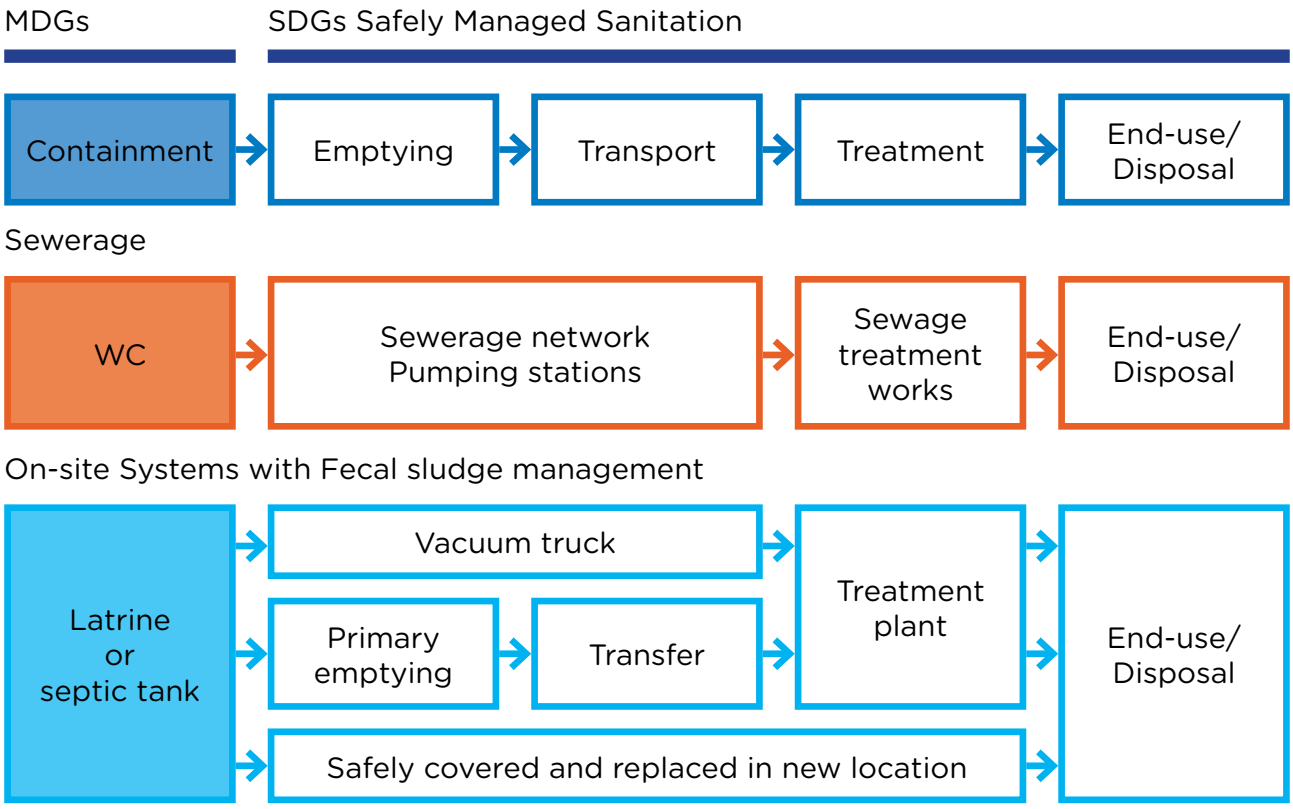
CONAGUA (Comisión Nacional de Agua), the primary national entity responsible for wastewater treatment across Mexico, plans to support the treatment of 63% of wastewater generated by the end of 2018. Given that 57.6% of wastewater was estimated to be treated at the end of 2016, if Mexico is able to maintain this trajectory through 2030, they should be well on the path to meeting Target 6.3 of reducing by half the proportion of untreated wastewater nationally. To achieve this, CONAGUA, and the Mexican federal government, have supported a number of innovative wastewater treatment models involving reuse of (effectively treated) wastewater, which is also a key element of Target 6.3. This support has primarily been financial, with the federal government supporting up to 50% of the costs of collection, wastewater treatment plants, and subsequent re-distribution of treated water under reuse schemes. At the national level, of the 123.6 m^3/second of wastewater treated, 28.5 m^3/s is reused directly in activities that do not require a high level of treatment (e.g. agricultural and industrial uses), 78.9 m^3/s is reused indirectly in agriculture and aquaculture, and 8.2 m^3/s is freely exchanged for first-level use (i.e. reintroduced back into the water delivery system) diminishing greatly the over-exploitation of aquifers. This focus on and investment in innovative reuse models has helped put Mexico on a track to meet all elements of SDG6 Target 6.3, and serve as one of the leaders on the frontlines of the revolution needed across the region to meet this ambitious target.

Please see: (Alcocer & Pereyra, 2017) for further information

Chapter Two: "Before and After the Toilet": Sewer Connectivity and Fecal Sludge Management

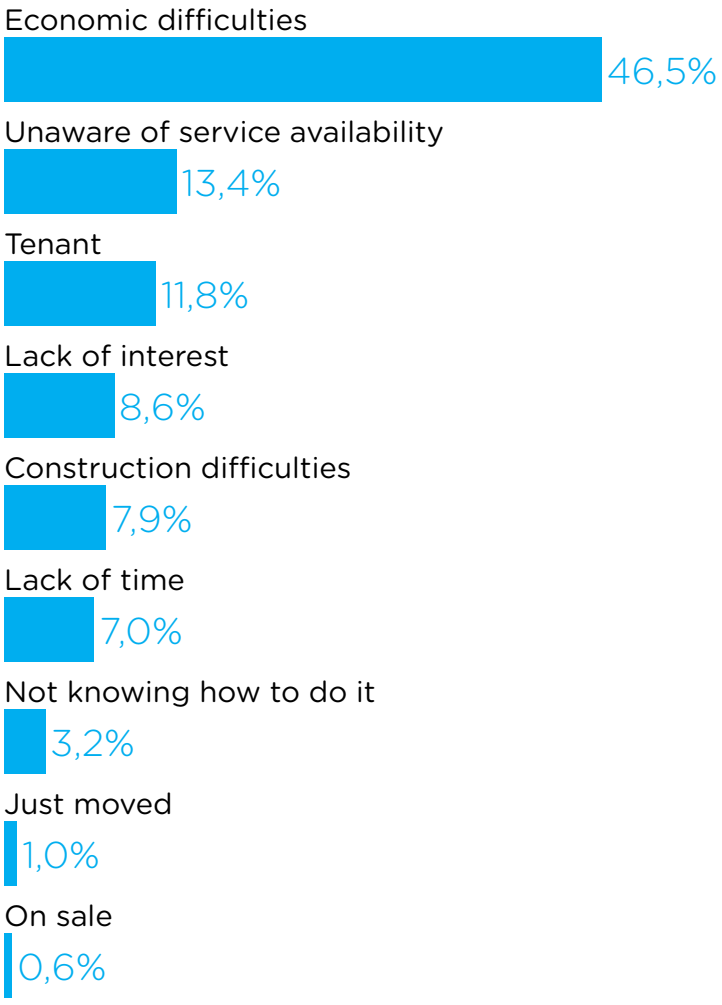
Previously, under the MDGs, much of the world viewed sanitation around the type of infrastructure (e.g. latrine, toilet, etc.) available at the household or public institution. Under SDG6, the understanding around sanitation has been broadened significantly: recognizing that sanitation infrastructure at the household (i.e. collection of feces) is only one element in a full service sanitation delivery chain from collection all the way to treatment of wastewater and fecal sludge. "Safely managed" sanitation, as introduced in Target 6.2, is best understood in the context of the full sanitation service delivery chain (See Figure 1 for a diagram illustrating this full sanitation service chain), in which all elements of sanitation, i.e. containment of fecal waste, emptying/ transport of this waste (either via a sewer network, tanker truck, or other device), treatment and eventual reuse or disposal—are all managed safely and effectively. This service chain can include sewer networks, or be based on other emptying models with on-site sanitation, the key element of the target is to "safely manage" all elements of the entire sanitation service chain.

Figure 1: Full Sanitation Service Delivery Chain, (Perez, 2017)



Beginning with sewer networks, there is often the assumption that all that needs to be done to resolve urban sanitation challenges is install sewer network infrastructure and households will magically connect to the service. This assumption often belies the challenge, seen in many LAC cities and especially expanding urban areas, around actually incentivizing, convincing and enabling households to connect to newly constructed sewer networks. In many LAC cities, sewer connection rates are as low as 50%, implying that despite infrastructure being built, wastewater is still not being effectively and safely transported via sewer networks as originally intended [19]. Even with sewer networks nearby, households all too often continue to rely on individual on-site sanitation options that can be prone to leaks, spills, and in some contexts are only a step above open defecation. Given that there are sewer networks installed in these neighborhoods, FSM services may not be readily available compounding future problems when on-site systems need to be emptied. While many households report that a lack of information, absence of sanctions (for not connecting), technical challenges, lack of awareness of network and a reluctance to damage their property as some reasons for not connecting, the chief barrier was reported to be financial, particularly related to liquidity (See Figure 2 and Box 2).

Figure 2: Reasons for not connecting to Sewer Networks in Argentina (Sturzenegger G., 2017)



Source: AySA

Box 2: Key Constraints and Barriers Inhibiting Increased Sewer Network Connectivity

Demand Side:

- **Financial and Liquidity:** Given that upfront connection fees can be substantial, households often do not have the available cash-on-hand or other financial alternatives needed to facilitate sewer connection.
- **Informational and Knowledge:** Households are often constrained by a lack of information or knowledge around the availability of sewer networks and/or processes for connecting to them.
- **Behavioral:** Cultural norms or other social factors do not properly incentivize households to connect efficiently. For example, households may have a "status quo bias" that discourages any investment in something new.

Supply/Institutional Side:

- **Legal:** Insecure or unclear property rights and/or titling can discourage households from investing.
- **Collective Action Constraints:** Migration and/or heterogeneity within unplanned areas can inhibit the collective action often necessary for increased connectivity.
- **Bureaucratic:** Perception of administrative hurdles discourages service adoption.

Adapted from (Sturzenegger G. , 2017)

Households often did not have the financial resources or liquidity available to pay connection fees, which in some cases were up to $250, representing a significant investment for lower-income households. Efforts should be carried out in urban areas not only to expand sewer networks where appropriate, but also to understand some of these behavioral, legal, institutional, technical, and primarily financial and liquidity constraints faced by households in connecting. From a financial perspective, given that upfront connection fees can often be substantial to lower income households, creating and providing incentive structures such as credits, subsidies, loans, or transfers could be effective ways to alleviate liquidity constraints. With respect to technology, and especially in peri-urban or less-formal urban areas, smaller-scale networks may be more appropriate and allow households to connect more efficiently (See Box 3 for an example). It will not be enough going forward to simply build more sewer networks; innovative mechanisms (particularly financial) must be devised to enable households to more efficiently connect to those networks. This challenge can be viewed as a "before the toilet" issue, in that before households (and the neighborhoods within which they reside) are able to enjoy the benefits of sewer networks, more work will need to be carried out to understand challenges and barriers they face in actually connecting to those networks.

Box 3: Promoting Network Connectivity in Honduras and Nicaragua through Condominial Sewerage

Some of the challenges associated with conventional, larger- scale sewer networks include massive infrastructure, a lack of participation from local households and end-users in the overall project design and implementation, little consideration of internal infrastructure (i.e. what currently exists at households), and the need for large-scale, costly investments. Condominial sewerage (i.e. smaller-scale networks) on the other hand can lead to up to a 50% reduction in necessary investment when compared with conventional models, increased flexibility, ease in adapting to complex topography across urban areas, greater simplicity in operation, and help to encourage community-level management and participation given their smaller size. In Honduras, a condominial sewerage network implemented nearly three years ago had a connection rate of 89% at an average cost of $924 per connection, compared with a 60% connection rate to the 10-year-old conventional sewer network at a cost of $2,631 per connection. While the condominial sewer model has shown much promise, and households are much more eager to connect given the lower overall connection costs when compared with conventional sewer networks, there has still not been adequate uptake or promotion of condominial sewerage in the region, primarily due to unfamiliarity with the model among the construction sector and other stakeholders associated with implementing sewer and wastewater conveyance networks. Given the higher connection rates observed due to lower overall connection costs, condominial sewerage should be considered much more widely across the region as an efficient and cost-effective means of expanding coverage in small towns, urban and peri-urban areas.

Please see (León, 2017) for further details.

Figure 3: Urban "After the Toilet" Sanitation Challenges in Haiti –Photo Courtesy of SOIL, (Kramer, 2017)

On the other hand, there are also numerous challenges surrounding issues "after" the toilet, chiefly around FSM services in areas that do not have sewer networks to connect to. In many peri-urban and less-formal urban areas around LAC, fecal waste is not being collected adequately (i.e. latrine pits or septic tanks not being emptied appropriately)—nor is collected waste being treated sufficiently before release into the environment—leading to many potential public health and environmental hazards, especially in areas with high population density. Furthermore, similar to sewer networks and conventional wastewater treatment, waste reuse and resource recovery options are not being explored or utilized adequately.

One model that is showing promise in a couple of urban areas in the region is known as Container Based Sanitation (CBS—See Box 4) [20]. CBS is essentially a full-sanitation-delivery-chain service that collects waste hygienically from waterless toilets that have been previously constructed around sealable, removable containers. These containers are collected on a regular basis, and transported to a centralized facility for further processing and treatment of the waste collected. In many instances, treated waste (rendered sanitary) is then re-purposed and sold on the market providing a viable resource recovery and reuse strategy. CBS is similar to sewers in that waste is removed from households on a frequent and regular basis (except using containers instead of pipes), and similar to onsite sanitation technologies in that it does not require significant upfront investments (in sewer networks) at the household or government level.

CBS models can be appealing solutions for informal and/or high-density urban areas given primarily that: (1) Space is an issue in these areas, precluding the implementation of sewer networks and in many cases making it challenging for households to even construct latrines or septic tanks; (2) Informal areas are often found in urban sectors that are vulnerable to flooding (hence why city planners have often shunned these areas for formal development), and conventional on-site sanitation systems such as septic tanks are much more complex and expensive to construct in flood-prone or high-water-table areas; and (3), Given that the informality of these sectors often hinders both household and government investment in public services (i.e. both parties are hesitant to invest too heavily in public services given the lack of formality), CBS models can provide a low-cost intermediate solution that does not rely heavily on infrastructure. When feasible, CBS has also shown much promise in waste reuse and resource recovery.

Overall, CBS not only provides an efficient and relatively inexpensive solution to ensuring safely managed sanitation along all elements of the sanitation service delivery chain under SDG6 Target 6.2 (particularly elements “after” the toilet), but given the potential for reuse and nutrient recovery, also provides a viable model for addressing objectives around waste reuse in Target 6.3. Like many sanitation service delivery models CBS is only applicable in certain contexts, but as a lower-cost and more efficient alternative to conventional sewer infrastructure, CBS represents one key model that should be considered--especially in higher density settlements.

If the region is to be successful in the sanitation and wastewater treatment “revolution”, SDG6 Targets 6.2 and 6.3 will have to be met, and the region will need to strongly consider the aforementioned key elements affecting sanitation services both “before” and “after” the toilet. The LAC region must ensure that populations not only have access to a viable toilet or other waste “collection“ facility, but that this facility is effectively connected to a sewer network or otherwise has sound FSM services available to manage waste transport, treatment and, ideally, eventual reuse.

Box 4: Responding to After the Toilet Challenges: Container Based Sanitation in Haiti

Sustainable Organic Integrated Livlihoods (SOIL), a socially minded container based sanitation (CBS) business operating in Haiti, seeks to respond to lower-income and traditionally underserved households living in urban and peri-urban areas. As urban centers grow and spread in LAC, water and wastewater utilities are often unable to keep up with growth, and implementation of public sanitation infrastructure (such as sewer networks) generally lags behind home construction by a number of years, if not decades. SOIL is implementing an innovative sanitation business model in that they are focusing not only on household sanitation infrastructure (e.g. latrines, bathrooms, etc.), but their model addresses after-the-toilet challenges and demand along the entire sanitation chain, from safe containment of excreta through basic household sanitation infrastructure, to waste transport, eventual treatment and even reuse and resource recovery. Similar to other CBS models, SOIL is an end-to-end service that collects waste hygienically from waterless toilets built around sealable, removable containers. It is similar to sewers in that waste is removed from the communities on a frequent and regular basis, and similar to onsite technologies in that it does not require significant upfront investments at the household or government level. With thousands of customers already and numerous similar models worldwide, SOIL, and other CBS models, can provide a viable sanitation alternative for mitigating "after the toilet" challenges in high density, unplanned or informal urban areas that often struggle with issues of high water tables and/or challenging access that render sewer networks and other FSM services difficult and expensive.

Please see (Kramer, 2017) for further discussion about CBS and SOIL specifically.

Figure 4: Urban "After the Toilet" Sanitation Challenges in Haiti –Photo Courtesy of SOIL, (Kramer, 2017)

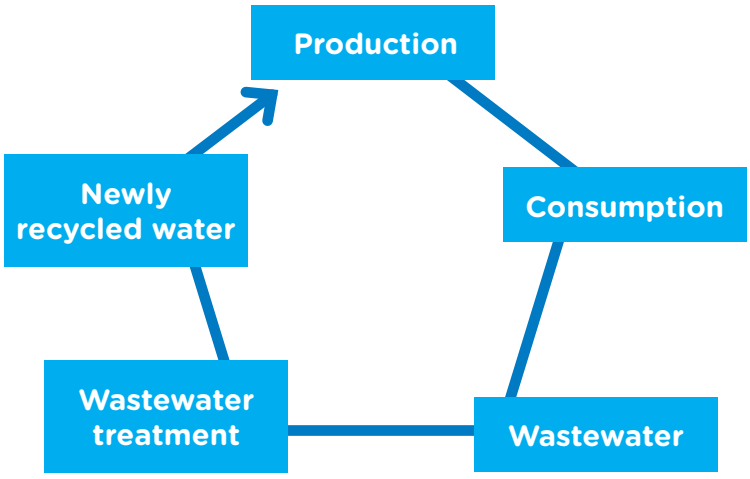
Chapter Three: Paying for the Revolution: Meeting the Costs of Target 6.3 and New Ideas Around Financing Wastewater Reuse

The sanitation revolution will have a cost: achieving safely managed sanitation will likely cost upwards of US$ 160 Billion across the region, and a key barrier to meeting specific challenges under Target 6.3 around wastewater treatment and *reuse* will be financial. While most large and medium size cities are already investing heavily in wastewater facilities, incorporating wastewater reuse is still very much in its infancy across the region, with the adoption of waste-to-resource approaches in all sectors still behind those favoring conventional models. The principal barrier inhibiting more finance towards wastewater reuse models specifically is that wastewater reuse itself is in large part still very much outside the mainstream and viewed as experimental. In order to attract more finance to wastewater reuse models, pilot programs and other experiments that involve reuse should be better understood, optimized and then promoted across the region.

Overall, not only have traditional rates of investment been insufficient to meet the overall wastewater treatment challenge facing the region, but a bias towards investment in conventional wastewater treatment systems has in many respects hindered the development of the innovative models—such as reuse--that will be needed to meet Target 6.3 efficiently and effectively by 2030.

Wastewater reuse itself is best viewed through the lens of circular economies. Within the context of water resources and the WASH sector, the idea of circular economies involves shifting the viewpoint of wastewater away from "waste", and exploring methods for its re-utilization post-treatment (a generic illustration of this model is presented in Figure 5). At the global-level, water cycles are already involved in a circular economy: any water that is currently consumed by humans has already been consumed and recycled a near-infinite amount of times by global hydrologic processes. On a smaller-scale however, the water we utilize, once consumed, is generally inadequate for subsequent human consumption without some form of treatment. The type of consumption of this water usually dictates the treatment necessary, i.e., water used for agricultural or industrial purposes may have specific treatment needs that differ from wastewater generated from households. Given the challenges around adequate treatment, wastewater is almost always viewed as a "waste" product, evidenced most directly by the etymology of the word itself.

Figure 5: Circular Economy of Water and Wastewater



Viewing wastewater simply as "waste" that should be disposed of post-treatment is a linear economic model, i.e., there is no circular feedback of resources within the system, and the process essentially passes linearly from production to consumption to disposal. A key paradigm shift that will help the LAC region better incorporate reuse into wastewater treatment models is to view wastewater as a potential resource instead of "waste." [21] Traditionally all of the aforementioned wastewater elements have been viewed strictly as waste that needs to be treated, disposed of and forgotten about. However, there is value in wastewater that can be recovered and reused post-treatment, instead of simply disposing of it. For example, wastewater is essentially 99% water and less than 1% pollutants and contaminants; as such, "wasting" this available water through disposal post-treatment is a significant missed opportunity to supplement natural water sources and recover energy and nutrients. Some examples of shifting the view of wastewater to resource include:

- **Water Recovery:** Treated wastewater has much potential to supplement existing water resources, particularly for uses (e.g. agricultural, industrial and household use not involving direct human consumption) needing less-intensive treatment than that applied to water used for activities involving direct consumption such as drinking, cooking or bathing.[22].

- **Nutrient Recovery:** Nutrients and organic matter essential for healthy soils and plant growth are very prevalent in wastewater, and can be recovered for utilization instead of disposed of, reducing demand for nutrients that are often unsustainably extracted through artificial fertilizers.

- **Energy Recovery:** Wastewater can also be converted into an energy source through biogas production, alleviating pressure on non-renewable and other energy resources elsewhere.

Improved recovery of the resources within wastewater could contribute greatly towards addressing some of the financing challenges of wastewater reuse across the region, and a revolution in perspective is needed in order to more properly view wastewater as a resource instead of waste.

By itself, wastewater reuse does not necessarily require new *sources* of finance; traditional financial sources could be applied to reuse models, assuming reuse models can be mainstreamed and shown to be financially viable. In a recent ten-country study across LAC carried out by the Latin America Development Bank (CAF), it is estimated that roughly US$ 53.4 Billion has been invested historically in wastewater treatment across those ten countries [23]. Also within those countries, the current financial shortfall to ensure that all wastewater generated is treated is approximately US$ 38.9 billion, or more than 70% of what has already been invested. This will imply the need for a significant mobilization of resources. Instead of investing in traditional linear models around wastewater treatment, more emphasis should be placed on circular economy reuse models that leverage the resources available in wastewater to offset costs, better align incentives, and reduce overall waste. To better mainstream wastewater reuse not only as a financially viable alternative to conventional approaches, but also as an approach that more efficiently utilizes resources with less waste, LAC countries should:

- **Integrate Resource-recovery Models in all Levels of Planning.** The importance of recovering resources in elements traditionally deemed "waste," such as wastewater, needs to take much greater priority in all levels of government planning. In many countries national objectives, public policies plans and programs around wastewater treatment are inadequately developed or articulated. All too often, there is a lack of knowledge among politicians and other government representatives around wastewater treatment in general, particularly with respect to international commitments such as SDG6. There are currently very few policies, criteria or government programs for reuse in LAC. A greater political awareness and prioritization of

wastewater treatment in general, including the associated costs with meeting SDG6, could help foster a greater focus on innovative and potentially more cost-effective models such as reuse and resource recovery.

- **Strengthen Institutions and Improve Fragmented Institutional Relationships:** Currently, there is often a divide between the entities responsible for different elements along the water and wastewater service chain. For example, wastewater treatment plant management may be separated from the entities responsible for the original sourcing and treatment of water, and are almost always somewhat removed from agricultural, industrial and household end-users of water resources. This divide inhibits a holistic view of the entire water-wastewater circle, and greater coordination between consumers and all agencies responsible for water and wastewater treatment would facilitate planning around circular economies.

- **Establish Consistent and Appropriate Legislative Framework:** Often in LAC, legislative frameworks are more designed towards linear WASH models; if legislative frameworks could be improved to support and encourage the growth of wastewater reuse and circular models, across all sectors, the expansion of circular-economic models would be greatly facilitated.

- **Better Define Context-specific and Relevant Water Quality and Treated Wastewater Effluent Parameters:** While water quality and effluent parameters should always be in place to protect health and ensure environmental standards, all too often these parameters are incorrectly applied universally or improperly imported from other countries. Adapting these parameters to the specific use of water or reclaimed wastewater (whether effluent for discharge in the environment, re-use in agriculture/industry, or standards necessary for direct consumption) would support the growth of a variety of wastewater uses.

- **Enforce Water Quality and Effluent Standards:** Accompanying any refinement of water quality and wastewater treatment effluent parameters should also be increased enforcement of those standards. In much of LAC, there are unnecessarily strict regulations on certain water uses, but they often aren't enforced properly. This lack of enforcement can lead to skepticism and mistrust around effluent or water safety among end-users, and greater enforcement of regulations could help alleviate some of the reservations most people have currently to wastewater reuse. To be effective, this enforcement should be consistent, transparent, objective and applied universally to all water and wastewater system operators.

- **Promote Technological Innovation:** Generally, the chief barrier to wastewater reuse is not technological, in large part the technology already exists. However, more enabling frameworks can be put into place to support increased research and development around technologies focused on wastewater reuse.

- **Foster Financial Innovation:** The majority of financial models that currently sustain wastewater treatment plants are designed around a linear economy, with many of them run under some form of a public-private partnership (PPP). Given the potential financial incentives surrounding resource recovery, more efforts should be made to leverage these PPPs and the potential they have for advancing sustainable circular economy models around wastewater reuse. Current financial mechanisms are insufficient to cope with the investment gap, and overall, there is generally a significant shortage of technically, financially and socially feasible investment projects involving wastewater treatment. More research and documentation of successful financial models supporting circular economies will facilitate increased investment and financial resources available for innovative wastewater reuse models.

- **Establish Appropriate Tariffs:** All too often, non-existent or unrealistic wastewater treatment tariff frameworks (often unable to even adequately cover operation and maintenance expenses) create a vicious cycle of poor service, resulting in users no longer wanting to pay for diminishing service quality, resulting in even poorer service and lack of resources for wastewater treatment improvement. Tariffs and costs should be clearly understood and transparent from the beginning so that appropriate tariff models can be developed.

Conventional financing around linear models for wastewater treatment will not be close to adequate to meet Target 6.3 by 2030; to better manage diminishing water resources and capture resources within wastewater, now is the time for a revolution in thinking across the region. This revolution should focus on circular economies, wastewater reuse, resource recovery, and creative models for piloting and financing this essential shift in perspective.

Chapter Four: A Revolution in Water Resources: The Circular Economy of Water in the Industrial Sector

Viewing wastewater treatment in the context of a circular economy has implications not only for recovering nutrients and other resources within wastewater, but also for supplementing water resources themselves. Given that water resources are finite, linear economic models around water resources can lead to environmental degradation, translating into significant economic costs that could be on the order of 4% of GDP in LAC countries. [24] As economies and populations grow, competition among households, communities, industry, agriculture and/or the energy sectors for water resources will also grow. [25] To meet this increased demand, it is estimated that the LAC region will have to obtain and distribute at least: 30% more water than is currently being distributed for human consumption, 40% more energy, and increase the food supply by 50% [26]. Water scarcity is already a heightened risk for much of the region, and given this estimated 30% increase in demand for water resources, the LAC region will need to identify new sources and minimize competition among users, and now is the time to begin considering alternative methods for supplementing existing water resources and increased water-use efficiency.

Table 1: Dimensions of Corporate Water Risk; Table courtesy of: (Sarni, 2017)

	Category		
Risk	Supply Chain	Operations	Product Use
Physical	Water scarcity drives up input prices (~2%-20%)	Increased capital expenditure on water treatment, extraction or alternative technologies raises costs	Non-availability or scarcity of water required for using product or service limits growth
Regulatory	Suspension or withdrawal of supplier's water license or discharge permits disrupts supply chain	Reallocation to more urgent needs during drought disrupts operations	Restrictions on use of particular products or services due to water intensity raises costs or checks growth
Reputational	Responsibility "by association" for suppliers' water pollution damages brand or reputation, hinders growth	Competition with household demands, or pollution incidents, damages brand or reputation, hinders growth	Public outcry regarding water intensity of product damages brand, reputation, hinders growth

All of the above translates into a **financial impact:**

- Lost revenue
- Higher costs from: supply chain, changes in production, capital expenditure, regulatory compliance, increasing price of consuming or discharging water, delayed or suppressed growth, and potential higher cost of capital, among other associated cost increases.

In addition to governments and the public sector, one key driver for moving this revolution forward should come from the industrial sector. For many industries, water scarcity issues can drive up input costs anywhere between 2-20% (Please see Table 1). [27] In LAC, industries consume more than 10% of all available water resources. For almost all private companies, water represents a key productive input (see Box 5), which is why the private and industrial sectors are increasingly financing water efficiency and circular economy programs to guarantee their water availability in the long run.

Increased investment in water extraction, treatment and/or other alternative technologies can raise overall costs and can limit overall growth. Additionally, brands can be damaged if they are viewed as poor stewards of water resources, especially if their utilization involves pollution or increased competition with households or other users of increasingly scarce water resources. To mitigate some of the risks associated with increasing water scarcity, industry should:

- Incorporate *water* risk specifically into traditional corporate risk management strategies;
- Quantify the "true" value of water to a particular business or industry;
- Understand the energy-water nexus and its potential business implications, and set targets across the value chain;
- Increase focus on engagement and innovation;
- Make a public commitment to water stewardship;
- Practice "radical transparency" about water and seek opportunities to collaborate.

Some of the potential benefits to industry from an increased focus on water-use efficiency and circular economy models in the water sector include:

- Lower operation and maintenance costs
- Resource recovery
- Reduced energy costs
- Reduced water cost to consumer
- Increased economic opportunities from preservation of natural capital
- Potential brand recognition if viewed as responsible environmental stewards.

Even with these benefits, the new revolution around circular economies in the industrial sector is not without its challenges. Moving forward, in order for circular economics to gain greater traction in the WASH sector, much work will need to be done to dispel certain aversions and perceptions around wastewater; optimize models so that a sound return on investment can be demonstrated and replicated; accurately measure benefits; improve coordination among different sectors and stakeholders so that industries are not operating in isolation; continue development of new infrastructure; and, improve public policy so that circular economies are not only mainstreamed, but incentivized and encouraged over other conventional models that focus solely on more wasteful linear economies and conventional models.

The circular economy revolution will not come easy, but with key industries taking the lead, ideally accompanied by an enabling environment that encourages innovation, conservation, and resource recovery, the LAC region will not only be on their way to achieving Target 6.3 by 2030, but can serve as an example to other regions interested in integrating more circular economy models around WASH-related services and resources.

Box 5: A New Industrial Revolution: Circular Economies around Water in Industry

Almost all industries in one form or another depend on water, some more directly than others. Two sectors that would be non-existent without sufficient access to water include the beverage and cement manufacturing sectors. Heineken, a global brewer with over 75,000 employees across 70 countries, is one of the key leaders in applying circular economies to the beer and beverage sectors. For example: at their plant in The Netherlands, 6% of their energy is generated from sewage sludge in wastewater. In the LAC region, at four of their production plants in Mexico (a water-stressed area), source water vulnerability assessments and protection plans have been completed. Between 2014 and 2016, through rainwater harvesting, wastewater treatment plants, process optimization and water reclamation, Heineken has reduced their water consumption from 3.43 hl/hl to 2.83 hl/hl, with a goal of reaching 2.5 hl/hl by 2020.

In the cement manufacturing sector, Argos, a Colombian firm active throughout the region, has implemented plans with objectives of significantly reducing their water consumption by 2025. Some steps they are taking in Colombia include: improved measurement and monitoring of water resources, more efficient response to leakages, improved efficiency in pumping systems, and overall increased water resource education. Moreover, Argos has done much work understanding the true costs of water to their business, better incentivizing not only reduced wasting of water resources, but overall research to incorporate circular water economic models to their business practices.

With respect to the construction of new wastewater treatment plants that focus primarily on reuse, Suez, a French multi-national corporation active in numerous sectors, has been at the forefront of innovative wastewater treatment models in Mexico. With experience building and managing hundreds of water and wastewater plants serving millions of customers over the past 40 years, of particular interest is Suez's experience in San Luis Potosí, Mexico, with the Tenorio treatment plant that they have built and managed for the last 20 years. The Tenorio plant is novel in that it recycles 100% of its water, with 43% of this going to the industrial sector, and 57% going to the agricultural sector for irrigation. This water recycling rate is particularly important given the aridity of the San Luis Potosí region, and is an excellent example and model of how to leverage circular economies and innovative wastewater treatment processes focused on reuse to both secure water supply for the population while also supporting the development of agriculture and industry--a challenging but important balance to achieve.

Not only do these initiatives save water and reduce costs for these businesses and the industrial sector, they also can help to increase awareness and brand value given the emphasis on water stewardship and care towards a resource that everyone depends on. These companies are at the forefront of a new industrial revolution around water stewardship across the region; it is time for other industries to either follow their lead, or prepare for increased costs in the future associated with greater water scarcity.

(Builes, 2017) (Vosmeer, 2017), and (Achard, 2017)

Conclusions and Recommendations: How to Start a Sanitation Revolution

To effectively and efficiently achieve SDG6 Targets 6.2 and 6.3 in LAC by 2030, nothing short of a revolution in thinking around sanitation and wastewater treatment will be needed. This revolution will involve all stakeholders, from households, to governments, to industry and the private sector, among others. The LAC region was successful with respect to the MDGs, but now that the focus has shifted towards understanding sanitation as a full service delivery chain, from waste containment all the way to treatment and eventual reuse, the challenge is more complex and greater in scope; and business-as-usual practices will be nowhere near enough to meet this challenge by 2030.

This paper has discussed five key challenges and focus areas that the LAC region must adequately consider and act on to achieve Targets 6.2 and 6.3: (1) Halving the proportion of untreated wastewater; (2) Sewer connectivity; (3) FSM services; (4) Wastewater reuse; and (5), Circular Economies in the industrial and WASH sectors. These areas should not be the only focus, and there are certainly other sectors and ideas worth exploring and a variety of methodologies, strategies, resources and tools will be needed to achieve the scope and ambition of all the targets under SDG6. However, they represent key challenges and strategic focus areas for launching and implementing the sanitation and wastewater treatment revolution the LAC region needs over the next 12 years.

While each area has its own specific needs, there are general, overarching recommendations that are applicable to all areas and essential for efficiently and effectively meeting SDG6:

- **Mainstream Non-Conventional Approaches:** Although the paradigm shift will take some time, more steps should be taken to institutionally acknowledge, at the government level, that business as usual and conventional approaches will not be sufficient, and more innovative experimentation needs to be encouraged. Adapting a regulatory framework to allow for and foster more non-conventional approaches will support the necessary creativity and experimentation needed to better establish circular economy models in the WASH sector, improved FSM services including wastewater treatment, and increased sewer connectivity rates. Going further, when evaluating newly proposed WASH infrastructure projects, whether from the public, private and/or aid sectors, proposals should as a default first consider less wasteful circular economy approaches, with justification rooted in environmental impact analysis being required in cases where conventional approaches should be implemented instead in certain areas. Any situation where WASH services can be provided in a more equitable, cost-efficient and environmentally friendly manner, they should be incentivized and encouraged to do so.

- **Change the Water and Wastewater Organizational Culture:** Managers at water and wastewater utilities should be encouraged to be open to alternative technologies such as condominial sewerage, which can address some financial challenges given that the cost per connection is lower than large-scale sewerage networks. Where sewerage networks are present and expansions are planned, more emphasis should be placed on extending services to informal areas. Overall, a general change in organizational culture, especially among those managing and running utilities, is needed so that innovation and more effective practices can be prioritized and implemented.

- **Establish Innovative Financial Models:** Given the risk inherent with experimentation, it is understandable that traditional financial markets are reluctant to invest in non-conventional approaches, creating a cycle that continues to prioritize conventional approaches that while appropriate in many areas, will not be sufficient to meet SDG6 Targets 6.2 and 6.3. Governments and/or the aid sector could help establish mechanisms for mitigating the financial risk inherent to investing in innovative approaches so that eventually non-conventional approaches become more mainstreamed, proven, and attractive to traditional sources of finance.

- **Increase Overall Investment:** However, simply investing at current levels in non-conventional approaches will not be sufficient; overall regional and country-level prioritization of, and investment in, the sanitation sector needs to increase significantly if SDG6 targets are to be met. Investment needs over the next 12 years to meet SDG6 are on the order of at least US$ 160 Billion in LAC; it will not be enough to simply spend more, or to solely identify innovative lower-cost options—a reality check is necessary around the needed overall increase in investment. Much of this investment could be leveraged further from households, industry and other end-users by establishing a realistic understanding around the true costs of setting up and sustaining WASH services. However, more effort also needs to be carried out in many areas (e.g. connecting households to sewer networks) to provide viable alternatives for customers that struggle with financial and liquidity constraints. Overall, decision-makers need to be open to mainstreaming non-conventional approaches, establishing innovative financial models, and increasing overall investment and prioritization of the sanitation sector.

It is now 2018, with just 12 years to go, it is time to accelerate planning and investment allocation towards the new wastewater revolution. Simply channeling more investment towards conventional approaches will not be sufficient; the region needs to establish policies that encourage increased wastewater treatment, circular economies, higher connection rates and improved FSM services, among other challenges. With the business as usual focus, and with growing populations and increasing climate change effects, challenges will only grow more complex and the revolution will falter before it even gains traction. Now is the time to act—¡Que viva la revolución!

Annex 1: Sustainable Development Goal 6, Associated Targets and Indicators

SUSTAINABLE DEVELOPMENT GOAL 6: Ensure availability and sustainable management of water and sanitation for all

Target	Indicator
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	**6.1.1** Proportion of population using safely managed drinking water services
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	**6.2.1** Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	**6.3.1** Proportion of wastewater safely treated
	6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	**6.4.1** Change in water-use efficiency over time
	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	**6.5.1** Degree of integrated water resources management implementation (0-100)
	6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2030, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	**6.6.1** Change in the extent of water-related ecosystems over time
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	**6.a.1** Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan

Target	Indicator
6.b Support and strengthen the participation of local communities in improving water and sanitation management	**6.b.1** Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

Taken from: https://unstats.un.org/sdgs/indicators/indicators-list/

Annex 2: LAC WASH sessions convened by IDB during Stockholm World Water Week 2017

Session	Description
Session 1: Halving the proportion of untreated wastewater by 2030	From 1990 to 2014, more than 200 million people gained access to sanitation in LAC. However, more than 106 million still lack access to this basic service. The challenge for the region now is to commit to and pursue the new sector Sustainable Development Goal. Wastewater treatment is central to it. Target 6.3 seeks to (by 2030) halve the proportion of untreated wastewater and substantially increase recycling and safe reuse. In LAC, it is estimated that only 28% of collected wastewater is adequately treated before being discharged into the environment. In some LAC countries, up to 75% of the households, and across the region roughly half of all households are not connected to a sewer network. These numbers imply that significant infrastructure investments are needed to meet this target and mitigate the challenges associated with inadequate treatment and/or unsafe wastewater disposal. It is time to discuss how LAC will effectively implement this target. This event will address questions such as: What are the major challenges the region faces for achieving target 6.3? What are the existing strategies already addressing it? What governance structures and financial instruments are needed to achieve it?
Session 2: What is new on wastewater reuse financing in LAC?	Global Water Intelligence estimated that between 2013 and 2020 capital expenditures on wastewater treatment in Latin America and the Caribbean (LAC) would increase from two to three billion dollars. Most of the large and medium size cities are already investing heavily on wastewater facilities. However, there is consensus that results are not as satisfactory as expected when measured by the percentage of wastewater effectively treated. Moreover, wastewater reuse is still at its very early stage, and the adoption of waste-to-resource approaches is further behind. To advance a circular economy agenda in the region it is essential to identify the barriers that are obstructing wastewater reuse. This event will present innovative cases of wastewater reuse projects and financing in LAC, focusing on the instruments and incentives used to address these barriers all across the investment cycle (from river basin planning to engineering, normative/regulatory, procurement, construction and operational issues). By identifying these innovative cases, the session will provoke a lively discussion (based on short presentations of the most representative reuse projects) on the status of wastewater development in LAC and the potential for a circular economy agenda around wastewater reuse.
Session 3: Before & After the Toilet: Sewer Connectivity and Fecal Sludge Management	Latin American countries have agreed to work towards adequate sanitation by 2030. This goal will not be achieved if people do not connect to the sewer network and fecal sludge is not properly managed. Access to adequate sanitation does not only mean constructing networks and toilets. It must be understood as an entire service delivery chain. Many sector agencies and utilities are investing in expanding sewerage to later find out that only 30-40% actually connects to the network they built. This low connectivity carries technical and financial problems that make sanitation infrastructure unsustainable. Policy makers have very few instruments at hand. At the same time, a high percentage of Latin Americas rely on on-site sanitation solutions,

Session	Description
	but very rarely, unless treated on-site through an ecological toilet or otherwise, fecal sludge is properly managed. There is no circular economy if these two issues (connectivity and fecal sludge management) are not properly addressed. This event will thus focus on: i) identifying strategies to promote connectivity to the sewer network through information and economic incentives; ii) finding solutions to the FSM challenges the region faces; and iii) showcasing good examples/practices on how the public and private sector are overcoming these problems.
Session 4: Green Infrastructure and the Circular Economy of Water	Nature-based solutions (green infrastructure) can play a significant role in addressing some of the water management challenges cities face. Improved land management practices, for example, can reduce sediments and help maintain water quality levels. Reservoirs, parks and forests inside cities can help them cope with storm-water runoff and extreme weather events such as floods and droughts. It has been proven that nature can provide cost effective complementary solutions to grey infrastructure. It can help reduce capital and operational expenditures and generate other benefits such as increased health, quality of life, or biodiversity. Incorporating nature-based solutions should be part of a comprehensive approach to managing the full water cycle, from source to discharge and reuse. Adopting this approach requires the participation of public and private stakeholders. Governments have the responsibility of internalizing new approaches into policies and creating the framework to incentivize participation from other actors. Private companies can play a role by adopting and promoting innovative green solutions among peers. Under this framework, the seminar will present cases from the Latin America region on the use of nature-based solutions by public and private stakeholders to address water-waste challenges and move towards a more comprehensive water cycle approach

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1 Please see http://www.worldwaterweek.org/wp-content/uploads/2016/12/2017-Call-for-engagement-web.pdf for further details on 2017 WWW.

2 Target 6.2 of SDG6 is to "by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations"; Target 6.3 under SDG6 is to "by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally." Please see Annex 1 for the complete list of targets under SDG6; indicator 6.3.1 (under Target 6.3) is focused specifically on the proportion of wastewater that is safely treated and is discussed in Chapter 1 of this document.

3 Please see Annex 2 for the original published abstracts for each session.

4 For further discussion surrounding the shift between the MDGs and SDG6, please see the 2016 WWW policy paper (Sparkman & Sturzenegger, 2017), available here: https://publications.iadb.org/handle/11319/8486

5 The JMP is a program funded "jointly" between UNICEF and the World Health Organization (WHO), chiefly responsible for tracking global, regional and country-level progress towards WASH-related sub-targets under SDG6, and also previously responsible for tracking WASH indicators under the MDGs. For more details on the JMP 2017 baseline assessment, including specific parameters and methodology, as well as definitions of terms such as "safely managed," please see: (Joint Monitoring Programme (UNICEF/WHO), 2017)

6 These estimates are conservative figures based on average costs of service implementation and management consistent to the LAC region, and are only focused on Targets 6.1 and 6.2. Achieving the other targets under SDG6 will almost certainly require a greater degree of investment. Please see (Hutton & Varughese, 2016) for further information.

7 Ibid.

8 Ibid, also please see (Ducci, J, et al, 2015), and (Garzón & Sturzenegger, 2016) for further discussion of investment needs across the region.

9 Wastewater is generally defined to be a combination of one or more of:

- Domestic effluent consisting of blackwater (excreta, urine and fecal sludge) and greywater (kitchen and bathing wastewater);
- Water from commercial establishments and institutions, including hospitals;
- Industrial effluent, storm water and other urban run-off;
- Agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter.

Definitions taken from: (Corcoran, Nellemann, Baker, Bos, Osborn, & Savelli, 2010)

10 Please see https://unstats.un.org/sdgs/indicators/indicators-list/ for a complete list of all SDG indicators. While the JMP is the chief agency responsible for tracking global progress towards Targets 6.1 and 6.2, UN-Habitat, UNEP (United Nations Environment Program) and the UNSD (United Nations Statistics Division) are also involved with tracking progress towards indicators under Target 6.3.

11 (Joint Monitoring Programme (WHO/UNICEF), 2017)

12 Please see (Sturzenegger G. , 2017) for further information.

13 (Hutton & Varughese, 2016)

14 Many of the conclusions and recommendations from this section have been taken from (Nolasco, 2017), in addition to other key points raised during this specific session.

15 There are thousands of wastewater treatment plants (Brazil and Mexico alone have at least 2500), all operating at different (and sometimes unknown) levels of functionality; please see (Mestre, 2017) for further information.

16 Majority of these recommendations come from (Nolasco, 2017) and (del Rio Marrero, 2017).

17 In many LAC countries, sanitation and wastewater treatment-related regulations have often been understood as a tool to control private sector participation. However, sanitation infrastructure development and O&M have in many instances been shown to be largely unrelated to the type of ownership, and regulations leading to transparent accountability structures can be applied to public operators as well. Overall, government should set appropriate process regulations and guidelines, and they should be applied equally to public, private, or entities operating under a PPP arrangement.

18 See (del Rio Marrero, 2017) for additional discussion around services, as well as other key recommendations.

19 For example, in Buenos Aires, Argentina, 51% of the population is not connected to sewer networks; in Guayaquil, Ecuador, 50% of the population is not connected. Unless otherwise mentioned, information and figures presented in this paragraph come from: (Sturzenegger G. , 2017)

20 Much of the information that follows, unless otherwise mentioned, is taken from (Kramer, 2017) and related to SOIL's CBS work in Haiti (See Box 4). X-Runner in Lima, Peru, is another example of a CBS model that is showing promise in the LAC region.

21 Wastewater that is "reclaimed" post-treatment can be referred to as recycled, regenerated and/or reclaimed water; this paper will use the term "recycled water" to refer to any wastewater reclaimed post-treatment, however please note that the term is synonymous with other aforementioned terms. (Ibid.)

22 More than 95% of water currently provided to households is utilized for non-drinking activities such as toilet flushing or food preparation. (Ibid.)

23 Data in this paragraph and recommendations that follow are generally summarized from: (Mestre, 2017)

24 (Martin-Hurtado & Nolasco, 2016)

25 It is estimated that the 140 cities in LAC currently with more than 2 million residents will double their populations in the next 20 years, representing an even more significant growth than larger population centers (i.e. currently greater than 5 million residents), which will only account for 15% of the overall urban growth predicted across the region. (Garzón & Sturzenegger, 2016)

26 Ibid.

27 Unless otherwise mentioned, figures and information presented in this paragraph are from: (Sarni, 2017)

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IDB Inter-American Development Bank

FUNDACIÓN FEMSA

Water Center for Latin America & the Caribbean

The Nature Conservancy

CAF DEVELOPMENT BANK OF LATIN AMERICA

CONAGUA COMISIÓN NACIONAL DEL AGUA

spanish cooperation

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