



MILLENNIUM CHALLENGE CORPORATION
PRINCIPLES INTO PRACTICE

LESSONS FROM EVALUATIONS OF MCC WATER, SANITATION, AND HYGIENE (WASH) PROGRAMS

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PRINCIPLES INTO PRACTICE

The Millennium Challenge Corporation's mandate is to reduce poverty through economic growth. MCC works with a select number of developing countries that demonstrate a commitment to good governance and sound economic and social policies where the opportunity for economic growth and poverty reduction is greatest. MCC's model reflects a set of principles that the United States—and many other donors and advocates—agree are required for development assistance to work well: country ownership, an evidence-based approach, focus on results, and transparency.

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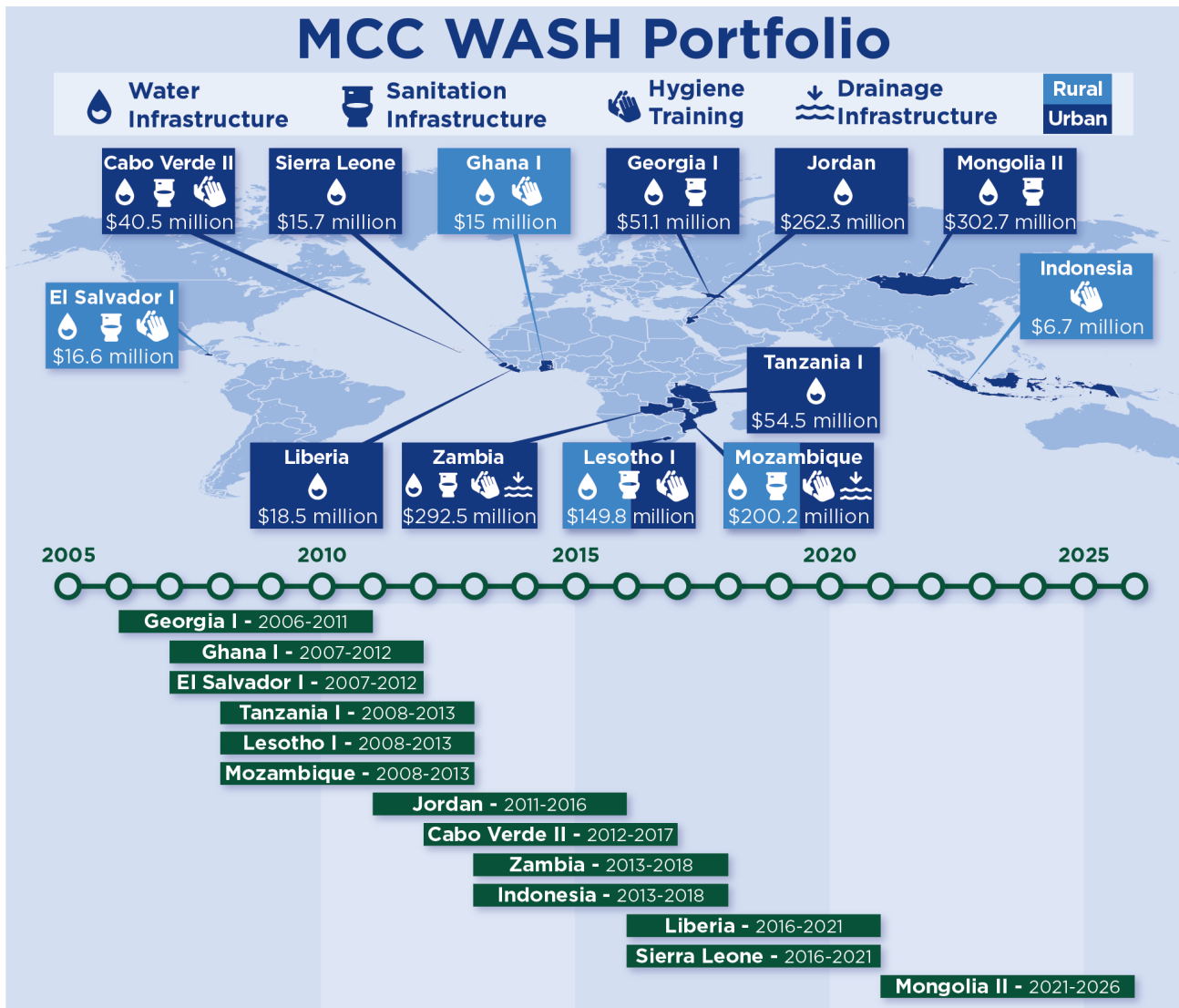
About the cover: The Cabo Verde II Compact Fundo De Acesso Social provided Victoria Furtado with water inside of her home.
Photo by: Kyle LaFerriere

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INTRODUCTION

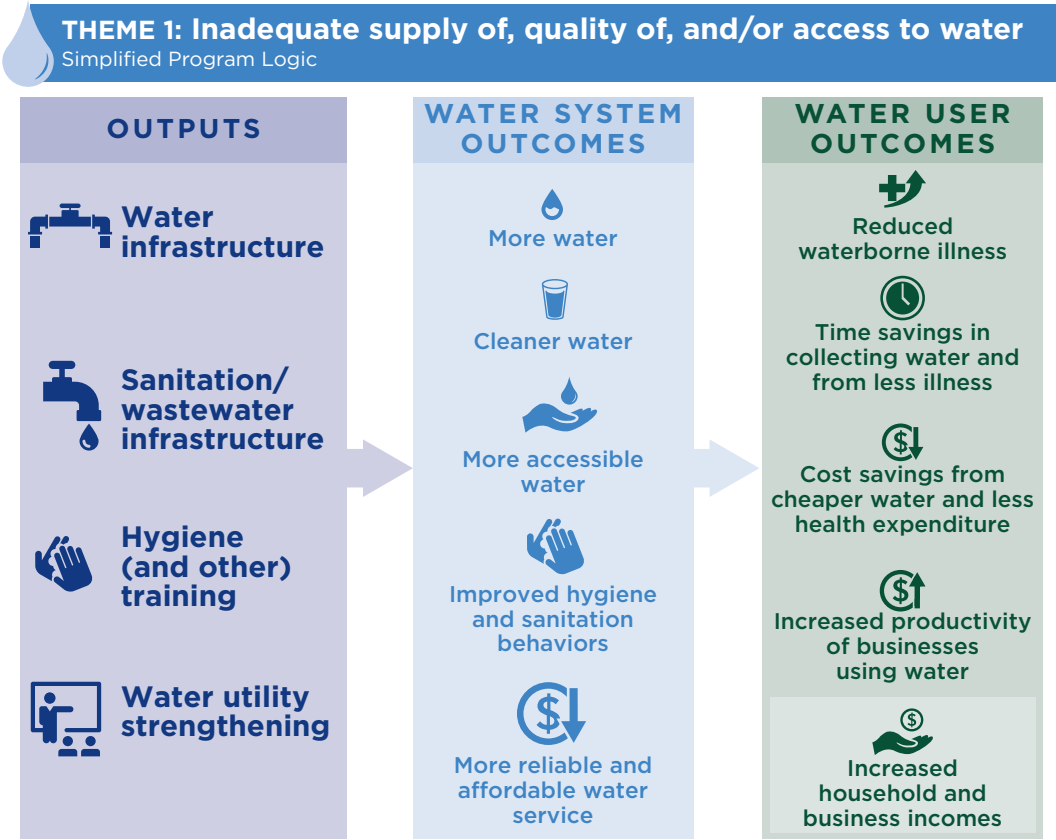
The Millennium Challenge Corporation (MCC) has invested approximately \$1.4 billion in water, sanitation, and hygiene (WASH) programs since the agency was founded in 2004.¹ As summarized below, past investments spanned 13 countries and successfully constructed water supply systems, water treatment plants, water distribution networks, and wastewater collection and treatment systems. In addition to critical infrastructure investments, these programs also funded policy and institutional reforms such as community awareness and training and capacity building for water utilities. There are ongoing or planned WASH investments in another three countries.



¹ This total reflects MCC's expenditures and commitments in WASH as of May 2021, a small portion of which is not referenced in this paper. WASH (or WaSH) is an acronym that stands for "water, sanitation, and hygiene." Several international development agencies assert that attention to WASH can also improve health, life expectancy, student learning, gender equality, and other important issues of global development. For the purpose of this publication, WASH encompasses all of the investments that MCC has undertaken in water supply, sanitation, and drainage, regardless of the intended program outcomes.

In the early years of program development, WASH programs proposed by the agency’s partner countries were largely guided by the Millennium Development Goals, which targeted increased access to improved water sources in rural areas and increased water system supply and access to the network in urban areas. With the introduction of the Constraints Analysis in 2009 as a standard diagnostic tool to guide MCC funding, proposed programs shifted to an urban focus, where investments in water supply infrastructure (not necessarily network access) had the potential for higher economic impact than in rural areas.² Looking at the portfolio as a whole, MCC’s WASH interventions resulted from one, or a combination, of three themes, which are enumerated below. A simplified program logic summarizing typical outputs and potential outcomes is provided for each theme; these outcomes also reflect the universe of potential economic benefits that MCC currently models in its WASH cost-benefit analysis.³ The likelihood of achieving these outcomes depends on the intervention’s outputs, the country context, and the alignment between the problem and solution.

TYPICAL WASH-RELATED THEMES⁴:

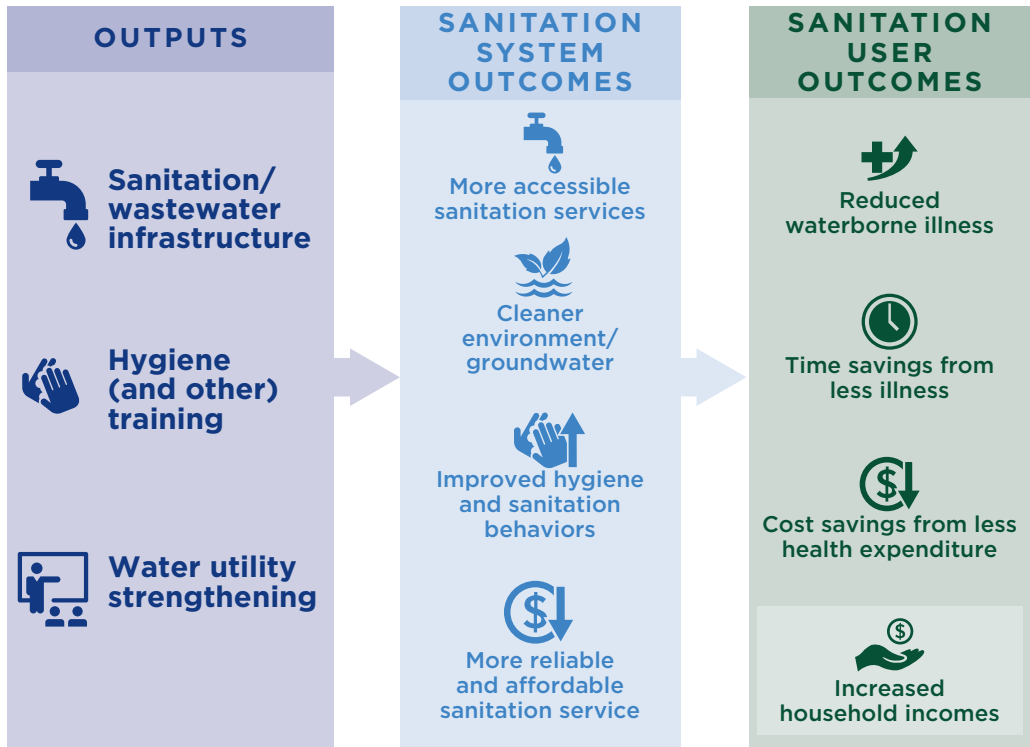


2 The Constraints Analysis is the first stage of MCC’s compact or threshold program development process. A selected partner country begins the process with a thorough analysis of its economy aimed at identifying the most serious impediments to economic growth through their impact on private investment and entrepreneurship. Mozambique was the first of MCC’s WASH programs to be motivated by a constraints analysis and all subsequent programs (Jordan through Mongolia II) were as well.

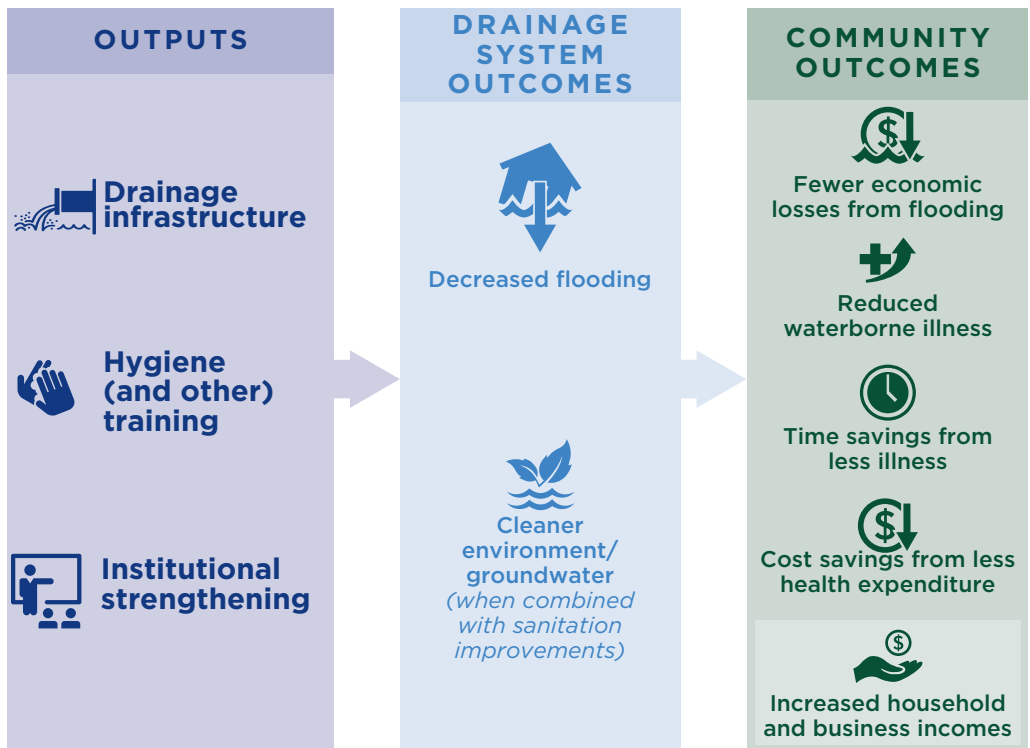
3 MCC’s M&E Policy defines an output as “The direct result of a Project Activity. The goods or services produced by the implementation of an Activity.” It defines an outcome as “The likely or achieved intermediate effects of an intervention’s outputs.”

4 To determine which theme each MCC program focused on, refer to the MCC WASH Portfolio infographic above. Each theme corresponds to one of the activity area icons, i.e., theme 1 relates to water infrastructure, 2 to sanitation infrastructure, and 3 to drainage infrastructure. Training in hygiene practices and/or other related topics tends to be a complementary investment.

THEME 2: Inadequate access to sanitation
 Simplified Program Logic



THEME 3: Excessive economic losses caused by flooding
 Simplified Program Logic



INDEPENDENT EVALUATION RESULTS

This paper reflects on what MCC has learned from its experience over the last 15 years in designing, implementing, and evaluating WASH programs. Independent evaluations constitute a significant source of learning because they objectively measure and assess the achievement of targeted outcomes for each program in which MCC invests. The evaluations focus on validating the theory of change or program logic elaborated in the *Compact* or *Threshold* Program and related monitoring and evaluation (M&E) plan, which documents the results explicitly targeted by the program as well as benefit streams modeled in the cost-benefit analysis that supported the investment decision. There is not always perfect alignment between the program’s stated objective(s) and the results assessed and reported by the evaluations. This misalignment may be the result of program design changes, measurement prioritization decisions, or measurement challenges.

To date, 12 final evaluation reports and six interim evaluation reports for ongoing evaluations in the WASH sector have been published.⁵ The WASH evaluations measure results between 6 months and 6 years after target beneficiaries’ exposure to the WASH interventions. The following section summarizes the findings of 17 evaluations that reflect the most current set of results for each program, along with a brief description of the program interventions and objective(s) targeted and evaluated.⁶ Evaluations are presented chronologically in order of the evaluated program’s implementation timeline.



GEORGIA I | **Regional Infrastructure Rehabilitation Project**
 Regional Infrastructure Development Activity
 Water and Sanitation Sub-Activity **URBAN**

5 Municipalities granted funding for water supply and wastewater collection projects

The Georgia I Compact’s Regional Infrastructure Development Activity aimed to *make grants to national and sub-national government units and municipal utilities to achieve the broader project objective of rehabilitating key regional infrastructure*. The planned impact evaluation had to be canceled due to changes in the program and methodological challenges in the evaluation, and, as such, there are no evaluation results. After this cancellation, MCC commissioned an independent cost-benefit analysis, which resulted in an estimated economic rate of return (ERR) of between 0.7 and 2.5 percent for the program (versus the original MCC estimate of 11.6 percent). This range falls below MCC’s investment threshold of 10 percent.⁷

⁵ Evaluations of eight of the 13 completed WASH programs have concluded, while Cabo Verde II, Liberia, Sierra Leone, and Zambia evaluations are ongoing; the evaluation for Mongolia II has not begun. Depending on the program logic, there may be more than one evaluation for a given program. While the Indonesia Community-Based Health and Nutrition Project included a hygiene and sanitation component, the evaluation results are not presented here because WASH was just one of many health-focused interventions.

⁶ The italicized text in the evaluation summaries reflects either the official Project Objective or a description of the aims of the Activity or Sub-Activity.

⁷ Readers may be familiar with cost-benefit analysis, which compares the benefits expected from an investment to its cost. The economic rate of return (ERR) is a summary statistic produced in the analysis, which reflects the potential economic benefits of a proposed investment. A project is considered a sensible economic investment when the estimated ERR is higher than the local discount rate for capital. In most developing countries, one would expect that discount rate to be near or above 10 percent and this is the hurdle rate that MCC applies when considering investments.

| | | | | |
|--|---|---|--|---|
| <p>EL SALVADOR I Human Development Project Water and Sanitation Sub-Activity RURAL</p> | <p> 45 water and sanitation systems constructed</p> | <p> 15 community taps constructed</p> | <p> 7,634 household taps constructed</p> | <p> Community education campaign provided</p> |
|--|---|---|--|---|

The El Salvador I Compact’s Water and Sanitation Sub-Activity aimed to increase coverage of water supply and sanitation facilities in order to achieve the objective of increasing human and physical capital of residents of the Northern Zone to take advantage of employment and business opportunities. The impact evaluation confirmed that access to water and improved sanitation had improved and that time spent collecting water decreased by approximately 26 minutes per day per household, relative to the comparison group. However, there was no overall increase in water consumption and no evidence of increased time spent on income-earning activities. Similarly, there was no evidence of impact on school enrollment or attendance, nor on the diarrhea rate among children under age five. Finally, the evaluation found no impact on household income.

| | |
|--|---|
| <p>GHANA I Rural Development Project Water and Sanitation Sub-Activity RURAL</p> | <p> 392 water points constructed or rehabilitated</p> |
|--|---|

The Ghana I Compact’s Water and Sanitation Sub-Activity aimed to *reduce the distance to water and sanitation facilities and reduce the incidence of guinea worm, diarrhea, or bilharzia*. This sub-activity supported the broader project objective to *strengthen the rural institutions that provide services complementary to, and supportive of, agricultural and agri-business development*. The impact *evaluation* confirmed that time spent collecting water decreased by 13 minutes per day per household, relative to the comparison group, and that water quality from the improved water sources was better than surface water. However, the program did not significantly increase water consumption or affect the price paid for water. The evaluation was not able to detect if the hygiene and sanitation training had an effect on handwashing. While there was a reduction in diarrhea in children under five, it could not be attributed to the program. Finally, the evaluation found no impact on household income.

| | |
|--|---|
| <p>TANZANIA Water Sector Project Lower Ruvu Plant Expansion & Morogoro Water Supply Activities URBAN</p> | <p> 2 treatment plants upgraded 1 new treatment plant constructed Increased production capacity by 100 million liters of water per day</p> |
|--|---|

The Tanzania Compact’s Water Sector Project objective was to *increase investment in human and physical capital and reduce the prevalence of water-related disease*. The impact *evaluation* of the Morogoro Water Supply Activity found that while the quantity and quality of water supplied to the water network increased, continuity of service to customers decreased due to utility rationing to provide more equitable service across the growing customer base that was independent of the program. Since intermittency in water supply persisted for customers, the evaluators concluded that effects on investment in physical and human capital and water related diseases were unlikely to have been achieved during the study period. The evaluation was unable to assess impacts on household income.

The impact *evaluation* of the Lower Ruvu Plant Expansion Activity concluded that access to piped water had increased in Dar es Salaam, at least in part due to the program. Households that had newly connected to the piped water network consumed more water than unconnected households and saved one-and-a half hours per week in time spent collecting water. The evaluation did not find definitive evidence of a reduction in diarrhea or an increase in household income as a result of the program.

MOZAMBIQUE | **Water and Sanitation Project**
Rural Water Supply Activity **RURAL**



615 boreholes constructed



8,400 people trained in hygiene and sanitary best practices

The Mozambique I Compact's Rural Water Supply Activity aimed to support the broader water project objective of *increasing the accessibility, reliability, and quality of water and sanitation services*. The impact *evaluation* confirmed that access to higher quality water had improved in program areas, relative to comparison areas, and that water consumption from safer water sources increased by 16.7 liters per capita per day. Water collectors reported time savings of 55 minutes per each 20 liters of water collected. Community-based training failed to impact sanitation and handwashing behavior. Finally, the evaluation found no impact on household income.

MOZAMBIQUE | **Water and Sanitation Project**
Urban Water Supply and Drainage and Sanitation Activities **URBAN**



Municipal water supply and drainage systems upgraded. Technical support for national reforms provided.

The Mozambique I Compact's Urban Water Supply and Drainage and Sanitation Activities aimed to support the broader water project objective of *increasing the accessibility, reliability, and quality of water and sanitation services*. The performance *evaluation* found that the water distribution investments in Nampula had contributed to increased water service hours, but broader benefits for customers were constrained by insufficient water supply. The dam construction in Nacala had not produced benefits because complementary investments in treatment and distribution that were not completed during the compact had not been continued by the government. Though there was a perceived reduction in flooding in the cities where drains were installed, this did not seem to have affected the prevalence of malaria. Finally, the remaining set of works in Mocuba could not be assessed by the evaluation because they were severely damaged in a flood after the compact ended.

LESOTHO | Water Sector Project
Rural Water Supply and Sanitation Activity **RURAL**

29,000
latrines constructed

175
water systems constructed

The Lesotho I Compact's Rural Water Supply and Sanitation Activity aimed to *support the broader water project objective to improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management*. The impact *evaluation* confirmed that access to improved water and improved toilets had increased relative to comparison areas. In addition, time spent collecting water had decreased by 44 minutes per day. However, no impacts were detected on water-related illness or household income.

LESOTHO | Water Sector Project
Urban and Peri-Urban Water Activity **URBAN**

Water treatment plant constructed, water supply and distribution infrastructure upgraded, and 2,312 households given provisions to connect to the water network

The Lesotho I Compact's Metolong Dam program and Urban and Peri-Urban Water Activity aimed to *support the broader water project objective to improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management*. In studying the investment in the Metolong Dam, the impact *evaluation* found no impact on water supply reliability relative to comparison groups and did not detect impacts on time savings, water collection, water consumption, diarrheal illness, or water expenditures. Related to the other works on the water network, the evaluation found that newly connected households experienced significant time savings, increased water consumption, and decreased water collection, relative to unconnected households. The choice to connect to the water system cannot be directly attributed to the program. The evaluation also found that water expenditures increased where the entire piped water network was new. There was no impact detected on diarrhea in children under the age of five.

JORDAN | Compact
Water Network Project
Wastewater Network Project
As-Samra Expansion Project **URBAN**

1,160 km of water network constructed

As-Samra water treatment plant expanded

Wastewater system extended to new customers

The Jordan Compact focused entirely on the water sector and its objective was *to increase the effective supply of water available to the inhabitants of Zarqa Governorate through improvements in the efficiency of water delivery, the extent of wastewater collection, and the capacity of wastewater treatment*. Three projects supported this objective. The objectives of the Water Network Project were *to (i) improve the efficiency of network water delivery and the condition of home water systems, and (ii) decrease certain costs that households in Zarqa Governorate incur to satisfy their subsistence water needs*. The objectives of the Wastewater Network Project were *to (i) increase access to the wastewater network, (ii) increase the volume of wastewater collected within Zarqa Governorate for treatment and reuse, and (iii) reduce the incidents of sewage overflow*. Finally, the objectives of the As-Samra Expansion Project were *to (i) increase the capacity to treat wastewater from Amman and Zarqa Governorates, (ii) increase the volume of treated wastewater that is available as a*

substitute for freshwater for non-domestic use, and (iii) protect existing agriculture from the potential consequences of pollution from untreated wastewater.

The impact *evaluation* confirmed that the program had successfully expanded Zarqa’s sewer network and thereby increased the volume of wastewater flowing to the As-Samra treatment plant and reducing the amount of freshwater that needed to be supplied to the Jordan Valley for agricultural purposes. This allowed for 3-5 million cubic meters per year of additional freshwater to be sent to urban areas. While there was some indication of an increase in water consumption among urban customers, they did not switch away from other sources to piped water. Regarding the objective of more efficient water delivery, the evaluation concluded that the compact had helped to improve the Zarqa water utility’s performance. However the reduction in non-revenue water lagged expectations.

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|---|--|--|--|
| <p>JORDAN Water Network Project Water Smart Homes Activity URBAN</p> |  3,958 HHs provided with water/wastewater infrastructure |  Communications campaign implemented |  30 women plumbers trained |
|---|--|--|--|

The Jordan Compact’s Water Smart Homes Activity supported the Water Network Project objective noted above, specifically *to improve the condition of home water systems and decrease certain costs that households in Zarqa Governorate incur to satisfy their subsistence water needs.* The performance *evaluation* did not detect an effect of the outreach campaign on household water handling or water sourcing. Households that had received household water infrastructure did not appear to use more piped water relative to non-targeted households and there was no evidence of changes in household water-related costs, productivity, health, or well-being. Finally, more than half of the women trained to become plumbers were still working in the profession after the compact and may have increased incomes as a result, though this could not be attributed to the program.

| | | |
|---|---|--|
| <p>CABO VERDE WASH Project National Policy and Institutional Reform Activity Utility Reform Activity Infrastructure Grant Activity URBAN</p> |  Technical assistance provided to support utility reform |  \$20M Grant funding provided to support municipal water works |
|---|---|--|

The Cabo Verde II Compact’s Water, Sanitation, and Hygiene Project objective was *to establish a financially sound, transparent, and accountable institutional basis for the delivery of water and sanitation services to Cabo Verdean households and firms by: (i) reforming national policy and regulatory institutions; (ii) transforming inefficient utilities into autonomous corporate entities operating on a commercial basis; and (iii) improving the quality and reach of infrastructure in the sector.* At the interim stage, the performance *evaluation* found that the national and institutional reform efforts had successfully consolidated the regulatory entities and passed critical reforms into law. A new water utility, Aguas de Santiago, had been created, though later than planned, and continued to require external technical assistance. The infrastructure grants and connection subsidies contributed to increased access to the piped water and sanitation networks, but they did not result in time savings for water users. The final evaluation is forthcoming.

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|--|--|---|--|
| <p>ZAMBIA Compact</p> <p>Lusaka Water Supply, Sanitation, and Drainage Project URBAN</p> |  <p>Portions of water infra. backbone in Lusaka rehabilitated</p> |  <p>Technical assistance provided</p> |  <p>Grant funding provided to support access to water, sanitation, and drainage service</p> |
|--|--|---|--|

The Zambia Compact focused entirely on the water sector with the following objectives: *to expand access to, and improve the reliability of, water supply and sanitation, and improve drainage services in select urban and peri-urban areas of the city of Lusaka in order to decrease the incidence of water-borne and water-related diseases, generate time savings for households and businesses, and reduce non-revenue water in the water supply network.* Five evaluations were undertaken to assess the broad-ranging compact investments: the first focused largely on institutional reform efforts; the second on the infrastructure efforts (but only a water quality study could be continued after the baseline stage due to methodological issues and changes in program implementation); and the third through fifth focused on a grant-giving mechanism known as a grant facility.

At the interim stage, the performance *evaluation* of the Lusaka Water Supply, Sanitation, and Drainage Project, (or the entire compact), found that infrastructure works were not yet completed one year after the compact ended. The project’s technical assistance had enabled Lusaka Water and Sewerage Company (LWSC) to adopt new policies and practices to improve asset management, but the utility was not yet maximizing the benefits of this support. The evaluation noted that residents and businesses along the primary drains had perceived a reduction in flooding, but that the usefulness of these drains is limited without secondary drains. The compact had supported the development of a solid waste management utility to prevent blockage of the drains, but this utility had not yet been formed.

The interim performance *evaluation* of the Municipal Utility Operations Monitoring Sub-Activity, which posited that improved water supply and sanitation would result in improved water quality and reduced water-related diseases, found some evidence of an improvement in water quality through a reduction in E. coli, but noted that challenges remain. The evaluation confirmed that wastewater treatment at the improved facility is taking place effectively.

The Zambia Compact’s Innovation Grants Sub-Activity intended *to support innovative opportunities and partnerships in the water, sanitation, and solid waste management sectors* in support of the broader program objectives. The overarching grant program’s performance *evaluation* found that the program’s implementation veered from the original model and grantees were often delayed, but communities perceived positive effects, particularly on drainage and solid waste management. The performance *evaluation* of the “Smart Safe Water Supply Scheme-Scaling Up” grant project found that water access in peri-urban areas of Lusaka improved but remained uneven. The performance *evaluation* of the *Zambian Breweries’ Manja Pamodzi* grant project reported that respondents perceived a reduction in waste, risk of cholera, and blockage of drains in their communities as a result of the program.

WASH PORTFOLIO RESULTS

These evaluations report mixed results across MCC's WASH portfolio. Program activities were generally completed as planned and the infrastructure installed was generally functioning as expected. However, the expected benefits to households and businesses mostly did not materialize, particularly the posited reductions in diarrhea and increases in incomes. Where programs focused more on performance of the water network, there were better results. In the rural program settings, time spent collecting water was reduced, but the programs had unrealistic expectations for the economic productivity impact that the time savings would bring about. There also seemed to have been lacking or inadequate attention to human factors besides water supply that affect health outcomes. Finally, a mechanism for continued funding for the operations and maintenance of rural water infrastructure was a key success factor to sustainability of the investments.

In the urban, networked setting, it was challenging to identify an impact evaluation methodology that could estimate the program effect on households and businesses. The Tanzania and Lesotho urban evaluations demonstrate the potential benefits of water connections and more reliable water supply, but neither program directly connected households to the system, so these results are harder to attribute directly to MCC's investments (i.e., MCC's investment provided critical infrastructure to make a piped connection more beneficial, but ultimately the household decision to connect drove the positive results).

Evaluations of large water infrastructure also struggled to validate the water system level improvements introduced by the compacts. In the Jordan case, the evaluation confirmed the achievement of expected changes in water flows and supply, while in the Mozambique case, it was not possible to reliably assess the effect of urban drains on flooding due to limited data. The Jordan Compact was one WASH program whose design reflected an understanding of the broader water network across Jordan, while that level of understanding seemed missing from the other programs. Regarding capacity building, in the Cabo Verde and Mozambique urban cases, MCC successfully supported significant reforms in the water sector and water utility operations, though challenges remained at the close of those compacts.

These evaluation findings, along with experiences in implementing MCC's WASH investments, prompted the lessons outlined in this paper and will hopefully lead to more consistently successful MCC WASH programs going forward. The lessons are interconnected and so will be cross referenced throughout the paper. While all of these lessons have been motivated by experiences in the WASH sector, many are applicable to other sectors.

LESSONS FROM MCC'S WASH PORTFOLIO

LESSON 1: UNDERSTAND THE SPECIFIC PROBLEM THAT A WASH PROGRAM AIMS TO RESOLVE AND FOCUS INTERVENTIONS ACCORDINGLY AROUND A CLEAR AND REALISTIC OBJECTIVE.⁸

MCC's experience across sectors has shown that focus and clarity in program design leads to a higher likelihood of achieving measurable results. This is highly relevant in the WASH sector, where the agency has observed well-implemented programs that did not achieve intended results. Rather than interpreting these results as a sign of bad investments or a lack of alignment of WASH programs with MCC's model to focus on beneficiary-level results, the problem may instead have been a lack of understanding of the context in which MCC was intervening and/or unrealistic expectations about what the program could achieve. Several specific lessons stem from this overarching lesson.

Know your problem and quantify it. Understanding the context is a critical element for designing an intervention and this context should frame the problem MCC is aiming to solve. In order to identify or confirm an issue as a problem worthy of an MCC investment, the program team must be able to quantify it using data. Early MCC WASH investments in both rural and urban settings were justified in the economic analysis on the basis of time savings and health benefits, implying that time spent collecting water and waterborne illness were problems in need of MCC support. However, inferring from the evaluation work, the pre-program levels for these outcomes were not well understood by the program designers and these baselines ultimately did not provide a strong justification for intervention. In reality, in the rural setting, the problem that was being addressed was one of access to water, and the time savings and health benefits were assumed rather than substantiated. This issue was likely a combination of misunderstanding the problem and the incorporation of benefit streams into the economic analysis that were not closely tied to the project design and aims, which is discussed in a later lesson. For instance, MCC's urban WASH programs in Tanzania and Cabo Verde anticipated reductions in time spent collecting water; however, the evaluations revealed that the target population was not spending an economically significant amount of time collecting water at baseline. The evaluations found a reduction of only a few minutes per week in Tanzania and no reduction in Cabo Verde. The evaluators hypothesized that the limited impact was largely due to low baseline levels of time spent collecting water, rather than a particular failure of the program. Even in the rural setting in Ghana, Mozambique, Lesotho, and El Salvador, where MCC constructed boreholes and pumps, time savings ranged from 13 to 55 minutes per day and this was not found to have translated to increased economic productivity. Based on this evidence, time spent collecting water did not prove to be a significant problem needing to be targeted or an outcome that MCC could likely influence in a way that would produce the modeled economic impact, even in a rural setting.⁹

These rural WASH programs were also justified based on the premise that providing access to improved water

⁸ The word "program" is used throughout the paper to refer to any WASH sector intervention funded by MCC. In the past, MCC has funded WASH-focused Compacts, Projects, Activities, and Sub-Activities, all of which are considered WASH programs.

⁹ Note that in January 2019, MCC released Water Sector Cost-Benefit Analysis Guidance, which presents a revised approach to modeling the benefits of WASH programs, relative to the approaches applied to the economic analysis of the programs referenced in this paper.

sources through boreholes would reduce exposure to pathogens and reduce diarrhea prevalence. However, the evaluations showed that diarrhea prevalence at baseline was relatively low; in the case of Lesotho, only 10 percent of households had a member who experienced diarrhea in the two weeks prior to baseline data collection.¹⁰ None of the evaluations of these four rural water programs detected reductions in diarrhea that were attributable to MCC's investment. A misdiagnosis of the problem, or misunderstanding of its magnitude, can lead to an overestimate of the likely program impact and potentially an inefficient use of MCC funds. In defining the problem, the program team is defining the ultimate program objective, i.e., the resolution of the problem. In order to design investments that can demonstrate their results in measurable terms, it is critical for program development teams to select a problem that can be realistically and significantly impacted by an appropriate MCC investment. To do this, MCC must identify a clear problem that contributes to the binding constraint to economic growth identified by the growth diagnostic, on the basis of evidence. MCC must then investigate that problem so that the program team understands its magnitude and dimensions in the specific context of the partner country or target region. Only then can they properly design interventions to target the problem and accurately define the expected impact of these interventions.

This exercise should be the focus of the root cause analysis phase of development that MCC undertakes, using available secondary data or primary data collected by MCC. However, in the development of recent WASH programs, the problem could only be substantiated with quantitative data once technical studies were underway, at a later stage of program development. As such, the team's understanding of the core problem may need to be refined throughout the program development cycle.

In many cases, a water problem lies at the heart of a water-related binding constraint. However, in other situations, water is one root cause of a health-related constraint (e.g., water and sanitation's relationship to a stunting constraint). In the latter scenario, it is critical to frame the problem and program objective in line with evidence on the proven health benefits of WASH interventions. For example, under the right conditions, a water quality intervention could impact an objective of diarrhea reduction. However, if the program objective is to reduce stunting, it may be less credible that water interventions alone would achieve the objective. Country teams should be careful to ensure that a WASH investment is necessary *and* sufficient to resolve the targeted health problem or is complemented by other activities¹¹ to support targeted health impacts, using evidence to support the investment case. In many of MCC's early WASH investments, it seems that health benefits were modeled to justify water infrastructure investments, rather than a well-defined health problem motivating the need for WASH. Teams must focus on defining a problem first and then gather data on that problem as well as evidence on interventions that have been proven to ameliorate that problem. This evidence will then form the basis of results projections in the cost-benefit analysis. Only after this level of clarity is achieved should teams move on to detailed design of solutions to that problem.

Design for targeted results using program logic diagrams as a tool. The WASH portfolio is unique in that the programs are often linked to, or justified based on, outcomes in another sector, specifically health in terms of reductions in waterborne illness. The evidentiary basis for a WASH intervention

¹⁰ Note that in the case of Lesotho, the ex-ante cost-benefit analysis indicated that costs likely exceeded benefits, but MCC proceeded with the investment anyway.

¹¹ Either as part of the MCC investment or in coordination with other government or donor programs.

in pursuit of health outcomes needs to be clearly established and confirmed with data during the root cause analysis. And, in the subsequent stage of program design, water engineering and public health considerations must be combined to ensure that a necessary and sufficient set of interventions are proposed to produce intended health impacts. MCC's early WASH programs were generally treated as engineering challenges and did not adequately consider other factors that could affect population-level outcomes (e.g., reduced waterborne illness), such as the behavior changes required to make effective use of improved WASH infrastructure. Understanding the problem is the first step to designing impactful programs and the next is identifying interventions, based on evidence, that are proven to address the identified problem. Given that program logics summarize the causal chain that links proposed activities to the ultimate program objective, they are essential to focus program design explicitly around the achievement of results. Elaborating the logic helps to identify critical assumptions and risks that may require additional investments to prevent a breakdown in the logic. This process can also highlight when proposed program elements do not support the overall program objective and are instead targeting a separate set of results that may not have been identified through the root cause analysis.

MCC's completed WASH program evaluation results indicate a lack of alignment between the activities that were implemented and the outcomes that were targeted. Sometimes programs were not designed to achieve the objective (the outcome that best defines program success) stated in the compact. In the rural WASH portfolio, while access to an improved water source increased and time spent collecting water decreased, the evaluations did not detect meaningful changes in targeted follow-on outcomes of increased consumption of water, school attendance, health improvements, or increased income. Given these results, it is unlikely that these investments achieved the economic impact expected at the time.

The Mozambique rural water evaluation found that the program exceeded infrastructure targets to increase access to an improved water source and even resulted in an increase in consumption of water from an improved source by targeted households. However, neither the aim of reduced diarrhea nor that of increased incomes materialized. In part, this was due to the underlying low levels of diarrheal prevalence, which goes back to the previous sub-lesson about understanding your problem. However, since MCC sought to reduce waterborne illness, there was also a disconnect between the program interventions and the targeted outcomes. The evaluation found that nearly half the tested samples of water stored in households were unsafe for consumption and posited household water storage practices as a potential source of contamination in the household water supply; this could explain the lack of impact on diarrhea or the disconnect in the program theory. The program did not address household water storage practices and, in hindsight, the incorrect or unexplored assumption that households were safely storing water may have wiped out the expected benefits of providing them with an improved water source. Once MCC made the decision to target a reduction in waterborne illness as a pathway to increase household incomes, there should have been an analysis of all the drivers of illness and the solution should have been more holistic to address the key, validated drivers (perhaps household water storage and hygiene practices), in addition to the production and distribution of water. Articulating the program logic that linked the construction of boreholes to a reduction in diarrhea in rural Mozambique at the outset would have made the program designers' assumptions more explicit and may have highlighted household water storage as an issue in need of intervention.

Another results-targeting challenge stems from programs that incorporate activities that are extraneous to the program logic. When particular interventions do not support the overarching objective of a program, they divert attention and resources away from the program's focus and can inhibit MCC's ability to achieve and measure the program objective. A case in point is the Water Smart Homes Activity of the Water Network Project in Jordan, which was driven by a desire to have an investment that sought to impact exclusively highly poor/vulnerable populations, rather than by a concrete link to the overall objective of the project. This challenge also relates to the previous lesson about knowing and quantifying your problem. The Water Smart Homes Activity was not designed to address the problem that was at the core of the Jordan Compact objective and the program ended up consisting of interventions that were unconnected to one another and to the rest of the compact. The activity required a separate evaluation since its intended outcomes differed from the rest of the project, but it was not clear what outcomes to evaluate because the program logic was never actually defined. Ad-hoc project additions like this not only complicate implementation and M&E, but they also obscure the program's results narrative by introducing interventions that must be accounted for but are not well documented in terms of MCC's investment criteria.

→ **Putting the Lesson into Practice:** In the case of the Mongolia Water Compact, the Public Awareness and Behavior Change Sub-Activity was included in the compact to promote water sector sustainability for Ulaanbaatar, in particular to ensure water tariffs are increased in accordance with a cost recovery plan. The need for this activity was not substantiated with evidence prior to compact signing, thereby presenting a challenge for defining its expected results. Ongoing due diligence for this activity will collect rigorous and statistically representative data on the socio-economic determinants of stakeholders' choices, beliefs, and behaviors regarding water, tariffs, and payments. In line with this lesson, these data will inform the diagnosis of the problem (if any) in acceptance of the required water tariff increases in Ulaanbaatar and clarify the expected results. If deemed an appropriate solution to an identified problem, a public awareness or behavior change investment will be designed.

Ensure that the program logic and design, cost-benefit analysis, implementation plans, and M&E Plan are in alignment. As alluded to in the previous lessons, a misalignment between program design and the results modeled in the economic analysis can lead to confusion about the aim of the program and to evaluation results that are hard to interpret. Prior to 2018, when the Mongolia Water Compact was signed, every WASH program modeled health benefits as the pathway to economic growth. However, program designs focused almost entirely on WASH infrastructure and program teams rarely, if ever, included health programming expertise. Expectations about the results of these programs were frequently misaligned, with sector staff and the economist offering different perspectives on targeted results.

As an example, the cost-benefit analysis for the Tanzania Water Sector Project modeled health benefits as a result of upgrades to water treatment plant infrastructure. There was disagreement within the project team

about whether diarrhea reduction, followed by a reduction in stunting, was an appropriate expectation, given the interventions. The project evaluation also faced challenges in attempting to measure health benefits that were not clearly defined in terms of effect, size, and timing, and were not necessarily calibrated to reflect the specific intervention. As a result of this misalignment of targeted and modeled results, the evaluation data collection and analysis became overly complex and the project's accountability framework and results narrative became unclear.

In the Jordan Compact, the primary objective was to increase the effective supply of water available to the inhabitants of the Zarqa Governorate by reducing physical losses in the water distribution system and by using recycled wastewater for agriculture in the Jordan River Valley. The evaluation found that the overall objective was achieved. However, it also found that one of the Water Network Project's specific objectives in the compact, to "decrease certain costs that households in Zarqa Governorate incur to satisfy their subsistence water needs," was not achieved. At the close of the evaluation, there were differing perspectives within the team about whether the program should be held to this objective, despite the fact that it was included as a benefit stream in the cost-benefit analysis that supported MCC's investment decision. There was disagreement about whether this outcome was indeed something that the program was designed to achieve, versus a result that was theoretically possible. Similar to the Tanzania case, this misalignment between the intended objectives and those stated in the compact agreement confused the accountability framework and results narrative for the program and put the evaluation in the position of assessing results that may not have truly been targeted by the program.

These differing team perspectives are usually brought about by the different lenses with which team members view programs, rather than a fundamental team conflict. However, it is critical that, from the beginning, all team members have a common understanding of both the program objective and the means to reach that objective. The aforementioned pitfalls can be avoided through better team coordination across departments and across program documentation. This lesson is not specific to WASH and can be applied to all sectors. Given MCC's focus on results, it is critical to ensure that there is a consistent understanding across the program teams about the problem MCC is trying to solve (articulated as the program objective), the activities MCC plans to fund, how they are expected to lead to achievement of the objective (articulated in the program design description/logic model), and how the achievement of the objective is quantified in the economic analysis (articulated in the cost-benefit analysis documentation). In other words, there must be a continuum of results starting with those identified during program development and committed to in the compact or threshold agreement, moving to the results that are the focus of final designs and implementation plans during program implementation, and finally to the results that are measured during the evaluation period after the program has ended. The independent program evaluations are required to measure the achievement of the objectives stated in the agreements and to measure outcomes modeled in the cost-benefit analysis. For MCC to remain accountable to itself and its stakeholders, this accountability framework must be clear and consistent at the outset so that there are not differing perspectives on what success looks like for a given program. This clarity will also allow evaluations to be better focused and to provide clearer and likely more actionable results.

In practice, this type of coordination requires careful reviews by country team members of critical documentation, including program design descriptions, the logic model, the cost-benefit analysis, program implementation plans, and the M&E Plan. This collaboration should start during the program development phase when the entire program team should agree to the results that the program is targeting and the best way to measure and demonstrate achievement of those results. It is crucial that the project lead confirm agreement with these results.

LESSON 2: THE ABILITY OF A PROGRAM TO ACHIEVE AND DEMONSTRATE SUCCESS DEPENDS ON DATA QUALITY AND AVAILABILITY, AND THESE ISSUES MUST BE EXPLORED IN PROGRAM DEVELOPMENT.

To date, MCC WASH evaluations have shown that MCC has considerable work to do in this area and that this is a particularly difficult area for WASH interventions as much of the data is presumed to come from recipient utilities and often does not meet the high standard required for a rigorous evaluation. In addition to the specifics set out below, this lesson is also dependent on the team collaboration described above.

Set a measurable objective. MCC's investments in WASH have generally been successful in terms of implementation, in some cases completing works in excess of original plans, but have frequently been unable to demonstrate the achievement of outcome-level results, such as the program's objective. This is inextricably linked to issues already considered in the first lesson, but another contributing factor has been the selection of program objectives that are not well or consistently defined and are difficult to measure cost-effectively. This is best exemplified by the Jordan Compact's Water Network Project, which aimed to "improve the efficiency of network water delivery" by reducing physical losses in the system. This objective did not point to a clear outcome with an obvious measurement approach, but a reduction in leakage of water throughout the system was assumed to be the main driver of achieving this objective. During the program development stage, MCC understood that the utility was unable to measure physical losses due to how the water network was constructed, and instead relied on modeling estimates of the current level of losses (both physical and commercial), as reported by the utility as non-revenue water (NRW) to design the project. However, this approach did not consider whether and how MCC would be able to measure the project's specific effect on physical losses after the fact.

The imperfect proxy of NRW became an issue toward the end of the Jordan Compact, when implementation had progressed to a point that it became feasible to report on program results. MCC did not have good baseline or current data on either physical losses or NRW to report on the effectiveness of the Water Network Project. MCC staff was also not aligned on the right measure or measurement approach for this result, an issue that was time-consuming to resolve. Ultimately, the independent evaluation had to rely on an imperfect measure to validate the project's achievement of its stated objective, which hindered MCC's ability to demonstrate that it achieved its mission in Jordan. The project could have benefitted from incorporation of specific measures to monitor physical losses in the areas where MCC worked.

A similar issue arose in the evaluation of the Mozambique Compact's drainage investments in Nampula and Quelimane, which were intended to reduce flooding to reduce outbreaks of malaria. Flooding is a particularly challenging outcome to measure because it is heavily impacted by factors outside the control of the program, including rainfall and changes in topography in the surrounding area due to population growth or construction. While it is impossible to account for all potential factors that could influence an outcome like flooding, particularly when it is also impossible to identify a counterfactual for the particular drains that MCC installed, it would have been possible to assess the effectiveness of the drains using a hydraulic model as the basis. In other words, if the drains were designed based on assumptions about the future flood events, and that model was well documented, the evaluation could have validated those assumptions and updated the model to assess the drains' effectiveness. While there was a modeling exercise to design the drains, it was not documented in MCC's records, so it was not possible for the evaluator to confirm whether these drains had proven to be effective.

The lesson from this experience, which is supported by other program and evaluation experiences across sectors, is to ensure upfront that the main outcome that is targeted by the program is one that is feasible to measure cost-effectively. This lesson applies equally to infrastructure programs and investments in policy and institutional reform, which also require a clear and measurable outcome to assess success. MCC should only commit to funding programs where there is a plausible reason to believe that the intended objective can be measured cost-effectively and accurately reported, and should be proactive about building these measurement mechanisms into program design. The method and data sources for measuring the objective should be well-understood and documented by MCC before an investment decision is taken.

→ **Putting the Lesson into Practice:** MCC has applied elements of this lesson in the development of WASH programs in the signed Mongolia II Compact and proposed Timor-Leste Compact by incorporating water engineering expertise on the evaluation team, assessing the status of the WASH infrastructure, and assessing network performance ahead of collecting customer-level data to assess downstream results expected from the infrastructure. For example, the Tanzania final evaluation that focused on works in Dar es Salaam was restructured to collect network-level performance data in addition to household data. The Lesotho urban water evaluation was phased to first conduct a detailed assessment of the design and sustainability of the infrastructure before moving to outcome-level data collection. This shift has produced richer evaluations that provide more actionable evidence to MCC; however, it has been challenging for evaluation experts to take responsibility for assessments or data collection that is more commonly undertaken by water engineers. Going forward, the approach of better understanding utility and network performance will require closer collaboration between M&E and the sector to build a data collection and/or reporting system with the utility that can provide the data that will allow accurate assessments of WASH program impact. This need arises not only in the WASH sector, but also in energy across electric grids, and to some extent in roads across the road network.

Collaborate to build and strengthen data systems. Once MCC recognized the need to better understand infrastructure and network performance to assess program results, M&E attempted to expand the scope of its data collection to include data more typically tracked by a water utility or water engineers. This included estimating end user water supply using pressure meters in Tanzania and ultrasonic sensors in Cabo Verde. In Tanzania and Zambia, the evaluators set up water quality testing laboratories to test bacteria and chlorine levels. In Jordan, the evaluators attempted to estimate water losses in the network. Finally, in Cabo Verde, the evaluators attempted to understand the performance of the utility that was formed with MCC's support in terms of its own data and customer experiences. However, these various data collection exercises proved challenging in different ways, as it can be costly and difficult to independently collect data that a utility should ideally be collecting itself to monitor its system and financial performance. The need for utility-like or actual utility data is even more critical in cases where MCC has invested in water sector and utility reforms, such as in Cabo Verde and Mozambique. To evaluate utility performance, MCC and the evaluators need access to the utility's administrative data, such as the location and performance of the piped network, customer connections and billing, water supply and quality, utility revenues, procurement timelines, etc. This type of data has proven challenging, if not impossible, to get because utilities may not collect it, it may not be of high quality, it may not be tracked in an analyzable form, and/or the utility may not be readily willing to share it with MCC.

In addition to recognizing MCC's need for utility data for its own business purposes, the agency recognizes the value of supporting data-driven decision making in MCC's partner institutions. The production and use of reliable performance data are an important input to a well-functioning utility, and poor data systems may be one of the root causes of water being a binding constraint to economic growth. While the idea of investing in a utility's ability to monitor its own performance with reliable data is not a new one at MCC, the agency has not yet approached it in a way that expressly serves both the utility's business needs and MCC's, in terms of results measurement and reporting. There is, therefore, an opportunity for MCC to address both the aforementioned data collection challenges and promote utility performance improvements by more explicitly incorporating utility data systems strengthening into program design. MCC could assess the need for establishing water sector data systems that run throughout the program lifecycle to support program design and oversight, utility performance management, and independent evaluations.

Collaborating around data systems can take various forms, depending on the context, so there is not one prescribed approach to implementing this lesson. However, there may be some common approaches to considering data system strengthening. As a first step, utility performance data could be assessed during the root cause analysis to determine whether data gaps are a significant issue for utility operations and to consider evidence-based interventions. In a case where MCC is aiming toward sector strengthening or utility reform, the program could invest in the utility's data collection and reporting systems to improve the quality and availability of data that the utility needs to monitor and improve its operations and that MCC needs to monitor its investment. Specific interventions could include technical assistance to fill data gaps or address data quality issues on key performance indicators, or a management information system to collect and store data in a form that is easier to analyze. If basic data on the locations and features of the water network are not readily available in utility records, mapping the network could be a worthwhile investment that would inform MCC's

program design decisions, support the utility's operations, and later support MCC program oversight and M&E efforts. In a case where MCC is investing to improve water service provision, MCC could install smart meters during the development stage in the section of the network where the agency plans to invest, to collect data on water supply to inform program design and establish a baseline for future results reporting. MCC could also install smart technology on the new or upgraded infrastructure that the agency funds, to produce reliable performance data during the evaluation period.

In the Jordan case, for example, the ideal scenario would have been for MCC to commission its own study of physical losses during program development to understand the full magnitude of the problem and target interventions appropriately. This would have served as the baseline for the compact's core objective and could have been updated during the implementation period or at least at the end of the implementation period to confirm that the infrastructure works had accomplished their intended purpose. The utility could have used the study and adopted its methods to gain a better understanding of system water losses, and the independent evaluation could have used these studies to inform its overarching assessment of program impact.

In all cases, the data systems that MCC helps to build should leverage a combination of data collected by the utility and MCC's design, implementation, and evaluation consultants. Whenever MCC partners with a water utility, the compact or threshold agreement should incorporate a requirement for the utility to share its administrative data with MCC prior to, during, and after the program. Not only does this kind of data facilitate a more comprehensive and reliable impact analysis, but some of the data, such as financial performance data or service metrics, is impossible for an evaluator to collect independently.

→ **Putting the Lesson into Practice:** To at least partially address a utility's and MCC's needs for better performance data, MCC now implements AquaRating¹² in water utilities during compact development. AquaRating is a utility management tool that was developed in 2008 for the Inter-American Development Bank by the International Water Association, with the main goal of strengthening the water and sanitation sector around the world. The benefits of AquaRating include (i) the utility assessment is done by utility staff, ensuring better buy-in implementing recommendations,¹³ and (ii) an external audit by a third party to ensure reliable and comprehensive information about utility performance with detailed ratings for all areas assessed against universal standards for water and sanitation provision.

MCC's experience with AquaRating started in 2016 with the Sierra Leone Threshold Program. The overall assessment score for the Guma Valley Water Company was

12 AquaRating is an international standard that enables water and sanitation operators to focus on the quality of the service they are providing. The assessment is based on the data that is available within the utility. The AquaRating system was designed to support utilities to overcome these challenges by helping them become more transparent and attractive for investment. At the same time, their investment needs are clearer, and design and implementation of performance improvement plans becomes more effective. This brings better service delivery, more sustainability, and satisfaction of customers, regulators, governments, and investors.

13 The expectation is that this will facilitate invaluable fundamental knowledge transfer and capacity building within the utility.

very low compared to the maximum possible score of 100, but this was expected given Guma operates in a challenging context with known performance challenges. The benefit of a low score was that there were many potential avenues for improvement. Based on the challenges raised through the AquaRating certification, the Sierra Leone Threshold Program was designed to target the following issues:

- **Service Quality:** Implementation of a managed community water kiosk pilot is intended to test an approach for improving service to those currently accessing water from standpipes. The idea is to construct a kiosk where there is currently a single standpipe. The facility will include a storage tank to extend the period of availability and the water will be chlorinated as necessary to ensure the water is safe to drink. Kiosks will be operated by private contractors who will sign agreements with the water utility and will pay for the water they use based on the agreed volumetric rate.
- **Access to Service:** The program has assisted in establishing the Community Water Service Department, a pro-poor unit within Guma Valley Water Company. The department will focus on establishing appropriate service levels and infrastructure and management models for those without a service connection. The department will provide the link between the lower-income customers and the Guma Valley Water Company.
- **Business Management Efficiency:** Working to improve billings and collections using electronic data and management software.
- **Operating Efficiency:** Mapping the water supply system and developing a hydraulic model using the mapping and other data. The model is being used to simulate and improve system operations.
- **Financial Sustainability:** So far, Guma Valley has established two district metering areas and is mobilizing a works contractor to install bulk and household meters, replace pipes, and address physical leakages to reduce non-revenue water (NRW).

Another AquaRating assessment is planned for Guma Valley in 2020/2021 which will capture program adjustments in the intervening years and give MCC an objective, data-driven view of how successful the threshold program is. Early implementation of AquaRating during compact development will help MCC to gain independently audited values for baseline indicators on utility performance; identify hot spots to strengthen the utility performance and target MCC's technical assistance; and continually monitor the impact of MCC's investments with annually audited AquaRating performance measures. In addition to Sierra Leone, MCC conducted a utility certification in Zambia and is currently undertaking a utility certification in Mongolia.¹⁴

¹⁴ Unfortunately, AquaRating was only applied in Zambia at the end of the five-year compact period so it did not inform MCC's investment. However, hopefully it will contribute to the sustainability of the investment going forward.

LESSON 3: DESIGN FOR WATER SECTOR SUSTAINABILITY AND PERSISTENCE OF BENEFITS.

As with any investment, sustainability must be a key consideration in WASH investments if the anticipated benefits are to be maintained over a 20-year time horizon as MCC expects. In the WASH sector, sustainability of service provision and financial sustainability of the utility can be difficult to achieve while ensuring that everyone has access to adequate water supply and sanitation. Balancing cost recovery and affordability is difficult. MCC has tried to address each issue (cost recovery to the utility and affordability) separately, with the hope that a sound understanding of each issue will lead to the best solutions. At a basic level, sustainability of any infrastructure investment, whether WASH or otherwise, requires adequate operations and maintenance of the asset by the entity that takes it over. MCC's WASH infrastructure investments have had varying degrees of success in terms of asset maintenance. Finally, sustainability of sector or utility reform supported by a timebound five-year MCC investment requires coordination with existing partner government priorities and efforts and/or other donor support.

Cost recovery is paramount when promoting sustainable water service for all. In supporting broad aims such as the Sustainable Development Goal 6 related to access to clean water and sanitation for all, donors struggle with balancing population access to water service and affordability with supporting the financial sustainability of water utilities. As part of standard due diligence, MCC conducts a financial assessment of the target utility both with and without the program. Compact investments (physical infrastructure and technical assistance) are then selected with an expectation that the financial viability of the utility would be improved.

In the case of Zambia, the financial assessment of the Lusaka Water and Sewerage Company (LWSC) found that over several preceding years LWSC's financial position had improved significantly. At the start of the compact, LWSC held relatively little debt, which allowed it to focus on improving its bottom-line financial performance and become profitable. It was expected to recover greater than 100 percent of its operations and maintenance expenses through its rates and charges and remain profitable over the coming years. This turnaround in financial performance reflected significant efforts by LWSC to increase water production, metering and billed volumes, tariffs, and, therefore, total revenue. However, LWSC's improved financial performance had not generated enough income to cover the required capital investment to bring about system-wide improvement in its utility operations.¹⁵ While LWSC had many accomplishments, it still faced significant challenges. As a result of these ongoing challenges, LWSC's long-term financial performance was going to be unsustainable without continued performance improvements, tariff increases, infrastructure investment, modern management methods, and the ability to finance new investments from its own cash flow in the longer term.

Accordingly, MCC prepared several financial simulations to demonstrate the correlation between tariffs, reductions in NRW, and improved collection efficiency. It was expected that tariffs over the next five years were projected to need to increase a cumulative 131 percent without improvements in NRW and collection

¹⁵ Tariffs for service provision are only successful when service is actually being provided. For LWSC to be able to continue with financial recovery, it would need to be able to provide reliable service, which could not be achieved with the infrastructure that was in place at the time.

efficiency. Increases of this magnitude were not expected to be approved by the regulator due to affordability concerns. However, if LWSC's aggressive NRW and collection efficiency goals could be achieved, the required tariff increases would be significantly lower, and would allow for fulfillment of other service-level objectives, such as increased water production, expansion of water and sewer service into peri-urban areas, and funding of capital works repair and replacement. Details of the compact investments focused on achieving these goals.

Even after selection of investments to minimize the cost of water provision and sanitation services, the tariffs utilities need to charge to fully recover their costs may not be affordable to all, particularly the poor who are target beneficiaries of MCC investments. To accommodate this, MCC should identify and quantify the segments of the population that will require a subsidy to be able to afford service. Subsequently, MCC negotiates with the government to arrange the delivery of the subsidy to targeted users, directly or through the utility (with government funds so the utility is not required to provide the subsidy). Finally, MCC works with the government to agree on a cost recovery plan for the utility, including a tariff escalation schedule for the remaining customer segments.

One example where MCC has tried to introduce initiatives to address affordability is the Zambia Sanitation Connection Action Plan, a partnership between the Millennium Challenge Account (MCA)-Zambia¹⁶ and the Government of Zambia that aimed to make sure that at least 80 percent of the properties in Mtendere¹⁷ connected to the new sewer system. MCC understood that it was going to be a significant financial burden for many residents of peri-urban areas in Lusaka to connect to the wastewater network that was being extended into their neighborhoods.¹⁸ In part, this was due to the fact that nearly all of these households were to transition from the use of pit latrines and needed to install water closets in homes or compounds to make the connections. This would represent a large sum of cash that would be required upfront, and this effort was largely unsuccessful. MCC needs to continue to pursue affordability mechanisms that allow the poorest of the poor to achieve the benefits of a WASH investment without undermining the financial health of the utility providing the services.¹⁹

Incorporate infrastructure operations and maintenance training and planning into program design. MCC's infrastructure investments in both rural and urban settings have achieved varying degrees of sustainability, in terms of asset maintenance and the persistence of benefits provided by those assets. In the rural setting, MCC staff were able to visit a sub-sample of the water infrastructure installed in El Salvador, Ghana, Mozambique, and Lesotho to assess the sustainability of the infrastructure five-to-seven

16 When an MCC partner country is awarded a compact or threshold program, it sets up its own local accountable entity to manage and oversee all aspects of implementation. Each of these entities is known as the Millennium Challenge Account, or MCA.

17 Mtendere is a peri-urban area in Lusaka.

18 One-time expenses, such as connections, are a completely different problem from something like tariff increases, which are to be expected over time. Each of these affordability issues needs to be handled with a different set of criteria to make them successful.

19 This should (i) start with identification of the households that will be unable to afford the cost of service after the intervention, (ii) establish the budget required to provide these subsidies, and (iii) identify the appropriate manner to implement the subsidy. Additionally, the decommissioning of existing latrines should be included in works contracts. Finally, MCC should work with utilities to explore easy payment methods for connection fees.

years after the programs had ended. These visits, whose sites were selected out of convenience and are therefore not representative of the full program, revealed the following:

- ★ El Salvador—nine out of ten community water systems were still functioning six-to-seven years after installation. While service levels varied across sites, most of the physical infrastructure was still working and water was available at household taps. Half of the water systems visited were managed by a community water board, while the other half were managed by the municipality.
- ★ Ghana—one out of six community water systems visited was still working six or more years after installation and water committees were not operational. The sites visited were those closest to the capital city of Accra, and likely some of the higher capacity areas.
- ★ Mozambique—each of the six hand-pumps visited was still working seven years after installation. Water committees were still in operation and were conducting routine maintenance.
- ★ Lesotho—the one solar-powered water pump visited was working five or more years after installation, but it did not provide sufficient capacity for user needs and there was no maintenance being conducted.

The most comparable interventions were those in Ghana and Mozambique, where boreholes with hand-pumps were installed and the creation of a water user association was encouraged or supported. It is not clear why the associations were maintained in Mozambique but not in Ghana, but the water user association, which consistently collected user fees and managed the routine maintenance of the pump, seems to have been the driving factor behind the sustainability of the Mozambique investments. Community members in the six sites visited continue to be able to draw a sufficient amount of water from the boreholes and are satisfied with the quality of water being provided. The takeaway from all four countries is that even for small infrastructure whose maintenance may not be that expensive, it is critical to establish a source of funding to cover maintenance and repairs. Before investing in rural infrastructure, it is important to consider whether proposed communities have access to the expertise and materials required to conduct repairs as well as the funds to pay for them. If not, programs should consider how to address these sustainability factors in the program design.

In the urban setting, the independent evaluators were able to assess the status of infrastructure in Tanzania, Lesotho, and Mozambique between four and six years after the programs ended. These cases offered various lessons for sustainability.

- ★ In Tanzania, the evaluators found that as early as two years after the program ended, the new high-lift pumps installed at the Lower Ruvu Water Treatment Plant were not operational, as voltage fluctuations had damaged the control panels or the power source. Plant staff were unable to repair the pumps themselves and were unaware of where to procure replacement parts from. The pumps continued in this state a year later, when the evaluators returned to collect additional data. While the construction contract for the plant works had included an operations and maintenance training component for Lower Ruvu staff and a training manual, these final activities took a lower priority to completing the works, which were

significantly delayed during the compact period. Another challenge was high staff turnover within the utility and water treatment plant, which meant that none of the staff working at the plant at the time of evaluation data collection had been trained during the compact.

- ★ In Lesotho, evaluators observed program design or implementation issues that ultimately impeded the sustainability of MCC's investments at nearly all program sites. Observations included an absence of tailored operations and maintenance manuals for the network as a whole, lacking operating or diagnostic guidance for the units responsible for operations and maintenance, and commercial manuals that were only available for individual infrastructure components. These findings indicated a lack of preparation of the utility and operators to operate and maintain the infrastructure individually or as part of the networked system.
- ★ In Mozambique, the water supply infrastructure that was taken over by the country's main water utility responsible for large cities was well-maintained and operational. However, the water supply and treatment infrastructure in the smaller city of Mocuba that was managed by one of the utilities for smaller cities—newly formed with support from the compact—suffered issues with operations and maintenance. Similarly, the drains constructed by MCC that fell under an unclear management structure were not consistently well-maintained and were often filled with trash (thus impeding the intended water flow). These findings highlighted the importance of either partnering with experienced utilities when investing in large infrastructure or, again, ensuring that the partner is prepared to manage the new infrastructure.

All three country experiences highlight the importance of considering how utility staff will adapt to new technologies when designing infrastructure investments and adequately preparing staff to operate and maintain new infrastructure, particularly when installing new technologies. Without this type of training and preparation, assets are less likely to be adequately maintained. It is also important to note that strengthening a utility's capacity to improve practices or upgrade technologies is challenging and likely requires close engagement by experienced water sector experts to oversee a change management process. An arm's length technical assistance approach where international consultants draft a new policy or simply provide a manual is not sufficient.

WASH programs should consider the aforementioned sustainability challenges, in particular operations and maintenance capabilities, when designing interventions, and should adequately prepare utilities to maintain the assets that they will be taking over. In addition to providing manuals, there are circumstances where direct and targeted training needs to be provided to utilities in order to promote the sustainability of MCC's investments. One challenge has been how to incorporate both the costs and the benefits of these measures into the cost-benefit analyses so that they do not result in a lower estimated economic rate of return, as the benefits of these types of sustainability investments are often imperceptible.

→ **Putting the Lesson into Practice:** The Sierra Leone program attempted a 'learning by doing' approach to working with utility staff that promotes on the job capacity building. This challenge has also been anticipated in Mongolia, where program success is predicated on the fact that the utility, USUG, will need

assistance in the day-to-day operations of the new Advanced Water Treatment Plant and the Wastewater Recycling Plant. This assistance will be given to USUG before the taking over certificates are signed,²⁰ while the contractor(s) still have responsibility for the plants. Rather than conventional technical assistance (a finite amount of training provided over a period of time), the Mongolia program includes a requirement for the construction contractor to work side by side with the utility staff so the staff will understand the appropriate operations of the plant.

Factor donor coordination into sustainability planning. Donor coordination has proven to be both a challenge and a strength when it comes to the sustainability of MCC's WASH investments, depending on whether they are reform- or infrastructure-focused. Due to the strict five-year implementation timeline dictated by MCC's founding legislation, MCC is not able to provide long-term incentives to our recipient countries for sustainable reforms. Additionally, it is challenging to fully implement complex sector reform activities within the five-year compact timeline. The sector reform project in the Cabo Verde II Compact built on work already being done in the WASH sector by the Government of Cabo Verde, municipalities, stakeholders, and other donors, particularly the Luxembourg Agency for Development Cooperation (LuxDev). That work resulted in the development of corporatized water utilities on two islands in Cabo Verde. These earlier efforts contributed to building the political will for national water sector reform and corporatization of the water utility on Santiago Island, and served as a model for the compact reforms. While it was not realistic for MCC to complete all of the identified reforms in the sector in five years, and although by the end of the compact there was still work to be done, MCC's investments had moved the WASH sector beyond the point where the reforms could be reversed. At the end of the compact, the newly established institutions and utilities continued to need technical support. LuxDev, which had supported the reform process prior to MCC's compact, continues to offer technical support to the entities created by the compact.

The converse occurred in the case of the Mozambique I Compact's urban water program, which supported a significant restructuring of the country's water sector, including the creation of a new type of utility to manage water and sanitation in smaller municipalities. While one factor that helped the reforms move forward was the fact that the MCC program was well-aligned with government priorities, the evaluation found that the newly formed municipal sanitation companies had received insufficient technical assistance. This meant they were unable to autonomously operate and maintain the new drainage infrastructure funded by the compact. If the MCC-supported reform efforts had been done in coordination with a donor group and if the government or another donor had made plans for continuing the reforms explicit in their medium-to-long-term investment plans, like in the case of Cabo Verde, MCC's investments may have been more sustainable. Both the Cabo Verde and Mozambique examples highlight the need to expand upon government priorities and coordinate closely and explicitly with other donors to realize sustainable, sector-wide reforms during MCC's limited investment timeframe.

²⁰ Taking over certificates return the responsibility of operating and maintaining the infrastructure to the utility.

On the other hand, donor coordination, while oftentimes necessary, has proven to be challenging in WASH infrastructure programs. In the course of designing the water treatment plant upgrade in Dar es Salaam, it became clear that the existing transmission main would not be able to carry the increased volume of water that the plant would produce after completion of the upgrades. The Government of Tanzania funded the new transmission main, but the works were continually delayed and ultimately were not completed until nearly three years after the compact ended. This meant that the benefits of the Lower Ruvu Water Treatment Plant upgrades could not be realized until that time. In Mozambique, MCC did not have enough funds to address all parts of the water system that needed upgrading in the cities of Nampula and Nacala, and so chose to invest strategically in water treatment and distribution in Nampula, and water supply, treatment, and distribution in Nacala. However, in Nampula, though MCC's works were completed as planned, there was not enough water supply to allow for the upgrades to have the intended effect on targeted beneficiaries (i.e., the system needed a larger water source in addition to better treatment and distribution). Perhaps coordination with another donor to cover the supply works could have prevented this. In Nacala, poor contractor performance resulted in only the water supply works (i.e., a significant upgrade to the Nacala dam) being completed, and the treatment and distribution works were partially or not completed. Six years after the compact ended, these works remained incomplete, so the improvement to the dam was still not being put to use. While this did not start as a problem of donor coordination, perhaps closer coordination from the outset and throughout the compact period could have secured funding to complete the works after the compact ended. Though donor coordination can have its challenges, as in the case of Tanzania, it can also allow MCC to apply our resources strategically to solve specific problems, which, in concert with other donor investments on other problems, can create sustainable improvements in the water sector.

→ **Putting the Lesson into Practice:** This approach is being applied in developing the proposed Timor-Leste compact, which is addressing stunting as a binding constraint to growth. The team has identified fecal contamination as a critical issue contributing to high rates of stunting and has selected water, drainage, and sanitation infrastructure as an underlying problem that can be addressed using MCC funding. The team identified another set of problems influencing stunting that relate to health, and MCC is actively coordinating with other donors to encourage them to fund health and behavior-change-focused interventions that will complement the infrastructure. However, the expectation is that MCC's interventions alone are sufficient to reduce fecal pathogens and diarrhea.

IMPLEMENTATION LESSONS

In addition to the previously discussed lessons, which are largely motivated by the findings of the independent program evaluations, there are important lessons gleaned from MCC's implementation of WASH programs.

Densely populated urban areas can be very hard to work in. It only makes sense that programs with a higher number of beneficiaries are likely to have a higher economic rate of return, which makes working in urban environments appealing. Having now completed two large investments in densely populated

urban areas in Lusaka, Zambia and Zarqa, Jordan, MCC has gained valuable insights into the difficulties of implementing projects in these circumstances. Tremendous thought and planning have to be put into traffic management plans and phasing implementation in a manner that will cause the least amount of disruption. Engaging stakeholders is also very important as their cooperation ultimately makes implementation easier. Additionally, in these densely populated areas, there could be an increased need for resettlement compensation. In addition to the obvious increase in program cost, this also results in a longer implementation schedule.

Hiring of a reliable, competent consulting engineer to advise the Millennium Challenge Account (MCA) is essential to the success of infrastructure projects. While this may seem obvious, it is important that MCAs have an advisor looking out for their best interests during implementation. The need for this was explicitly articulated in the evaluation for Lesotho, where it was determined that proper design reviews had not been completed for the infrastructure that was being constructed, which resulted in multiple implementation obstacles and the program objectives not being met. MCC has been a proponent of all MCAs hiring an internationally recognized engineering firm to serve as a program management consultant. The consultant is responsible for general program management (as the name would imply) and serves as the main technical advisor during implementation. In many cases, this position also serves as the supervisory engineer during construction.²¹ In the case of the Lesotho I Compact, the MCA had hired a program management consultant but then decided not to renew the contract after the first year, which resulted in a sub-optimal engineering review of the detailed designs for the large infrastructure. MCC should encourage MCAs to use advisory engineers for the life of the compact.

Incorporating health and safety into WASH programs is paramount. MCC has had some difficulty finding ways to enforce health and safety practices on infrastructure programs. Most water and wastewater network construction is paid for on a unit cost basis. When work is being installed to meet the technical requirements, it is difficult for the supervisory engineer to penalize the contractor for non-compliance with safety requirements, since safety measures are usually considered “means and methods.” This was the case in Jordan, where non-compliance with safety measures could not be assigned a value once the work was installed and met the technical requirements. If Environmental and Social Management Plan requirements like trench safety and traffic management are clearly specified in the contract document, the cost component of compliance can be calculated and included in the bill of quantities as a percentage of the unit rate or a work item. Inspections can then measure the quantities of work where the contractor did not comply with the safety requirements and act accordingly.

Use of sections (milestones) can incentivize contractor performance and control program management budgets. Despite the entire program being successfully completed during the five-year compact period, an ex-post analysis of the Jordan Compact recommended MCC consider sectional completion in future projects to allow the implementing entity, or MCA, better leverage to manage contractor delays during construction. Requiring sectional completion (milestones) with defined delay damages (liquidated damages) would provide an incentive to the contractor to hand over completed portions of the network.

²¹ MCC uses the FIDIC (International Federation of Consulting Engineers) form of contract. In FIDIC contracts, the Engineer is a defined entity with specific responsibilities. Oftentimes the MCA Program Management Consultant serves as the FIDIC Engineer.

Imposing delay damages (without sectional delay damages) at the back end of a contract offers limited relief to MCA in achieving compact goals in the event of contractor-caused delays. By the time the contractor defaults in the time for completion of the works (in their entirety), collecting delay damages cannot possibly pay for the recovery of lost time in a compact. MCAs will have limited time to hire a new contractor to finish the works as MCC disbursements are required to stop by the compact end date. It will be more effective if each contract is divided into sections (milestones) and realistic delay damages are imposed and deducted from interim payments as and when contractors miss the sectional completion dates. This approach not only incentivizes the contractor to maintain the overall schedule, but also allows the MCA to suspend portions of the remaining work and assign new contractors to do the suspended work. Timely completion of sections also would allow for placing completed work into service, thus improving results.

Grant facilities present challenges for producing measurable impacts in WASH. MCC supported WASH infrastructure investments identified through a grant-making process in the Georgia I, Cabo Verde II, and Zambia compacts. In all three cases, inadequate definition of the program's intended results presented challenges for MCC to demonstrate measurable economic impacts. In the Georgia case, the independent evaluation had to be canceled midway because it was designed to measure outcomes that were ultimately deemed not to be achievable by the programs that were funded through the facility. The five municipal water grants that were funded came out of the Regional Infrastructure Development Project, which did not have a specific water objective up front and therefore did not have a clearly defined scope for the programs to be funded. Backing into WASH investments this way resulted in a lost learning opportunity for MCC and the Georgian Government about the economic effects of municipal water system upgrades. In the case of Cabo Verde, water infrastructure grant funding was offered to municipalities on the island of Santiago to incentivize them to agree to corporatize their water utility functions into one utility for the island. Municipalities proposed investments in line with their priorities and the majority of the grant funding went toward extending water distribution to provide water access to more people. From the perspective of the new consolidated utility, these small grants exacerbated an existing challenge of insufficient water supply to meet customer demand. So, while the primary aim of the grant facility to incentivize reform may have been achieved, it is not clear whether there were tangible or sustainable benefits to the infrastructure that was built. Lastly, in Zambia, grants were small and varied and were grouped under an umbrella of "innovation." A smattering of small grant programs without a well-defined or consistent objective proved challenging to evaluate in a way that accounted for what MCC achieved relative to what was committed.

CONCLUSION AND CONTINUED LEARNING

MCC has learned a considerable amount in the 15 years of WASH investments described here and will strive to continue learning. The evolution of MCC WASH projects, from projects focused on the Millennium Development Goals (rural access, then urban access) to those focusing on increasing overall supply to meet demand in urban areas, is likely to continue (proposed projects are likely to focus on the economic growth impacts of water scarcity) as MCC operates in a changing global context, where water is becoming increasingly scarce. Applying the lessons of this paper in that context will become increasingly important on a number of fronts.

LESSONS SUMMARY

Lesson 1: Understand the specific problem that a WASH program aims to resolve and focus interventions accordingly around a clear and realistic objective.

MCC programs should address problems that are substantiated with quantitative evidence. They should be designed based on logic models, supported by evidence, and should consider whether the problem diagnosis necessitates interventions that complement infrastructure to achieve targeted results. It is also important that all team members have the same understanding of what the results, especially the stated objective of the MCC program, are, and that this understanding is reflected consistently across all program documentation and analysis. Team members should work together to ensure that objective is achieved and ancillary activities should not be added to programs unless they are deemed necessary to achieve the objective. It will require a tremendous amount of restraint to substantively focus on problems and solutions corroborated by evidence when the problem is largely a macro problem but MCC measures benefits at the micro level. This is why it is going to be imperative that teams have difficult conversations about what problems exist, can be solved, and how.

Lesson 2: The ability of a program to achieve and demonstrate success depends on data quality and availability, and these must be explored in program development.

Just as critical to setting a clear objective is ensuring that the objective can be measured to assess program impact. As teams are developing programs, they should be thinking about the data sources that will be needed to design, monitor, and evaluate interventions, both in terms of WASH infrastructure and beneficiaries. Where relevant data already exists within partner government entities or civil society, teams should ensure that MCC gains access to it. Where reliable data does not exist, teams should consider incorporating data systems strengthening into the program design. Data collection is inherently much more difficult in a networked, urban setting than it is in a rural context, not just from a volume perspective but also because of the interconnectivity of the water system in which MCC intervenes. Since an investment in one area of the network will likely affect other parts of the network, data on the performance of the entire network is needed to assess performance. This data is often part of a utility's operations or requires coordination with engineers and access to the utility's infrastructure. MCC has started to build data collection into program design but needs to expand this practice in a way that serves program, utility, and M&E needs.

Lesson 3: Design for water sector sustainability and the persistence of benefits.

In addition to ensuring cost recovery for the service provision, the project must address affordability for the consumer. While linked, these issues have to be addressed separately. Additionally, sustainability is also dependent on the ability of the beneficiaries to operate and maintain any new infrastructure that is provided. All of these issues need to be considered during program design. When dealing with a scarce resource that is required for life and has historically been free, there are going to be challenges to providing sustainable service provision.

Implementation Lessons. Learning from MCC's experiences implementing WASH programs, a number of lessons arose that should be relatively straightforward to incorporate into implementation plans: (1) Consider the challenges of working in densely populated areas, (2) Hire a reliable consulting engineer, (3) Incorporate health and safety into construction plans, (4) Incentivize contractor performance and manage progress using sections (milestones), and (5) Consider the challenges of producing and detecting high-level impacts when pursuing grant facilities.

MCC WASH LEARNING AGENDA

MCC plans to build upon the lessons identified in this paper by pursuing a broader learning agenda in the WASH sector. This agenda supports results-focused program design, results measurement, and the sustainability of results, which relate to lessons one through three, respectively. It reflects MCC's ongoing and planned WASH programming as well as areas for further exploration as MCC continues to invest in WASH. Future topics of exploration include:

1. **Detecting constraints to growth in water scarce environments:** Given the impact water scarcity has on economic growth, and the number of countries and cities soon facing real water shortages, how might MCC approach the constraints analysis to incorporate the impacts of water scarcity, quality, and impacts of climatic change on future water availability and access?²²
2. **Modeling the economic impacts of water supply and wastewater projects in water-scarce environments:** Given the contrast between the large potential impact of water scarcity on economies and the lack of success MCC has had detecting economic impacts from WASH programs in the form of household income, how might MCC re-conceptualize the economic impacts of WASH projects? Typically, wastewater projects do not tend to result in high rates of financial return or economic return, given that they do not generate monetized income. However, there is an ethical imperative to treat the wastewater that results from bringing people more water, especially in water-stressed countries or regions. One would imagine this would result in a positive welfare impact on the economy as well. As planned, the independent evaluation of the Mongolia Water Compact will provide evidence on measures to increase the effective water supply to meet growing demand for water, while avoiding depletion of groundwater assets. It will assess the economic impacts of increased water supply on residential and commercial users.
3. **Building utility capacity for network planning, operations and maintenance, and sustainable water and sanitation service provision:** The independent evaluation of the Sierra Leone Threshold Program will produce evidence on the effectiveness of MCC's use of AquaRating to guide investments in utility strengthening. The future Mongolia Water Compact evaluation is also expected to produce evidence on the effects of capacity building to improve operations and maintenance of compact-funded water infrastructure. Additionally, MCC will roll out AquaRating on compacts as soon as water is identified as a constraint. This should also help MCC to ensure adequate operations and maintenance of infrastructure.

²² This issue was raised in Morocco, where water scarcity was identified as a possible *future* constraint.

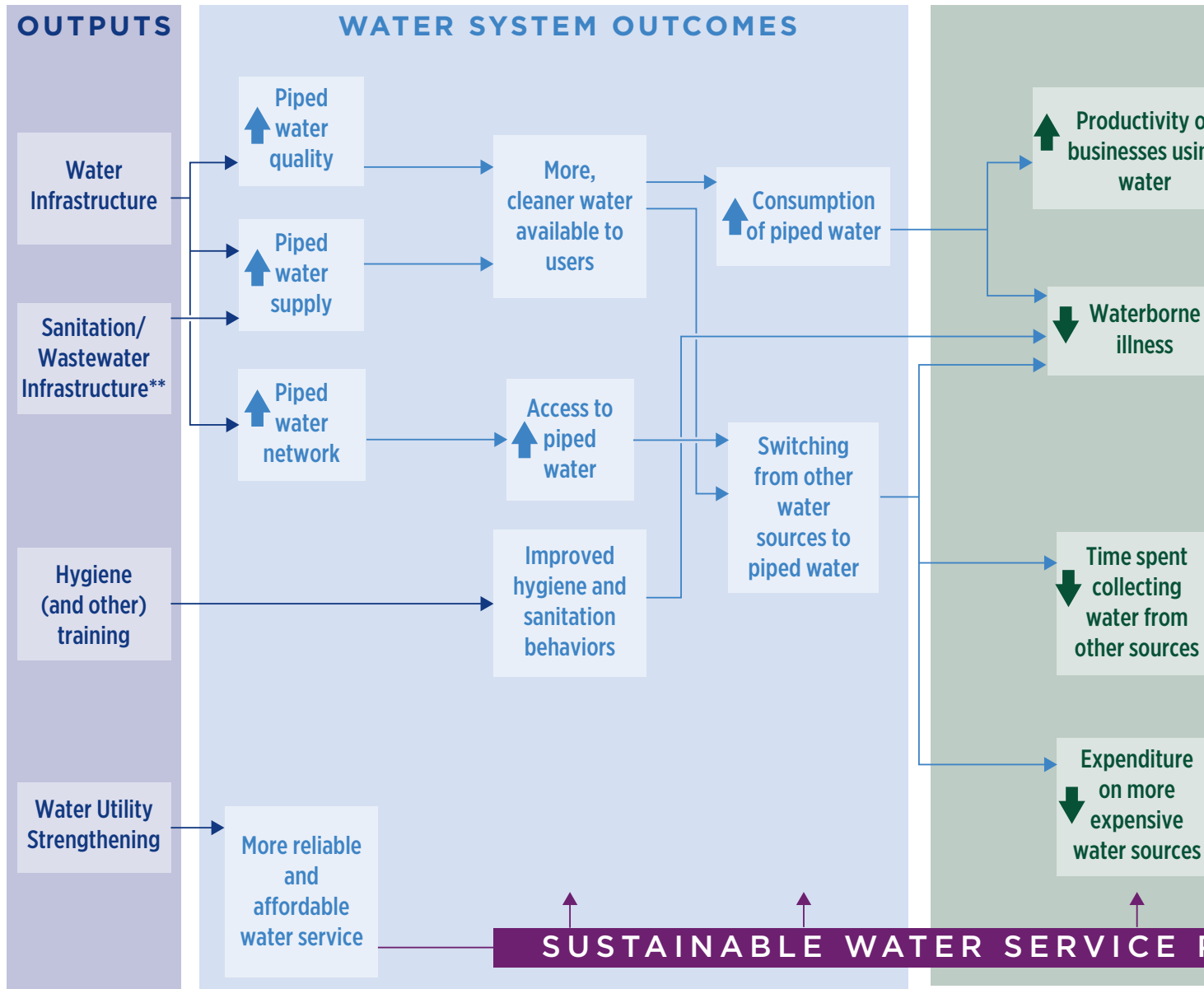
4. **Building data systems for program management and monitoring and evaluation (M&E) into WASH investments:** By thinking hard about data needs, quality, and availability upfront and building measures to address data deficiencies into WASH programs, the expectation is that MCC will discover methods to collect more reliable and comprehensive data on water network performance and water and sanitation service delivery more cost-effectively. As a complement to this, M&E will continue to explore methods to collect high-frequency, low-cost data on water and sanitation service delivery and quality from the customer perspective. In Sierra Leone, MCC is piloting a remote sensing system to track water kiosk supply levels.
5. **Ways to balance tariffs with cost recovery:** This will continue to be an issue for MCC to wrestle with over time. With increasing water scarcity, and the opinion in many places that water should be free, MCC must continue to look for ways to ensure that water is affordable to all without undermining the success of investments by not covering critical operations and maintenance costs. Specifically, MCC will explore analytical methods, hopefully developing a tool, to cost effectively identify the target populations for subsidization in a time-effective manner.

ANNEX: DETAILED PROGRAM LOGIC FOR NETWORKED SYSTEM



THEME 1: Inadequate supply of, quality of, and/or access

Networked System Program Logic*

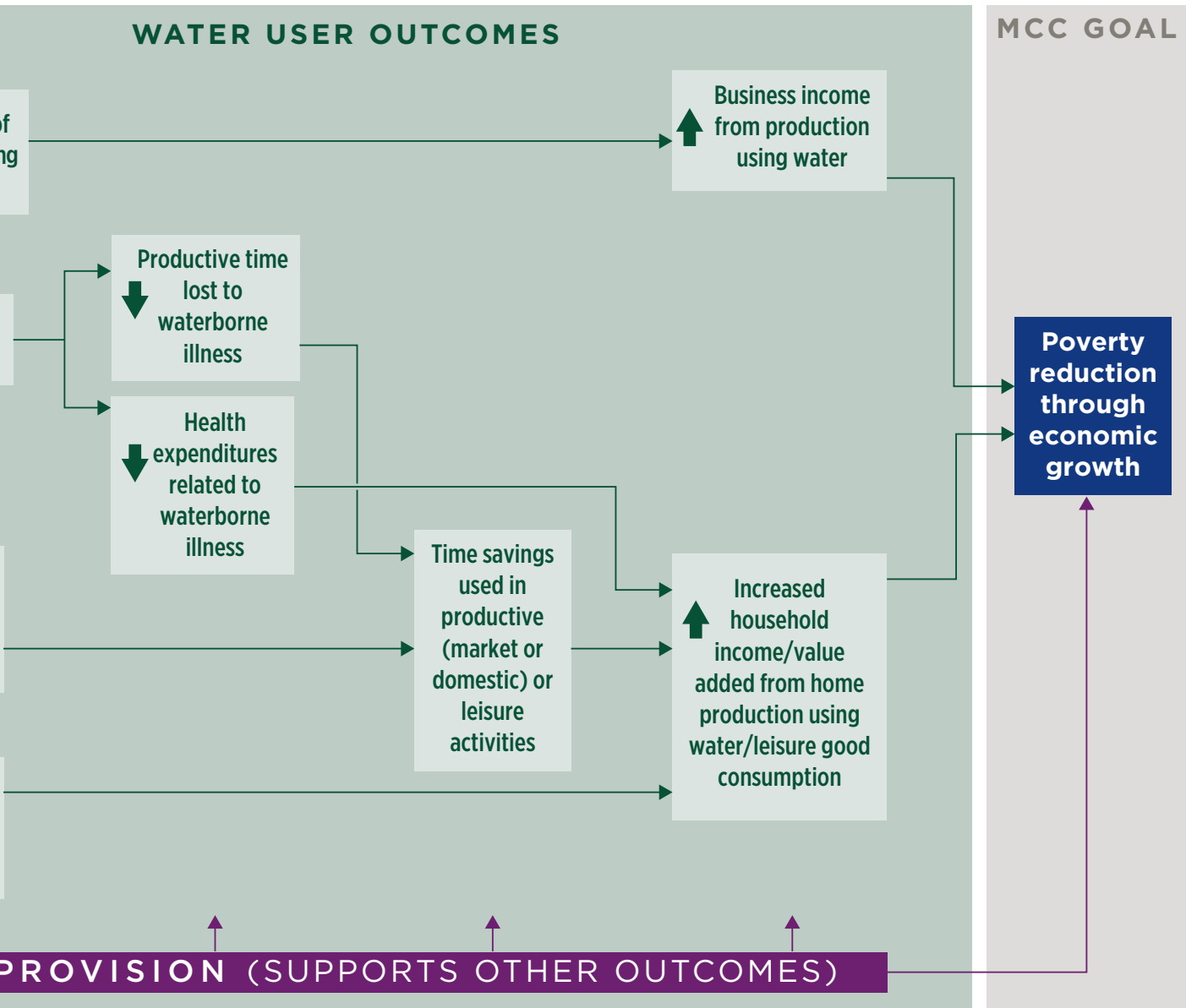


Notes:

*While this logic reflects a networked (usually urban) water system and specifically references piped water sources (such as boreholes) are provided to communities. “Piped water” would be replaced by other water sources if applicable.

**In this scenario, an investment in sanitation/wastewater infrastructure would focus on wastewater treatment and of water feeding into the system.

to water



ed water, it also generally applies to a non-networked (usually rural) scenario where improved by “Improved water source” in the non-networked scenario.

r collection and/or treatment to produce more treated water and thereby increase the supply

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