SOCIAL IMPACT

ADVANCING DEVELOPMENT EFFECTIVENESS

MCC Lesotho Metolong Program (MP) and Urban and Peri-Urban Water (UPUW) Activity

FINAL EVALUATION REPORT

June 2020

This report was prepared independently by Social Impact, Inc. for the Millennium Challenge Corporation (MCC).

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ACRONYMS

AGOA	African Growth and Opportunity Act
ATT	Average treatment effect on the treated
CMMS	Computerized Maintenance Management System
CMT	Cut-Make-Trim
DBE	Design and Build Engineer
DCS	Downstream Conveyance System
DCSE	Design and Construction Supervision Engineer
DRWS	Department of Rural Water Supplies
EA	Enumeration Area
EQ	Evaluation Question
ERR	Economic Rate of Return
FCR	Free Chlorine Residual
FGD	Focus Group Discussion
IE	Impact Evaluation
ITT	Indicator Tracking Table
KII	Key Informant Interview
LMDA	Lesotho Millennium Development Agency
LNDC	Lesotho National Development Corporation
LPCD	Liters per capita per day
MA	Metolong Authority
MCA-L	Millennium Challenge Account-Lesotho
MCC	Millennium Challenge Corporation
MDES	Minimum Detectable Effect Sizes
M&E	Monitoring and Evaluation
ML	Megaliters
MP	Metolong Program
MPMU	Metolong Program Management Unit
MSME	Micro, Small, and Medium Enterprises
NRW	Non-Revenue Water
O&M	Operations & Maintenance
OMM	Operation and Maintenance Manual
PDNA	PD Naidoo & Associates
PE	Performance Evaluation
PIU	Program Implementation Unit
SCADA	Supervisory Control and Data Acquisition
SES	Socioeconomic Status
SI	Social Impact
SME	Small and Medium Enterprises
WTW	Water Treatment Works
UPUW	Urban and Peri-Urban Water
USD	United States Dollar
WASA	Water and Sewage Authority
WASCO	Lesotho Water and Sewerage Company
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WtP	Willingness to Pay
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

Background & Context

Lesotho is a landlocked, mountainous country in Southern Africa, approximately 30 thousand square kilometers in size with a total population of approximately 2.1 million people.[1] While Lesotho's population remains largely rural, in recent decades, its urban population has experienced rapid growth in large part due to job opportunities and access to services, reflecting an ongoing shift in Lesotho's economy from rural agriculture to manufacturing.[2] Over time, the increased population in urban areas has put strain on limited resources and resulted in expansion of peri-urban areas, especially around the capital of Maseru.

Due to its geography, water is an abundant natural resource in Lesotho. It is one of the country's main exports, along with diamonds, with most water exported to neighboring South Africa. Despite the abundance of the resource, by 2008, domestic and industrial demand for water in urban areas was rising faster than the available supply, resulting in declining reliability of the piped water supply and access limitations especially in peri-urban areas.[3] Under these conditions, the Lesotho Water and Sewerage Company (WASCO),[4] the utility managing piped water service delivery in urban areas across the country, was unable to expand service to rapidly growing urban and peri-urban areas. Further, a secure water supply was seen as a prerequisite to attract new investment in the textile and garment industry, which employs approximately 40% of the population – most of them women – and contributes nearly half of Lesotho's gross domestic product.[5]

Overview of Compact and Interventions

The Government of Lesotho (GoL) and the Millennium Challenge Corporation (MCC) sought to address these challenges through investments made as part of a Compact implemented between 2008 and 2013. This $362.5 million Compact included activities in the water sector, the health sector, and private sector development. The program objective of the water sector activities under the Lesotho Compact was to improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management. Social Impact's (SI) evaluation is focused specifically on the urban water activities implemented as part of this Compact, which were meant to fulfill the first portion of this program objective. The urban water activities accounted for $105.6 million of the Compact's disbursed funds, with $69.9 million for the Metolong Program (MP) and $35.7 million for the Urban and Peri-Urban Water (UPUW) Activity.[6]

The MP financed by MCC was part of a larger $428 million effort co-financed by a consortium of donor partners,[7] which centered around the construction of a new dam to provide a long-term, reliable bulk water supply to Maseru and surrounding towns. MCC's contributions primarily included funding for the

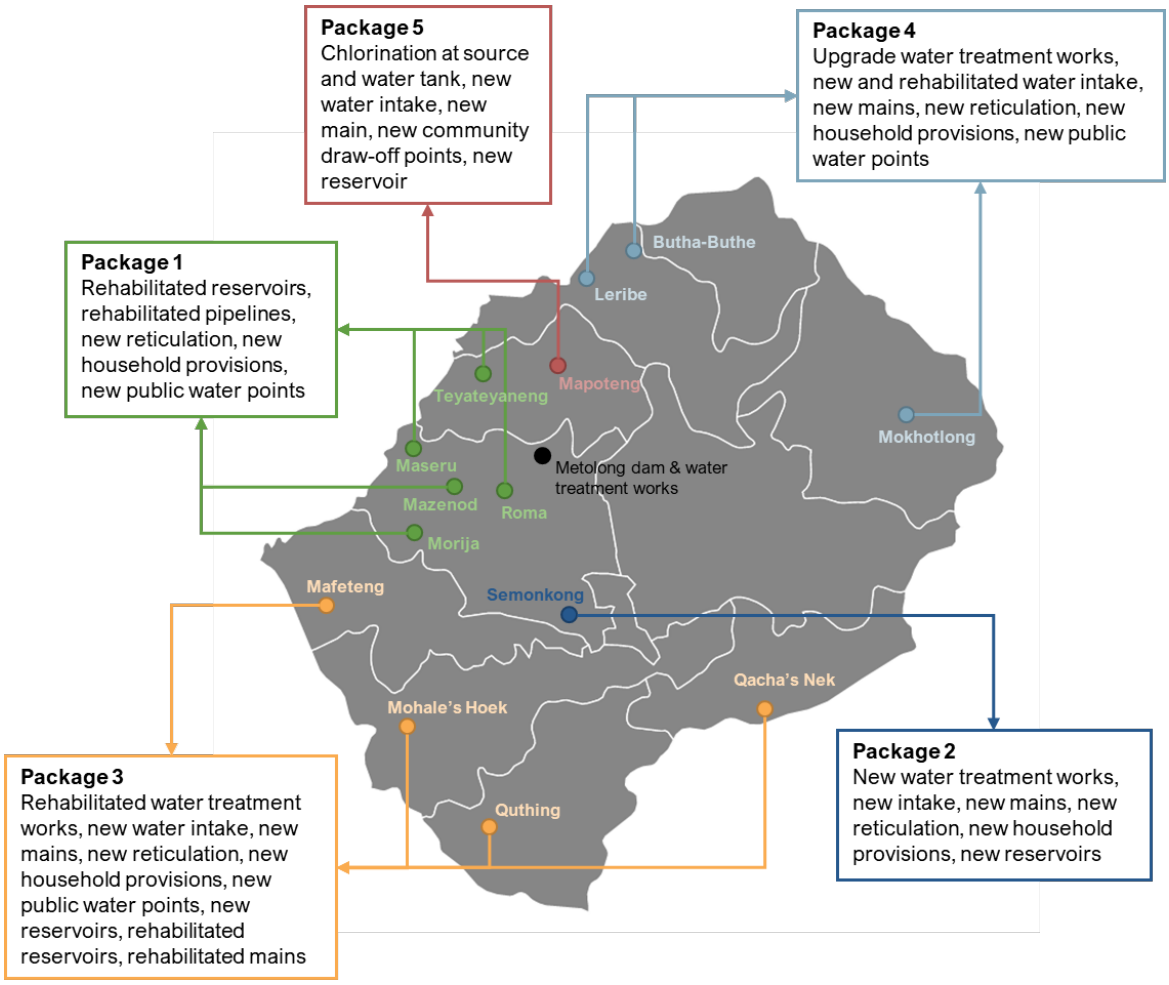
[1] United Nations Population Division 2019.
[2] PEM Consult 2010.
[3] Millennium Challenge Corporation n.d.(b).
[4] WASCO was officially incorporated in 2010, two years into Compact implementation. Prior to incorporation, this entity operated as the Water and Sewerage Authority (WASA), a government department within the Ministry of Public Works. See Ministry of Water website.
[5] Gain 2018.
[6] United States Agency for International Development Office of the Inspector General 2014.
[7] Other partners in this consortium include OPEC Fund for International Development, the Kuwait Fund for Arab Economic Development, the Arab Bank for Economic Development in Africa, the Saudi Fund for Development and the World Bank, and the European Union, along with the GoL.

new Water Treatment Works (WTW) downstream from the Metolong Dam, a new transmission system (downstream conveyance system [DCS]) to Maseru and surrounding towns, and a Metolong Program Management Unit (MPMU). The UPUW Activity mostly targeted rehabilitation, improvement, and expansion of urban water networks in Lesotho rather than increases in bulk supply to urban centers. The areas targeted are mostly in the lowlands of Lesotho, including the capital of Maseru and surrounding towns, as well as the majority of other urban areas around the country. Several UPUW sites are formally considered peri-urban with populations below 10 thousand and a mix of urban and rural livelihoods.

Table 1. Summary of MCC Lesotho Compact urban water activities

Metolong Program	Urban and Peri-Urban Water Activity
♦ Raw water transmission main from Metolong dam ♦ New transmission system to Maseru ♦ Bulk water supply components for peri-urban areas ♦ Designs for Teyateyaneng conveyance system ♦ Metolong Program Management Unit ♦ Environmental and social mitigation measures	♦ New or rehabilitated infrastructure including reservoirs, pipelines, treatment works, filters, tanks, reticulation, chlorination, service roads, pumps, household provisions, and others ♦ Covered 13 urban & peri-urban areas

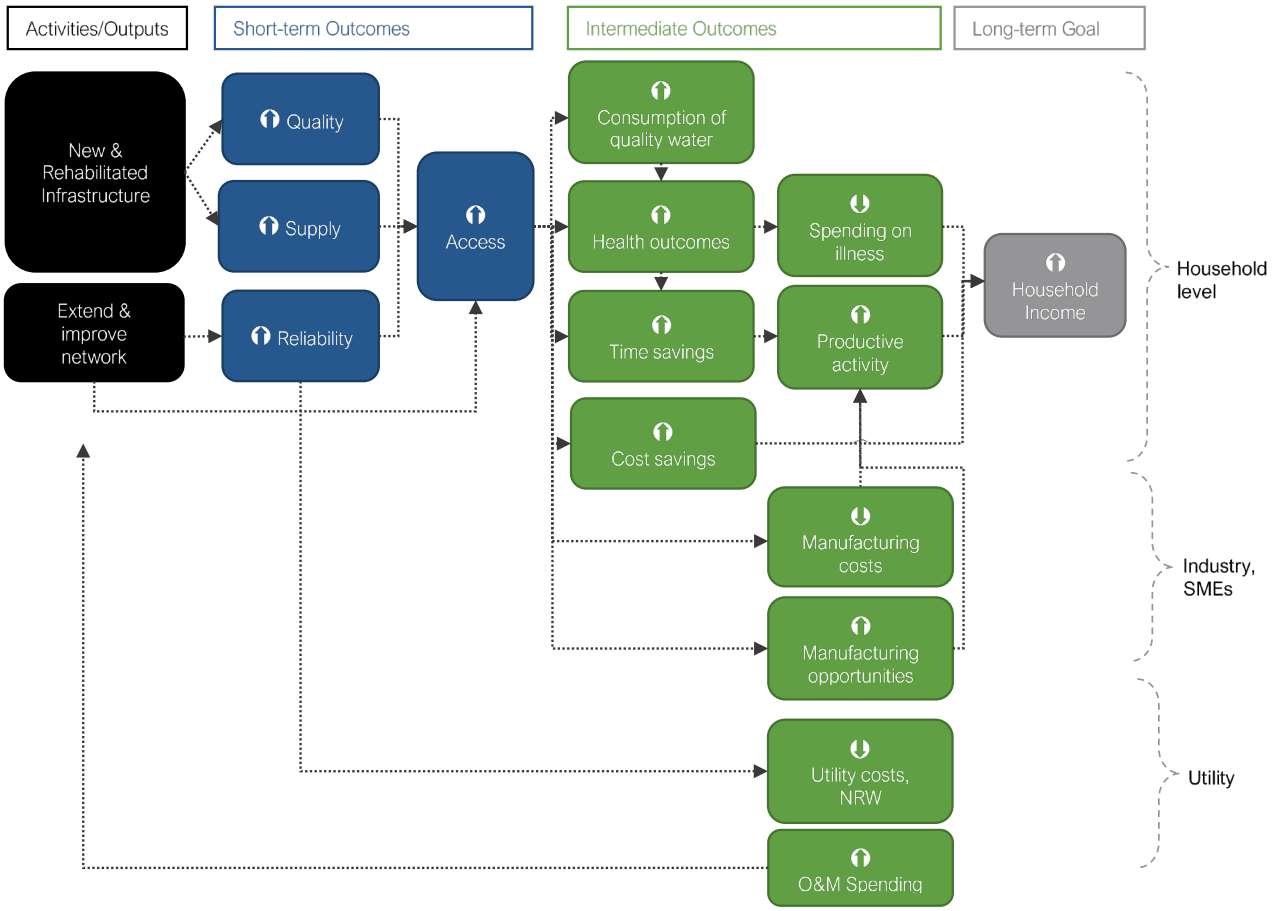
Figure 1. Map of MCC Lesotho urban water interventions, by package and site



Theory of Change

The MP and UPUW Activity's combined theories of change connect the Water Sector Project objectives with the Compact goal of reduced poverty through economic growth. The household theory of change asserts that increasing the amount of water in an urban network, upgrading infrastructure, and improving and extending the network would lead to increases in access and coverage, reliability, and quality of water for households, which would result in time savings and reduced diarrheal illness, ultimately increasing the time and resources available for generating income. MCC also hypothesized that an increased supply of quality, reliable water would result in expansion and growth of industrial firms, ultimately leading to more employment opportunities and greater production. The MP economic rate of return (ERR) considered as its benefit streams the preserved and additional income resulting from the preservation and expansion of industry employment, and expansion of industry employment. The UPUW ERR also includes a benefit stream related to small and medium enterprises (SMEs), which assumed an increase in private investment due to greater water availability. MCC also hypothesized that improved reliability would result in greater cost recovery for WASCO, which could then be allocated to operations and maintenance (O&M) to maintain the new infrastructure.

Figure 2. Theory of change



Evaluation Summary

This evaluation employs both performance evaluations (PEs) and impact evaluations (IEs), as defined by MCC's Monitoring and Evaluation Policy.[8] The evaluation was conducted in three phases: first, an evaluability assessment informed evaluation design. Then, a process evaluation addressed questions about program implementation. Finally, the summative evaluation assessed program impacts.

Evaluation Questions

MCC posed eight evaluation questions (EQs) pertaining to the MP and UPUW Activity. The questions are listed below, along with the evaluation design employed to address each of them. The questions are listed below in Table 2, along with the evaluation design employed to address each of them.

Table 2. MCC Evaluation Questions

Evaluation Questions	Evaluability	Process	Summative
EQ 1. Is the program evaluable?	♦		
EQ 2. Was the program implemented according to plan? Are interventions operating according to plan? If not, what are the major issues, and to what extent were they affected by implementation fidelity?		♦	
EQ 3. What is the current functionality, use, and plan for managing and maintaining the infrastructure under the MP and UPUW Activity?		♦	
EQ 4. To what extent has a management unit been established for the Semonkong water system? To what extent has WASCO HQ provided support to those managing the new system in Semonkong?		♦	
EQ 5. To what extent has support been provided to WASCO for the management of Metolong Dam, Water Treatment Works, and Pump Stations? If provided, who provided it, when was it provided, and how effective has this support and dam management been? Does a staffing plan exist for Metolong Dam? To what extent are positions occupied and what has turnover been to-date?		♦	
EQ 6. Do Operations and Maintenance plans exist for the MP and UPUW assets? How are these plans budgeted and funded? Are these O&M plans being observed and carried out?		♦	
EQ 7. What were program results on key short-term and intermediate outcomes? **a.** To what extent has access to quality water increased? What activities, if any, has WASCO conducted to encourage households to connect to the network? **b.** To what extent are community members (including businesses such as manufacturing firms) using water from the urban water network and how has this changed since the Lesotho Compact started? **c.** To what extent are community members experiencing cost and time savings, or reductions in water-related illness?			♦
d. How have the MP and UPUW programs impacted WASCO's income and costs? Has additional income been generated that can be directed to maintaining the new infrastructure?		♦	
EQ 8. What lessons can MCC or the Government of Lesotho apply to future programs related to program design, implementation, and sustaining results?		♦	♦

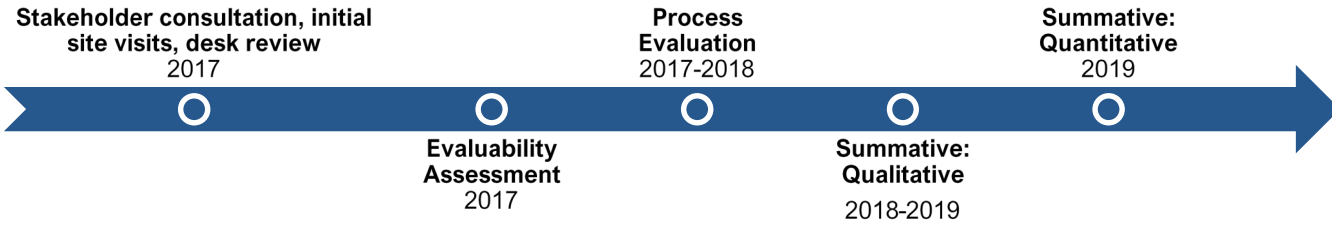
[8] Millennium Challenge Corporation 2017.

Methods

To inform the design of the evaluation and address EQ 1, SI conducted an evaluability assessment. The methodology for the evaluability assessment generally followed MCC's Project Evaluability Assessment Tool. To determine the feasibility and value of proceeding with an evaluation of the MP and UPUW Activity, SI assessed whether the project addressed a well-defined problem diagnostic, whether it was described by a theory of change with plausible causal links between measurable activities, outputs, and outcomes, and whether it was possible to identify and geographically locate beneficiaries of the project with a reasonable degree of precision.

Following the evaluability assessment, the evaluation proceeded in three stages. Although the Lesotho Compact closed in 2013, this *ex post* evaluation did not begin until November 2016. During evaluation work planning and development of the evaluability assessment, it became clear that some of the MP and UPUW Activity outputs were not performing as originally intended. Thus, MCC and SI agreed to sequence the evaluation such that implementation fidelity could be analyzed and taken into account before making decisions about the final scope and nature of any summative evaluation. SI and MCC also agreed to sequence qualitative data collection ahead of quantitative data collection to investigate the validity of potential counterfactual constructions before committing to a large-scale data collection activity.

Figure 3. Evaluation Timeline



Process Evaluation. The methodology for the process evaluation included an implementation fidelity exercise as well as a PE component. Data collection for the process evaluation included site visits to each of the urban areas, with structured observations of the infrastructure, key informant interviews (KIIs), document review, and secondary data analysis. SI conducted 32 KIIs with 43 key informants and 11 site visits which took place in September 2017.[9] All sites and key informants sampled for the process evaluation were selected purposively.

To analyze the implementation fidelity of each of the works of the MP and UPUW Activity, SI developed an implementation fidelity scoring system, which was applied to each site as a whole and for each component within each site. The scorecard assessed implementation fidelity on four dimensions: (i) design, (ii) installation, (iii) management/O&M, and (iv) funding. Scoring was conducted using the structured observation protocols populated during site visits. An aggregate score was also calculated, weighting the four dimensions equally. The scoring system was designed to summarize findings and communicate the overall success or failure of each site, and to enable easy comparison between sites, given the variation between them in terms of the specific nature of the MCC-funded interventions.

[9] The municipal networks in Roma, Teyateyaneng, and Mazenod were not visited because funded infrastructure was unobservable.

Impact Evaluations & Customer Survey. To measure the impact of the UPUW Activity on households in certain sites, SI carried out a quasi-experimental design, estimating impacts through propensity score matching. For sites not subject to an IE, a customer survey was implemented. Survey data were collected in the summer of 2019, following four to six years of exposure to interventions depending on the site.[10]

Design. The impact of the urban water interventions was hypothesized to occur through two potential pathways: by improving access/coverage (through new connections), and through improved supply (for existing connections). Thus, for this evaluation, we can conceptualize two types of treatment households: (A) households newly connected to the network, and (B) those with existing connections prior to the interventions. We thus designed and carried out two distinct IEs, referred to as Design A and Design B corresponding to these two pathways. Based on consultations with MCC and stakeholders in Lesotho, process evaluation results, assessment of available administrative data, and findings from early qualitative focus groups, SI determined that an IE would only be feasible in a subset of sites. These sites include Maseru urban (supply – Design B), Roma and Morija (access – Design A), and Semonkong (access – Design A). Customer surveys were carried out in all sites without an IE, as well as for customer groups not covered by the IE in Design A and B sites. Site selection is further discussed in the main report. The customer survey measured current service delivery and outcomes of interest among connected households. It was stratified by new and existing customers, defined by the UPUW commissioning date in each site, to ensure that the samples contained representation from customers who are likely to have benefited in different ways or to different extents from the UPUW Activity.

Table 3. Summary of Designs for Household Level Evaluations

	Design A – improved access	Design B – improved service	Customer Survey
Identification	Treatment (T): Connected households, with connection installed after UPUW commissioning Comparison (C): Unconnected households eligible to connect to the network	Treatment (T): Connected households living in townships connected to the Metolong supply Comparison (C): Connected households living in townships not connected to the Metolong supply	n/a
Sites	Semonkong Roma and Morija (together)	Maseru urban	New & Existing customers: Mazenod, Teyateyaneng, Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek, Leribe, Butha-Buthe, Mokhotlong, Mapoteng; New customers only: Maseru urban; Existing customers only: Roma, Morija
Sampling	Sampling frame constructed through a listing activity. Random sample from eligible households was intended; in practice, insufficient number of eligible units resulted in census of all eligible households in all three sites.	Randomly sampled from WASCO customer database; separated by townships with and without Metolong supply.	Randomly sampled from WASCO customer database; stratified by existing and new, defined by connected date relative to UPUW commissioning date in each site.

[10] The duration of exposure was largely a factor of the evaluation contract timing, rather than having been designated at the outset as the appropriate duration of exposure against the theory of change.

	Design A – improved access	Design B – improved service	Customer Survey
Data Collection	Household survey; Focus groups with newly connected and unconnected households; Water quality testing	Household survey; Water quality testing	Household survey; Focus groups with newly connected households; Water quality testing
Analysis	Propensity Score Matching; Qualitative	Propensity Score Matching	Descriptive analysis; Qualitative

Sampling. The Design B IE sample includes households with connections installed before the interventions were completed who reside in townships now served by Metolong (treatment households), and households who reside in townships not served by Metolong (comparison households). The list of townships was directly obtained from consultation with WASCO. Households were randomly sampled from WASCO's customer information database. The final sample size surveyed for Design B was 765.

The Design A IE sample includes households connected after the completion of the interventions (treatment), and households *eligible for a connection* that have remained unconnected since prior to the interventions (comparisons), all of whom have resided in their respective town since before the interventions were completed. Eligibility for a connection, among unconnected households, was defined for this evaluation as living within 300 meters of the WASCO network; the official WASCO eligibility buffer is 150 meters, but we learned during early qualitative data collection that WASCO does connect households further away than this for a fee. Thus, for Design A, there are not treatment and control *areas* but rather treatment and control households sampled from within the *same areas*.

A sample frame had to be constructed for Design A, given the specific geographic requirement and eligibility criteria for this evaluation. SI constructed a sampling frame through a listing activity, which involved a listing survey that asked about each eligibility criterion and other basic information allowing the teams to re-locate sampled households for the survey. Following the listing activity, we intended to randomly sample treatment and comparison units from the list. However, we ultimately deployed a census approach for Design A sampling, since there were fewer eligible households in the study areas than we required, according to our sample size calculations. Further details on the changes to the sample size can be found in Annex B: Methods & Additional Data. The final sample size surveyed for the Design A IE in Semonkong was 617 households; the final sample size surveyed for the Design A IE in Roma and Morija was 1,296.

For the customer survey, for sites in Packages 3 through 5, existing and new customers were proportionally sampled from the WASCO database according to the share of customers they represented in each site. "Existing" and "new" were defined according to the UPUW commissioning date of the works in each site. Since the IEs already included existing customers in Maseru urban, new customers from Maseru urban were also sampled from the WASCO database for the customer survey. Likewise, existing customers were sampled for the customer survey from Roma and Morija since new customers were already sampled as part of the IE. Semonkong is not included as part of the customer survey since the network is new, and there were no pre-existing customers.

Data Collection. A household survey was conducted to collect information on household demographic characteristics, water use and related practices in the household, and to measure the outcome variables of interest. Since valid baseline data for this IE design was not available,[11] the household survey also

[11] For a full explanation, see the Summative Evaluation Design Report https://data.mcc.gov/evaluations/index.php/catalog/221/download/1129.

collected recall information to reconstruct the baseline situation representing the pre-intervention period. Surveys were conducted in face-to-face interviews, with data captured on mobile phones using electronic data collection. Qualitative data collection was also conducted with households in the Design A treatment and comparison groups prior to the quantitative household surveys to inform the final IE design, as well as to gather information that would eventually explain, validate, and/or contextualize the IE results from these sites. A total of 52 focus group discussions (FGDs) were carried out in all project sites.

Water quality tests were also conducted for a subset of households sampled for our evaluation. The objective of these tests was to determine the compliance of water used for drinking with World Health Organization (WHO) standards—namely, to test for the presence of *E. coli* and the presence of free chlorine residual (FCR) in piped water, which is added to water at the treatment plant to bond with and neutralize any harmful pathogens present in the water. Sub-samples of connected households were tested for *E. coli* and FCR at their tap, and *E. coli* at their point of consumption (e.g. the location from which household members usually take water for drinking; this is often stored water within the household). A sub-sample of unconnected households were tested for *E. coli* at their point of consumption. In total, 2,472 water quality tests were taken from taps and 1,693 were taken from points of consumption.

Analysis. The main outcomes of interest connected to the ERR benefit streams at the household level are time savings and diarrheal illness among children under five. Other outcomes of interest, including water consumption, volume of water collected outside the home, and water expenditures are also assessed. Full definitions and measurement of these outcomes are detailed in the main body of the report. At the core of our impact analysis is the estimation of the counterfactual through propensity score matching techniques. This analysis estimates the average treatment effect on the treated (ATT), which represents the estimation of the effect on the treated units, had they not experienced the interventions. To carry out propensity score matching, we first use logistic regression with the treatment variable as the dependent variable and predicted the likelihood of treatment on the basis of a range of covariates, including demographic information and reconstructed baseline values of the outcomes of interest. On the basis of those propensity scores, we deployed different matching techniques to identify units comparable to each other, and then compare the outcomes of interest using each of those different techniques. The matching techniques used include nearest neighbor (five neighbors), caliper, and Gaussian kernel. Results from Gaussian kernel are presented in the body of the report.

Customer survey indicators are descriptively analyzed and discussed, for newly connected and pre-existing WASCO customers separately. Statistical analysis was not conducted for customer surveys. Qualitative data was analyzed using a systematic coding scheme with Atlas.ti software, with queries run and thematic analysis conducted by evaluation team members. Qualitative analysis and descriptive household survey data was used for analysis of spillover. Focus group data was analyzed in this same way to analyze unintended impacts.

For industry and enterprises, we combined analysis of qualitative data from KIIs and industry case studies with analysis of longitudinal trends from secondary data on water consumption and other variables (e.g. employment), where available. We assessed trends in industrial and business water accounts over time as well as consumption, with specific reference to changes after March 2015, when the Metolong Dam was commissioned, and in the context of information gathered through the qualitative interviews.

Findings

Process Evaluation

- EQ 2: Was the program implemented according to plan? Are interventions operating according to plan? If not, what are the major issues, and to what extent were they affected by implementation fidelity?

Implementation Fidelity. The main findings from this exercise are that the major outputs funded by MCC under the MP were implemented well with a high degree of implementation fidelity, while results are considerably more mixed for the UPUW Activity. Works in Packages 1, 2, and 5 (Table 1, Figure 1.) were implemented as planned with minimal issues in infrastructure design or installation, which can be easily remedied. However, there were significant issues with implementation for some sites in Packages 3 and 4 which have required, or still require, major remedies in order to allow the plants to meet intended design and function requirements. These issues are compounded by shortcomings in O&M and funding.

Major Issues. Observed failures in program implementation relative to plans at UPUW sites include inadequately designed river abstraction works that failed shortly after commissioning (observed in Quthing, Mokhotlong, Leribe, and Mohale's Hoek), absence of tailored O&M manuals for the network as a whole, with no operating or diagnostic guidance and commercial manuals only available for individual infrastructure components (observed at nearly all UPUW sites), inappropriate equipment selected and installed for function requirements (such as the clariflocculators in Mafeteng and Mohale's Hoek, pumps in Butha-Buthe, Mafeteng, and Mohale's Hoek, and chemical dosing equipment in Qacha's Nek), and commissioning of equipment which failed upon installation without remediation by implementing parties.

Effects of major issues. The end result of these issues in many of the UPUW sites, according to perceptions shared by many of the WASCO staff responsible for managing these networks, was difficulty in supplying water to meet demand without significant remediation at WASCO expense. WASCO staff expressed an original expectation for "turn-key" solutions to improve water supply, and instead found that old installations which at least worked moderately were replaced with new, problematic installations that, at times, had to be bypassed altogether. In some cases, the severity of the issues has reportedly rendered service delivery worse off compared to the previous situation and even temporarily prevented service.

There were redeeming aspects of the infrastructure funded under the UPUW Activity. WASCO staff nearly universally felt that new reservoirs improved the reliability of the water supply and extended or rehabilitated reticulation pipelines increased access to water for new customers. Fortunately, to date, even where plants have experienced issues filtering and treating raw water, the raw water quality for many sites is sufficiently good that they can still effectively treat the water delivered to customers.

Explanatory factors for results. Critical differences in the management and oversight of implementation for the MP compared to the UPUW Activity likely contributed to the observed results. In the case of the MP, the contractual arrangements between Managing Engineers, Design Engineers, Construction Contractors, and the Metolong Authority (MA) functioned as intended. Contractors installed works as they were designed and corrected defects raised by the MA and MPMU. There were different contractors assigned for different works, enabling adequate attention to be given to each set of works. In contrast, the Managing Engineer role of the UPUW Activity Program Implementation Unit (PIU) was never held consistently, and key informants reported that it was never executed competently by the various entities who held it. Two engineering firms were hired to fill this purpose, and Millennium Challenge Account-

Lesotho (MCA-L) either terminated them or declined to extend their services based on perceived poor performance. MCA-L then took on this role in-house, but many stakeholders, including some previously associated with MCA-L, felt that they did not have the expertise required to approve designs and commission works. Where flawed designs might have been caught and remedied prior to construction by a highly experienced and functioning PIU, instead they were constructed and installed as designed. Eventually, these design, management, and oversight issues resulted in problems in supplying water at most UPUW sites. Some of the required remediation, essential for the supply of water to consumers, required complete replacement of river infrastructure to different and suitable designs at WASCO's expense.

Apart from the issues described above, multiple entities involved in implementation also described perceived shortcomings of the MCC implementation model and the effect these had on their ability to deliver results as intended. For example, key informants from the UPUW Design and Construction Supervision Engineer (DCSE) expressed that many of their performance issues stemmed from the atypical use of a lump sum contract for large-scale engineering work combined with (1) significant re-working due to indecisiveness in project scope brought on by the breakdown of the intended forum between MCA-L, the PIU, PD Naidoo & Associates (PDNA), and WASCO, and (2) inflexibility in funding available for investigating design alternatives to previous feasibility studies. Stakeholders from both projects felt that the fixed five-year Compact period negatively affected implementation fidelity. Stakeholders with knowledge of UPUW PIU and DCSE operations expressed that this timeline rushed due diligence and design review, playing a role in the inadequacy of UPUW designs. Stakeholders from both projects felt this fixed period did not allow sufficient time to adequately address defects and ensure proper commissioning.

- EQ 3: What is the current functionality, use, and plan for managing and maintaining the infrastructure under the MP and UPUW Activity?

The Metolong Dam and associated infrastructure have succeeded in increasing the water supply available to Maseru and surrounding areas. Prior to the commissioning of the Metolong Dam in 2015, WASCO was capable of producing an average of 60 megaliters (ML) per day to serve Maseru,[12] which was about 10 ML short of the 70 ML per day projected demand in 2015.[13] The Metolong WTW alone is now capable of supplying an additional 75 ML per day, on average, with a peak of 94 ML per day, to these areas. This additional supply was intended to satisfy demand in Maseru and surrounding areas through at least 2020, and perhaps longer depending on the pace of demand increases over time.

WASCO staff have two main complaints about the Metolong supply. First, introducing the new high-pressure supply to the network's aging reticulation frequently results in bursts, requiring repairs at one part of the pipeline only to cause bursts a few meters downstream. This affects service reliability for some customers. Second, where many WASCO and other stakeholders hoped that the Metolong supply would be available to all consumers in Maseru, in practice there are still townships that are served by older water sources. While this does not affect WASCO's ability to meet demand for water in Maseru, it does increase their operating costs since they have to staff and operate these supplemental facilities.

[12] WASCO n.d.(d), pg. 1. Prior to Compact and until the commissioning of the Tikoe/Thetsane Water Supply project in December 2011, WASCO could only produce an average of 34 to 40 Ml per day.
[13] Mott MacDonald, Ltd. et al. 2007, pg. S-7 Figure S.1.

According to the MA, both of these stresses are not implementation failures, but rather a natural byproduct of the "nodal" design of the MP. This design meant that the MP was only responsible for supplying and conveying water to "nodes" in the form of reservoirs supplying Maseru and the surrounding areas, after which point it would be the responsibility of WASCO and other national authorities to ensure adequate integration with the existing municipal network and interconnection with townships not already connected to Metolong reservoirs. The MCC Investment Memo suggests that a hydraulic assessment that might have uncovered the potential difficulty in integrating the Metolong Supply with the aging Maseru infrastructure was underway around the time of Compact signing, and thus it would have been incumbent on WASCO to consider the increase in static pressures on the existing reticulation systems and to install pressure reducing /pressure maintaining installations in their downstream infrastructure.

As implementation fidelity results suggest, the current functionality and use of UPUW infrastructure varies according to the specific network. It is important to note that most of this information is current as of September 2017, when process study site visits were conducted. In a few cases, the evaluation team has been made aware of updates or changes regarding status and functionality since that time, which are integrated into the findings.

- **Maseru, Mazenod, Morija, Roma, Teyateyaneng (P1):** UPUW infrastructure is functioning well and being used as intended, with minor ongoing issues. New and rehabilitated reservoirs, despite some leaks, allow for sustained supply for at least two days in the event of an outage.
- **Semonkong (P2):** Some ongoing issues inhibit the ability to deliver water as intended and operate the plant efficiently, but overall the plant is capable of producing water in a quantity that reliably satisfies customer demand. The water treatment plant (WTP) can deliver design capacity if it operates 18 hours per day, but to date has only needed to operate about 8 hours per day to meet demand.
- **Qacha's Nek (P3)**: UPUW infrastructure has generally helped the network keep pace with demand, and operators are largely content with the current functioning of the treatment plant.
- **Quthing (P3)**: The plant is able to keep up with increasing demand due to increased reliability from improved storage, despite issues with the intake that reduce the plant's ability to draw water from the river in rainy conditions. The UPUW-funded river intake failed, but WASCO remediation currently allows for drawing water from the river effectively in low turbidity conditions.
- **Mafeteng (P3)**: Overall, UPUW infrastructure has reportedly improved water quality and helped to increase the supply capacity from 60,000 cubic meters per month to around 75,000 per month, but reliability problems are occasionally introduced from the failure of the UPUW-funded clariflocculator, which requires manual desludging at least once per month, necessitating three-day plant shutdowns.
- **Mohale's Hoek (P3)**: The introduction of the UPUW infrastructure has not affected the treatment plant's capacity of 33,000-42,000 cubic meters per month and generally left it unable to meet customer demand—estimated at 45,000 cubic meters per month—due to acute failure of the river intake works and clariflocculator. WASCO still must operate the plant using a makeshift engagement pumping through temporary pipelines to extract water from the river. The intake fails altogether in flood conditions, leaving the town without water until flooding recedes.
- **Leribe (P4)**: UPUW infrastructure has increased plant capacity, reliability of service, and allowed for new connections, but still is not functioning or used as intended due to the failure of UPUW-funded

intake infrastructure and pump operation problems. Plant production has increased from around 1.1 ML per day to around 1.8 ML per day, but the plant is still unable to meet an estimated demand of 3 ML per day due to the failure of UPUW-funded intake infrastructure.

- **Butha-Buthe (P4)**: The UPUW infrastructure, which is less extensive than in the other sites, is largely unused at present. Specifically, new pumps and pipeline installations have not operated as intended, through poor pump and motor selection and inadequate operation instruction at hand-over. The old replaced high lift pump was re-installed by WASCO to enable water delivery via the old delivery main and operating staff decided to bypass the new high lift pumps and new main entirely.
- **Mokhotlong (P4)**: Additional reservoirs and reticulation have helped WASCO expand their local customer base from 1,300 to around 2,100 households, but WASCO's ability to deliver water as intended is in jeopardy due to a highly vulnerable remediation to failed UPUW-funded intakes.
- **Mapoteng (P5):** The plant is functioning as intended and being used according to plan. Since 2013 and due to the additional UPUW intake infrastructure, production has increased from 12,000 to 40,000 cubic meters per month. Over the same period connected households increased from around 140 to 400 households.

- EQ 4: To what extent has a management unit been established for the Semonkong water system? To what extent has WASCO HQ provided support to those managing the new system in Semonkong?

The Semonkong water system was a brand-new system constructed under the UPUW Activity. Semonkong has been newly designated as a peri-urban area, subsumed into WASCO's purview, whereas the population was previously served under the Department of Rural Water Supplies (DRWS). The Semonkong network is now integrated into WASCO's Central region. In all, the management unit of the Semonkong plant is capable of carrying out its work and has the ongoing support of WASCO HQ but is vulnerable due to understaffing. The current staff would be unable to manage the plant operating at peak capacity in the event that the customer base increases. As it stands, staff report a focus on corrective rather than preventative maintenance, a de-prioritization of health and safety SOPs in favor of expedience, and occasional operational mistakes due to fatigue.

Although WASCO personnel generally consider this management structure to be capable of day-to-day operation, they also feel it is highly vulnerable. As mentioned before, short-staffing has led to fatigue and expediency in plant O&M. The current area manager had past experience as an operator, allowing him to effectively assist in the operation of the plant when manual operation of infrastructure is required. If someone with a different background were to fill the role, the arrangement may not be as successful. Staff in Semonkong feel that WASCO HQ and Central Region staff are as responsive and supportive as possible of the new system, in terms of responding to issues. Regarding training, staff feel more reliant on their own previous experience than on HQ-issued training to do their work, as they feel the training offered by WASCO HQ was generic and not tailored to the specific operation of the Semonkong plant.

- EQ 5: To what extent has support been provided to WASCO for the management of Metolong Dam, Water Treatment Works, and Pump Stations? If provided, who provided it, when was it provided, and how effective has this support and dam management been? Does a staffing plan exist for Metolong Dam? To what extent are positions occupied and what has turnover been to-date?

Overall, both the MA and WASCO are satisfied with the management of the Metolong Dam and associated works to date. Although the WTW and DCS were complete at Compact closure, progress on the Dam and other externally funded works lagged behind. Thus, staff responsible for the management and operation of these works could not be practically trained with Compact funds and required European Investment Bank (EIB)-funded assisted operational and practical trainings subsequent to the Compact when the dam was commissioned. Thanks in large part to this support, responsible staff are deemed competent to manage and operate the dam under normal conditions.[14]

A full staff complement exists for the dam but there is an insufficient number of staff filling many roles to effectively accommodate extended leave or turnover, unless these events are sufficiently staggered throughout the year to minimize their impact. The dam is quite vulnerable to turnover, in that budget constraints often dictate that staff with lower qualifications than are standard be hired and trained up to their roles. When they achieve a high-level of competency, there is a concern that they will be drawn to higher-paying opportunities elsewhere in WASCO or in South Africa. Despite some early turnover, many critical roles such as Dam Safety Engineer are still occupied by the originally hired staff.

Support for the management of Metolong infrastructure has mostly come in the form of externally funded trainings for key staff. Some trainings were offered by the MA to WASCO staff managing the Metolong Dam and associated works prior to Compact closure, but the efficacy of these trainings was limited by the fact that the Dam was not yet operational and defects were still being remedied; thus, there could be no practical element to trainings or verification of trainee competency. Additionally, stakeholders external to and within WASCO felt that WASCO was not proactive enough in hiring to have sufficient staff available in time to benefit from training delivered during the Compact. In some cases, staff responsible for management of the dam and associated works were hired late enough that they only received six months of capacitation within the one-year Assisted Operation phase following the Compact, during which key staff were accompanied by subject-matter experts.

The staffing plan of the Metolong Dam and associated works seems to exist only in ad hoc basis. A Test After Completion Report conducted by LogiProc, who was responsible for training WASCO to take over operation of the works, finds that the ad hoc structure that has emerged is one where management is siloed within the Laboratory, ICT, Production, Maintenance, and Corporate Service teams all reporting remotely through their managers to the WASCO Central Region Manager. This individual has other responsibilities outside the Metolong works and is further not stationed at the works consistently. According to LogiProc, a superior structure would be one where the Production Manager serves a central reporting and overall accountability function for the entire staff, chairing a steering committee that also includes the Laboratory, Process, and Maintenance Managers as members. This would allow for staffing and management decisions to be made by well-informed, on-site personnel and enable clearer lines of communication between the Metolong works and WASCO HQ. Although WASCO staff responsible for managing key elements of the Metolong Dam and associated works generally feel that they have the staff required to fulfill their duties, they share a concern that this situation is vulnerable to a variety of challenges. Even if they have been able to train staff to adequate levels of competency, they have struggled to recruit and staff individuals with industry-standard experience.

[14] This competence was assessed not only by the key informants we spoke with for the process study, but in a formal independent assessment of training outcomes conducted by LogiProc under the supervision of the MA (LogiProc 2017). LogiProc was hired to operate the Metolong WTW for 12 months and train WASCO to take over operation after their 12-month scope of work expired in 2017.

- EQ 6: Do Operations and Maintenance plans exist for the MP and UPUW assets? How are these plans budgeted and funded? Are these O&M plans being observed and carried out?

At the time of the process study, four years after Compact closure, there was no articulated, company-wide plan for maintenance of WASCO infrastructure. Site-specific O&M manuals and systems existed, but these were mostly ad hoc with the exception of a robust manual and Computerized Maintenance Management System (CMMS) for the Metolong WTW. WASCO was in the process of assembling a plan using regional workshops at the time of the process study, but it is unclear what this plan was intended to cover and how far it has progressed since then.

One element of WASCO's Strategic Plan for 2015-2020 included developing a policy for planned preventative maintenance of WASCO infrastructure.[15] Interviews with informed WASCO staff confirmed that there was still no articulated, company-wide plan for maintenance of WASCO infrastructure at the time of the Process Evaluation.

Despite the absence of an articulated WASCO-wide maintenance plan, O&M of the Metolong WTW is fairly robustly prescribed between a dedicated Operation and Maintenance Manual (OMM) and a CMMS. SI's direct observation of these resources and a more intensive independent review of their content by LogiProc both find them to be complete, relevant for operation of the WTW, and well-implemented.

O&M manuals for the UPUW infrastructure delivered by the UPUW Activity, to the extent they existed, were largely viewed as inadequate based on KIIs and site visits. There are exceptions to this view, such as the manual in Mapoteng, which appeared adequate and valued by plant staff, and manuals for Package 1 networks that were largely unchanged relative to before except for additional reservoirs and reticulation. However, manuals delivered for UPUW infrastructure in other sites provide basic manufacturer information on individual plant components, rather than being tailored to the plant's overall operation and do not aid in troubleshooting problems when they arise. To respond to this situation, WASCO funded workshops to develop formal SOPs for O&M at the plants that were ongoing at the time of SI's visit in September 2017.

- EQ 7d: How have the MP and UPUW programs impacted WASCO's income and costs? Has additional income been generated that can be directed to maintaining the new infrastructure?

At the time of the process evaluation, WASCO accounting systems were incapable of reporting on net revenue for each individual network under their management and can report only at the corporate level. Likewise, although expenses from the Metolong Dam and associated works are feasible to separate as discrete costs, remediation of issues on UPUW assets as described in previous sections are not differentiated in WASCO's records from other maintenance and repair costs in annual budgeting or accounting. Likewise, it is difficult to isolate the portion of non-revenue water (NRW) that comes from any one network, as a single figure is reported for WASCO's overall operations.

WASCO finance staff believe that the Semonkong plant has contributed to additional revenue, as have the works in Mapoteng and Package 1 areas. Due to the shortcomings in the way WASCO finances are documented, direct verification of changes attributable to MCC funding is not possible. WASCO staff also explained that MP allowed for some previous water treatment works in Maseru and surrounding areas to

[15] WASCO 2015, pg. 9.

be retired, which removed the cost of staffing and running these, although some water treatment works must remain open to serve townships that were not interconnected with the Metolong Supply. These continue to incur routine expenditures in terms of staffing and materials and capital investment costs for maintenance that would be avoided if the townships were connected to the Metolong source, which provides sufficient supply on its own. Also, given the considerable and unprecedented size of the Metolong Dam and associated works in WASCO's history, the reduced costs in closed water treatment works surrounding Maseru were offset by in new electricity costs in addition to increased and more expensive staff and a significant increase in essential staff transport costs.

NRW decreased from a pre-Compact annual figure of 34% to a Compact-close figure of 27% in 2013. However, NRW rebounded to over 40% after the commissioning of the Metolong Dam, which WASCO operations staff attribute chiefly to vandalism of the DCS and pipe bursts in Maseru. It has since settled to around 31% in early 2018, the most recent data available. Finally, there continue to be large costs to WASCO to remediate or institute temporary solutions to the issues with UPUW works, especially the failing abstraction points at many plants. It was not possible for SI to determine, in consultation with WASCO, the specific value of additional investment required by WASCO for these remediations, but they report that their O&M costs have increased directly as a result of that work.

Anecdotally, WASCO Finance staff perceive that the MP is likely to have contributed a net benefit to WASCO's finances, given the substantial additional water that is consumed and the new customers that have been able to connect to Maseru-area networks. Meanwhile, they perceive that revenue from new customers connected partly in response to the UPUW Activity outside the Central region has been insufficient to offset the significant remediation costs of faulty UPUW outputs. Given the scale of the MP relative to the UPUW Activity, it is reasonable to speculate that the net benefit from the MP exceeds the net cost incurred from UPUW, but WASCO staff interviewed as part of the study were not able to say with certainty that this was the case, due to the consolidated reporting of WASCO's accounting system.

Summative Evaluation

The summative evaluation focused on program results on key short- and intermediate-term outcomes, through IEs, customer surveys, supplemental qualitative data analysis, and secondary data analysis. Results are presented below first for households, followed by industry and enterprises.

- *EQ 7: What were program results on key short-term and intermediate outcomes?*
- EQ 7a: To what extent has access to quality water increased? What activities, if any, has WASCO conducted to encourage households to connect to the network?

Short-Term Outcomes. In sum, comparing population with rates of new connections, it appears that WASCO has succeeded in most of its service centers in maintaining a high level of service or improving service, even as it is increasing access in the context of population growth and urbanization. WASCO data shows an increase in connections across all sites during the time period of interest, a trend that begins near the Compact start-date, toward the end of 2008, potentially suggesting anticipatory effects of the MCC-funded works. In some sites, this trend continues on the same path after the commissioning of the works (Maseru urban, Mafeteng, Qacha's Nek, Quthing, Butha-Buthe, Mokhotlong, and Mapoteng), while in other sites, the trend appears to increase again toward the end of the Compact or around the time of the commissioning of the works (Roma, Mazenod, Mohale's Hoek, Teyateyaneng, and Butha-

Buthe). Household survey data validates these findings. In Roma, Morija, and Semonkong, we see that newly connected households appear to be relying on their piped connection almost exclusively for drinking, having shifted mostly from other piped and other improved sources. Importantly, even among unconnected households we see a reported shift toward greater use of piped sources, pointing to potential spillover. Additionally, new connections appear to have expanded in a pro-poor direction, especially in some sites, while those that remain unconnected are more likely to be of lower socioeconomic status (SES). This is especially apparent in Semonkong where those who remain unconnected are substantially more likely to be of lower SES than those who have become connected. Despite the existence of WASCO's credit policy, described below, between two thirds and three fourths of unconnected respondents, depending on the site, say that cost is their main barrier to connection.

With regard to attribution, the MCC projects can be described most accurately as one of several contributing factors driving this trend, rather than a direct cause. WASCO annual reports describe a number of efforts that WASCO took over approximately a decade which, collectively, are likely to have contributed to the observed increase in new connections over this period. The two most influential factors appear to have been a doubling of the monthly targets for new connections after 2010-11 from three to six thousand per month, which likely set in motion the process of directing or aligning incentives, budget, and/or other institutional resources to increase the number of household connections each year. The second factor is a credit policy described in the 2009-10 WASCO annual report: "The introduction and subsequent promotion of the credit policy whereby customers are given an opportunity to pay for new water and sewer connections in affordable instalments." It is also possible that the timing of the credit policy and increased targets were related to each other and/or to the planned Compact interventions, underlining again that MCC funding is among several interrelated factors contributing to WASCO's broader strategic goals for expanding and improve service delivery.

As with other MCC investments, the projects are meant to support, facilitate, and supplement other efforts by the utility, including through its own funding as well as other government or donor support. In some sites, MCC did directly fund provisions for new household connections (Leribe, Maseru, Mazenod, and Semonkong), though this was a relatively small component of the overall works. In other cases, new connections were facilitated through components of the works including network extensions and new reticulation (Leribe, Maseru, Mazenod, Roma, and Semonkong) or new transmission pipelines (Morija). With this perspective and also bearing in mind findings from the process study showing that the MCC-funded works in many sites did not actually function as intended upon commissioning, the observed trends showing increasing connections over time are likely due to a combination of several factors in some cases including but not limited to the MCC-funded works. The main exception to this is Semonkong, where the increase is entirely due to the MCC-funded works.

- *EQ 7: What were program results on key short-term and intermediate outcomes?*
- EQ 7b: To what extent are community members (including businesses such as manufacturing firms) using water from the urban water network and how has this changed since the Lesotho Compact started?
- EQ 7c: To what extent are community members experiencing cost and time savings, or reductions in water-related illness?

Impact Evaluations. Findings from both IEs are summarized below in Table 4. Our findings indicate no significant impacts on outcomes of interest in townships supplied by Metolong, compared with those not

supplied by Metolong. The results may appear unexpected given the process evaluation findings that the MP was implemented successfully. However, the IE results may mask a "smoothing" effect of Metolong supply, such that its main impact was system-wide and served a purpose of averting shortage in the long-term, rather than having immediate or acute impacts at the household level. Indeed, matched households in both the treatment and comparison group recalled a pre-intervention level of service reliability of about 22 hours per day suggesting that service had not yet declined, at least in terms of continuity, before the Metolong supply was made available. Furthermore, many of the household-level outcomes expected in MCC's original theory of change, such as increased time savings and reduced diarrheal illness, are generally more associated with network extensions than with central network upgrades, which has since been documented in MCC's updated Water Supply and Sanitation Sector Cost-Benefit Analysis Guidance.[16] While central upgrades can theoretically improve reliability, given pre-intervention levels of service delivery, the new Metolong supply may simply enable it to stay this way for longer.

Results from the IE of improved access in Semonkong show large and significant impacts for households who have gained a new connection, as a result of the UPUW Activity. Connected households in Semonkong have essentially eliminated all water collection from outside the home, while increasing their per capita water consumption substantially, to a level that is generally expected to meet all domestic needs.[17] Households that have remained unconnected continue to consume at a level sufficient only for basic consumption and hygiene. Connected households pay significantly more than unconnected households for water, an unsurprising result in Semonkong given their complete transition from free water provision to WASCO service provision. Although connected households reported a lower prevalence of diarrheal illness among children under five, the difference was not statistically significant.[18]

Similar to Semonkong, in Roma and Morija, results show that households with new connections have reduced water collection outside the home and increased water consumption. The impacts on time savings and volume collected from water collection outside the home were less strong than in Semonkong, which makes sense in the context that households in Roma and Morija may have had other, closer sources of water available to them, prior to the interventions as compared with households in Semonkong. Like in Semonkong, connected households reported a lower prevalence of diarrheal illness among children under five, but the difference was not significant. Unlike Semonkong, households in Roma and Morija did not have statistically different water expenditures than their unconnected counterparts.

Table 4. Summary of findings from IEs

OUTCOMES	SUPPLY MASERU URBAN	ACCESS SEMONKONG	ACCESS ROMA & MORIJA
TIME SAVINGS	☒	☑ **+ 24 min./day**	☑ **+ 12 min./day**
WATER COLLECTION	☒	☑ **- 83 liters/day**	☑ **- 62 liters/day**

[16] Osborne 2019.
[17] Howard and Bartram 2003.
[18] Due to the low number of children under five surveyed, our statistical power to detect an effect if one exists is low. Some predictors of health outcomes, such as water quality and hygiene resources, favor the possibility of reduced illness in newly connected households.

OUTCOMES	SUPPLY MASERU URBAN	ACCESS SEMONKONG	ACCESS ROMA & MORIJA
 WATER CONSUMPTION	☒	☑ **+ 46 liters per capita per day (lpcd)**	☑ **+ 73 lpcd**
 DIARRHEAL ILLNESS	☒	☒	☒
 WATER EXPENDITURES	☒	☑ **+ 35 Maloti/mo.**	☒
 RELIABILITY	☒	n/a	n/a

It is important to note limitations in attribution involved in both designs. For the IE focused on Metolong supply in Maseru urban, it is practically impossible to separate the MCC-funded components of the MP from the rest of the works; therefore, attribution would be relative to the totality of the MP and Package 1 interventions. For our IE of increased access in Maseru peri-urban, the household connections that define the treatment group cannot be solely attributed to MCC. It is not feasible to link *specific* household connections or connections in specific *areas* to MCC funding. The commissioning date of the UPUW works in each site is used as a threshold to define connections that occurred before and after the completion of the MCC-funded works, an admittedly imperfect measure of treatment in these sites. This threshold is used as way of indicating which households were *most likely* to have benefited from the MCC-funded infrastructure *via* their new connection. Attribution in Semonkong is not subject to these same limitations since there was no network at all prior to the Compact and all new connections in Semonkong, and any benefits conferred, can be fully attributed to the MCC interventions.

Customer Survey. Overall, we find that WASCO is reliably delivering a quality water supply to its customers except in water networks with severe, known service delivery issues, such as Mohale's Hoek, Leribe, Butha-Buthe, and Mokhotlong. As in the IE, new customers also report time savings in water collection and increased consumption, though the customer survey relies on before and after recall without a relevant comparison group for estimating impacts. In some Package 3-5 sites, consumption appears to have increased even for existing customers, suggesting improvements in service delivery since before the UPUW works were commissioned. In sites where UPUW Activity implementation was poor reliability is considerably lower than the country-wide average and the data suggest that this intermittency may be negatively associated with water quality. Nevertheless, across all sites, a plurality of WASCO customers perceives that diarrheal illness has become less common over time.

Spillover on unconnected households using neighbors' taps. Findings from the IEs indicate that there may be considerable spillover occurring to unconnected households who live in proximity to connected households. This suggests that unconnected households have also benefited from expansions in access to piped water, further implying that the estimated impacts above are likely a lower-bound of overall impact since they do not take into account the benefits on the unconnected households,

and because the impact on newly connected households is likely attenuated by the spillover. This spillover appears in the form of increases in time savings, access to piped water, and expenditures.

About 41% of households in Semonkong and 53% of unconnected households in Roma and Morija report using a neighbor's tap for all basic domestic purposes including drinking, cooking, bathing, washing hands, household cleaning, and laundry.[19] Approximately the same percentage report it is their main source for those activities. Conversely, the percentage of newly connected households who reported allowing their neighbors to collect water from their tap was 13% in Roma and Morija and 20% in Semonkong. In Maseru, 9% of households in both Metolong- and non-Metolong-supplied areas reported allowing neighbors to collect water from their tap. Most connected households who allow neighbors to connect report about two neighbors who collect water from them.

When connected households were asked how much they are paid by neighbors per month, responses were large in relation to their average water expenditures. Connected households in Semonkong, for example, average 69 Maloti per month in water expenditures, relative to an average of 59 Maloti reportedly received from neighbors. Since a relatively small number of households report selling water to neighbors, this phenomenon does not greatly alter the IE results detailed previously in terms of increased expenditures. However, these data suggest that households who allow their neighbors to collect from their tap may be recovering a substantial portion of their own water bill from their neighbors.

FGDs indicate that unconnected neighbors used water from connected neighbors taps in all project sites. The majority of unconnected households paid for the water on either a monthly basis or a per-container basis. These fees are a source of tension for both the connected and unconnected households. One respondent said that her neighbor insists on splitting the monthly 300 Maloti WASCO bill with her, even though she says she does not access or use as much as the owner. For their part, connected households expressed frustration that the unconnected households did not have to pay the costly initial connection fee or sometimes were unable to pay the negotiated fees. Connected households often say they are not charging for water per se, but rather collecting a nominal amount that goes to paying the bill, and that they are helping their unconnected neighbors. Unconnected households feel as though they pay too much, and many suspect that their neighbors are taking advantage of them to help subsidize their bills.

Unintended effects on rural villages along the DCS. The Metolong DCS, which conveys the bulk Metolong Supply to reservoirs in Maseru, Mazenod, Roma, Morija, and Teyateyaneng, bypasses rural villages in central Lesotho that were historically served by the Ministry of Water's DRWS. The MP, as an urban water supply project, did not contemplate providing water to these villages under its purview. However, shortly after the Metolong Dam's commissioning and coinciding with a period of acute drought, easily accessible portions of the DCS along roadsides were vandalized by people seeking to supplement the drought-induced shortage of other water supply sources with free water from the Metolong Dam. As vandalization of the DCS became more commonplace and vandalized sites became more frequently exploited as a regular source of water supply, the Ministry of Water decided to install taps at the sites of vandalization under the logic that the flow of water could at least be controlled, rather than leaking freely. Those taps remain a key source of water for rural communities along the DCS.

While these communities appear to have benefitted from access to the Metolong DCS in the form of increased water consumption, their use of the Metolong supply has also potentially created other

[19] 37% of households in Semonkong report using a neighbor's tap for laundry.

challenges while exacerbating social inequalities between those with and without the means to easily access that water. Apart from potential effects on villagers, WASCO cannot recover costs for this water use, effectively increasing WASCO's NRW figures. Meanwhile, where institutional responsibility for water service provision to these communities used to rest clearly with DRWS, the availability of water from the DCS and failed attempts to extend this water closer to villages through tertiary pipelines have left a vacuum in terms of institutional responsibility, where neither DRWS nor WASCO appears accountable for service provision. This institutional vacuum has left these communities increasingly dependent on the DCS source of water and without recourse when occasional supply issues arise, all while imposing significant financial cost on WASCO and, by extension, urban water consumers.

Many villagers participating in focus groups report more time spent collecting water compared to their previous situation, since the taps along the DCS are quite far from the majority of homes that rely on them. For those who live far but are able to travel to the taps on foot, the journey can be time-consuming, arduous, and sometimes dangerous. This situation has reportedly highlighted an inequality between those who live close to the DCS or have cars for transporting water, and those who live far away or face other barriers in accessing water from the DCS taps.

Further, there are some reports that people beyond the villagers for whom the taps were intended are taking advantage of this water for other purposes. In Ha Makhalanyane, there are reports of residents of Maseru and other cities driving to the DCS taps with large storage containers to take advantage of the free water for economic purposes such as brick-making. People from the village with smaller storage vessels have to wait for the large containers to be filled before they can fill theirs.

Respondents report that the Ministry of Water attempted to respond to this issue through the construction of tertiary lines from the DCS leading to public taps in nearby villages, which dispense water based on a paid token system, with funding from the GoL. However, in both villages, the public taps are plagued with a variety of problems, including low water pressure, poor water quality, broken equipment, and frequent unplanned cuts to the water supply. In Ha Makhalanyane, only one of the eight public taps were working as of May 2019. These consistent problems have left villagers in both locations frustrated with their current water access situation.

Industry & Enterprise. Through these case studies, and corroborated by secondary employment and water consumption data obtained from Lesotho National Development Corporation (LNDC) and WASCO, we have learned that increasing the bulk supply of water available to Maseru may have satisfied a necessary condition for the entry of new firms and the continued operation and growth of existing firms. However, according to the interviewed firms, increased growth was less directly connected to water supply and more strongly associated with political stability and ongoing support of the African Growth and Opportunity Act (AGOA) mechanism, together with macroeconomic trends favoring increased demand from major markets such as the United States, South Africa, India, and China. Additionally, new entrants into these industries are not the ones hypothesized by the MCC project. Water supply was only one of several barriers to entry, with a lack of adequate wastewater treatment reportedly posing a much more significant barrier to firms engaged in wet processes of production. Further, the extension of AGOA ran counter to ERR assumptions and continued to make it cheaper to import fabric duty-free, and thus the need or incentive for a new fabric mill was nearly eliminated. Further, firms engaged in wet processes perceive that the increased cost of water in recent years roughly offsets the increased revenue from less frequent plant shutdowns or production decreases that the improved water supply provides.

Finally, and perhaps critically, the industrial firms in Maseru are almost entirely supplied from the pre-existing Maseru Water Supply facilities. The Metolong Dam does not supply industrial estates directly.

The UPUW Activity ERR assumed that SMEs in urban areas of Lesotho where the UPUW activity operated would respond to an improved water supply by experiencing decreased manufacturing costs, taking advantage of increased manufacturing opportunities, and/or investing in new productive capabilities. As we have seen from the process evaluation findings, this theory of change broke down at the first stage in areas like Mohale's Hoek, Butha-Buthe, and other sites where the WASCO water supply is similar to or worse than it was prior to the Compact. However, even in areas where the supply seems to have improved such as in Maseru, peri-urban Maseru, and Semonkong, well-informed government and non-government stakeholders in the SME sector did not perceive significant effects on businesses. Informed stakeholders contend that any changes in the SME sector over this time period have more to do with broader contemporaneous economic trends than with any changes in water supply.

Synthesis of Findings Against Program Objectives. Compact investments made meaningful contributions in terms of improving the water supply for domestic and industrial use in urban Lesotho, but these improvements in supply have only yielded meaningful outcomes aligned with the Compact goals for certain subsets of the target beneficiary population, especially new domestic users, in certain sites where implementation was strong. Other non-water sector constraints to growth in the textile industry must be removed before this industry can further capitalize on the improved supply. However, the increased bulk supply will significantly prolong the timeframe over which domestic users of water in urban Lesotho have a reliable, high quality water supply.

Economic Rate of Return

Metolong Program. The economic rationale for the MP included the assumption that: "the absence of secure water supply to industry prevents Lesotho from attracting foreign direct investment to set-up new industries, and particularly so-called "wet" industries, such as knitted-fabric mills, the presence of which would remove Lesotho's dependence on the AGOA third country fabric provision for knit fabric exports to the United States. Some 28,000 employees could lose their jobs had the third country fabric provision expired in September 2007." MCC estimated that the MP would result in an ERR of 24.1% over twenty years, taking into account the costs of constructing, operating, and maintaining the Metolong works and benefits in the form of preserved and new employment in the textile industry, quantified through wage income.

It is not clear that any economic benefits aligned with MCC's original economic analysis can be attributed to the MP to date, even if some could arise in the future, and despite the overall success of its implementation. Although the MP supplies sufficient water in bulk to Maseru and surrounding areas for water-intensive textile and garment manufacturing firms to open, operate, and expand, there has been very little change in the size or number of "wet" textile firms since the commissioning of the Metolong Dam. Further, virtually all industrial firms in Maseru are supplied by the pre-existing Maseru water treatment plant, not the Metolong Dam. A key assumption underlying the causal mechanism for this change was the construction of a knit garment milling facility following the expiration of AGOA, but AGOA has been extended until at least 2025 and no such milling facility, nor any other significant investment in "wet" manufacturing infrastructure, such as wastewater treatment facilities, has been made that would enable new or expanded firms.

UPUW Activity. Insights from the evaluation suggest that the estimated ERR for the UPUW Activity would also be lower. The UPUW Activity, to the extent that it enabled access to piped water to households who would not have had access without it, certainly can claim a sizable reduction in time spent collecting water for such households. However, we do not find evidence of such a reduction among households who were already connected to the networks in Maseru. We also do not find evidence of a reduction in child diarrheal illness, although this finding could be sensitive to low statistical power, given the indications in water quality testing and questions regarding hygiene that suggest connected households may be less vulnerable to such illness than unconnected households. Further, we do not find evidence of investment enabled by improved water supply. Finally, the costs of operating and maintaining UPUW infrastructure are likely considerably higher than anticipated, since much of this infrastructure, outside of pipelines and reservoirs, has required remediation or replacement.

Potential Lessons for Future Models. The assumptions underlying the MP ERR were misaligned with the way that responsible parties ultimately intended to use the water. According to WASCO Annual Reports, the now-defunct Tikoe Thetsane Industrial Water Supply Project was in process as early as 2008, near the beginning of the Compact. With a dedicated water supply to the two major industrial estates in Maseru, the GoL sent a clear signal that the MP water would be targeted for domestic use. The MP economic analysis could have been recalculated with likely domestic users in mind. Furthermore, even if the MP was directed to industrial customers in practice, our case studies reveal that water supply was not a singular, binding constraint to private investment in wet industries in Lesotho. Future cost-benefit analyses should enumerate what other major constraints are likely to be so that these can be monitored over the course of the Compact and considered in the analysis of whether or not anticipated benefits manifested. Additional consideration might also be given to estimating the economic value of avoiding an acute water supply shortage. WASCO's consumption and NRW data suggests that the pre-existing Maseru supply might have been sufficient to satisfy non-industrial demand with the assistance of the Maseru water treatment plant to the present day, and even potentially into the future.

Many of the key parameters and assumptions informing the UPUW ERR were drawn directly or adapted from a rural water programming context. Although the narrative of the ERR acknowledged some of the ways that the urban water context might affect economic benefits, future economic analyses would benefit from more targeted measurements of pre-existing conditions and feasible program effects on outcomes of interest to calculate benefit streams. MCC's recent Water Sector Cost-Benefit Guidance acknowledges that time savings and health outcomes are more likely to manifest in the context of new infrastructure (i.e. new connections) rather than upgraded infrastructure (i.e. improved service), but economic analyses should further take into consideration that benefits may also vary depending on whether new connections are to an entirely new network, as in Semonkong, or to an existing network.[20] There may be additional consideration due in these dynamic urban contexts where unconnected customers may be receiving considerable spillover benefits via water collection from connected households, and to consider other realities of urban water service that call for differentiating the parameters used in economic analyses include multiple concurrent source use, household storage practices, and sanitation and environmental conditions within the household, as well as the range of different potential results in urban and peri-urban sites even within the same country context.

[20] Osborne 2019.

Lessons Learned

The urban water programming of the MCC Lesotho Compact had a wide range of results both in project implementation and final outcomes. From the process evaluation, differences in the implementation fidelity and current functionality of MP-funded and UPUW Activity-funded infrastructure drive home important lessons regarding project preparation, project management, and contracting for large-scale infrastructure programs. Given MCC's fixed five-year Compact timeframe and preference for fixed fee contracts, it is important with widespread infrastructure projects to use the due diligence and project preparation phase to ensure that project details are fixed, prioritized, and aligned with a clear and well-evidenced logic and end-goal.

If details including project scope and design can be fixed at the project preparation phase stage, MCC's preference for fixed fee contracts may be workable. However, if a Design and Build Engineer (DBE) or DCSE Engineer must design and scope work iteratively over the course of the Compact, as was the case in the UPUW Activity, selecting a fixed fee contract over a more typical cost-reimbursable model may open the project up to risk. This is especially true if the contract does not ensure an adequate liability period following commissioning of the works. As a best practice, contracts should include at least two years following the defects remediation period for design and supervision engineer liability. Finally, the difference in performance between the MPMU and the various iterations of the UPUW PIU underscore the necessity of adequate project management by a qualified entity in ensuring project success.

From the summative evaluation, our findings provide further support to the literature, including that which has informed MCC's most recent guidance for cost-benefit analysis of water sector programming,[21] especially regarding the types of program benefits that can be expected by upgrading central infrastructure versus expanding access, and key differences that must be considered for urban contexts.

Next Steps

SI has presented findings to MCC at their headquarters in Washington, DC, as well as for local stakeholders in Maseru, Lesotho. The final report includes revisions made on the basis of feedback from stakeholders. The report and public de-identified datasets will be published on MCC's evaluation catalog by mid-2020.

[21] Osborne 2019.

1 INTRODUCTION

1.1 Background and Context

Lesotho is a landlocked country in Southern Africa, approximately 30 thousand square kilometers in size with a total population of approximately 2.1 million people.[22] Lesotho is enclaved within the Republic of South Africa, and with its mountainous terrain, the lowest point across the entire country is 1400 meters above sea level. While Lesotho's population remains largely rural, in recent decades, its urban population has experienced rapid growth in large part due to job opportunities and access to services, reflecting an ongoing shift in Lesotho's economy from rural agriculture to manufacturing.[23] Over time, the increased population in urban areas has put strain on limited resources and resulted in expansion of peri-urban areas, especially around the capital of Maseru.

Due to its geography, water is an abundant natural resource in Lesotho. It is one of the country's main exports, along with diamonds, with most water exported to neighboring South Africa through the Lesotho Highlands Water Project.[24] Despite the abundance of the resource, infrastructure limitations have resulted in shortfalls in terms of delivering clean water domestically. By 2008, domestic and industrial demand for water in urban areas was rising faster than the available supply, resulting in declining reliability of the piped water supply and access limitations especially in peri-urban areas.[25] Under these conditions, the Lesotho Water and Sewerage Company (WASCO),[26] the utility managing piped water service delivery in urban areas across the country, was unable to expand service to rapidly growing urban and peri-urban areas. Further, a secure water supply was seen as a prerequisite to attract new investment in the textile and garment industry, which employs approximately 40% of the population – most of them women – and contributes nearly half of Lesotho's gross domestic product.[27]

The Government of Lesotho (GoL) and Millennium Challenge Corporation (MCC) sought to address these challenges through investments made as part of a Compact implemented between 2008 and 2013.[28] Among other objectives, Compact programming sought to "improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management;"[29] The Compact included two distinct but related investments in Lesotho's urban water sector: the Metolong Program (MP), and the Urban and Peri-Urban Water (UPUW) Activity. The combined objective of these investments was to ensure an adequate and reliable supply of quality water in urban areas of Lesotho, for domestic, commercial, and industrial use to satisfy demand "well beyond" 2020.[30]

[22] United Nations Population Division 2019.
[23] PEM Consult 2010.
[24] Gain 2018.
[25] Millennium Challenge Corporation n.d.(b).
[26] WASCO was officially incorporated in 2010, two years into Compact implementation. Prior to incorporation, this entity operated as the Water and Sewerage Authority (WASA), a government department within the Ministry of Public Works. See Ministry of Water website.
[27] Gain 2018.
[28] The MCC Lesotho Compact included investments in urban and rural water, health, and private sector development. Additional information about the Lesotho Compact can be obtained at the MCC Compact website (link). This evaluation pertains only to MCC's investments in Lesotho's urban water sector.
[29] Millennium Challenge Corporation 2008(a).
[30] Mott MacDonald, Ltd. et al. 2007.

1.2 Evaluation Purpose & Scope

Social Impact (SI) was contracted by MCC to conduct an evaluation of the Compact's water investments, including the MP and the UPUW Activity. The purpose of the evaluation is two-fold. First, it serves an accountability purpose by assessing implementation and impact relative to the project's stated goals. Second, it serves a learning purpose by highlighting ways that MCC, or other donors and institutions, might build on demonstrated successes or otherwise improve the design and implementation of urban water projects in similar contexts in the future.

The scope of the evaluation covered multiple components including an evaluability assessment to inform the design and methodology, a process evaluation assessing the overall implementation of the interventions, and a summative evaluation primarily focused on assessing the impact of the interventions at the household-level, while also examining potential effects on industry and enterprises.

1.3 Evaluation Report Objectives & Structure

The objective of this evaluation report is to provide responses to a series of eight evaluation questions (EQs) posed by MCC related to project implementation and impact (listed in Section 4.2).The structure of the report is as follows. We first provide a detailed overview of the MCC Lesotho Compact's interventions in Lesotho's water sector, including a summary of MCC's project logic and theory of change, as well as the entities involved in implementing these interventions (Section 3). We then place our study in the context of existing research in the water sector, highlighting evidence gaps that this evaluation contributes to filling (Section 4). We then summarize the evaluation design and methodology for each component of the evaluation including the evaluability assessment, process evaluation, and summative evaluation. (Section 4; additional methodological detail can be found in Annex B: Methods & Additional Data).

Findings from all components of the evaluation are then described in depth in Section 5. Following the detailed findings, we discuss the link between the evaluation findings and MCC's cost-benefit analysis and original targets. This section concludes with a discussion of lessons learned. Finally, the report concludes by summarizing next steps for the dissemination of evaluation results (Section 6).

2 OVERVIEW OF COMPACT & INTERVENTIONS

2.1 MCC Lesotho Compact

MCC entered into a Compact with the GoL between 2008 and 2013. This $362.5 million Compact included activities in the water sector, the health sector, and private sector development. These activities were meant, in tandem, to increase economic growth and reduce poverty in Lesotho. The Water Sector Project aimed to increase access to improved water supply and sanitation for rural and urban communities. Separate interventions were carried out for urban and rural areas. SI's evaluation is focused on urban water activities, described in depth below. These interventions together accounted for $103.8 million of the Compact's disbursed funds, with about $69.3 million dedicated to the MP and $34.6 million dedicated to the UPUW Activity.[31]

[31] Millennium Challenge Account – Lesotho Weekly Financial Report, October 7, 2013.

2.2 Interventions & Geographic Coverage

The Compact included two distinct but related investments in Lesotho's urban water sector – the MP, and the UPUW Activity. The MP financed by MCC was part of a larger $428 million effort co-financed by a consortium of donor partners, which centered around the construction of a new dam meant to provide a long-term, reliable bulk water supply to Maseru and surrounding towns.[32] MCC's specific contributions primarily included funding for the new Water Treatment Works (WTW) downstream from the Metolong Dam, a new transmission system (downstream conveyance system [DCS]) to Maseru and surrounding towns, and the Metolong Program Management Unit (MPMU). Once the Metolong Dam was commissioned, the MP meant to assist Maseru and surrounding areas keep up with increasing urbanization and demand through at least 2020.

Estimated populations in MP sites from 2006 to 2016, original demand and supply capacity in these sites as estimated in the 2007 Metolong Dam Additional Feasibility Study, and projected demand and target supply following completion of the MP and complementary works, are presented below in Table 5. Unlike the MP, due diligence documentation for the UPUW Activity did not detail pre-existing and projected supply and demand for water by site. The only exception is in Semonkong, where a new water supply system was installed. There, demand was projected to increase from 0.56 to 0.89 Ml per day from the pre-intervention period to 2020. The design capacity of the Semonkong water supply system, intended to satisfy demand through 2065, was 1.5 Ml per day.

Table 5. MP and UPUW Package 1, Site Context

Urban center	Pop. (2006)	Pop. (2016)	Estimated demand (Ml/day) Pre-intervention	Existing supply (Ml/day) Pre-intervention	Demand projection (Ml/day) for 2020	Supply Target post-intervention (Ml/day)
Maseru	197,907	330,760	34.00	34.00	67.82	75.0
Mazenod	27,553 *	19,744 (est.)**	1.53	3.0	2.08	75.0
Morija	6,909 (est.)**	7,595 (est.)**	0.59	0.4	0.80	75.0
Roma	11,557 (est.)**	13,347 (est.)**	1.40	1.1	1.95	75.0
Teyateyaneng	61,475	24,257	Not estimated	Not estimated	Not estimated	75.0

Population data source unless otherwise stated: Lesotho Bureau of Statistics (census data); 2016 includes foreigners. (https://www.citypopulation.de/Lesotho.html)

* Source: http://www.bos.gov.ls/Census_Pre_Results_2006.htm

** Figures not available from published BOS census data are presented as estimated in Metolong Additional Detailed Feasibility Study

Although it also aimed to help urban water networks in Lesotho keep pace with population growth, the UPUW Activity mostly targeted rehabilitation, improvement, and expansion of urban water networks in Lesotho rather than increases in bulk supply to urban centers. The urban areas targeted are mostly in the lowlands of Lesotho, including the capital of Maseru and surrounding towns, as well as the majority of other urban areas around the country. Some of the targeted UPUW sites, including Mokhotlong, Semonkong, and Qacha's Nek, are located in the mountainous center and east of the country, with just one site, Quthing, located in the Senqu River Valley. Many of the UPUW sites are formally considered peri-urban since they are the most significant urban agglomerations in their respective surroundings but

[32] Other partners in this consortium include OPEC Fund for International Development, the Kuwait Fund for Arab Economic Development, Arab Bank for Economic Development in Africa, Saudi Fund for Development and the World Bank, and the European Union, along with the GoL.

still have smaller populations. These include Mapoteng, Mokhotlong, and Semonkong, as well as areas surrounding Maseru including Roma, Morija, Mazenod, and Teyateyaneng.

Original UPUW Activity due diligence documentation contemplated splitting UPUW outputs into nine "packages" based on the specific infrastructure envisioned for rehabilitation, improvement, or extension; from basic pipeline or reservoir rehabilitation or addition in sites like Maseru to wholesale water network installation in Semonkong.[33] By the time that engineers were contracted to implement the UPUW Activity, works were distilled into five packages based on geographical proximity, the nature of the infrastructure funded, and the priority of the works to WASCO as their final user.[34] Over the course of Compact implementation, and with shifting priorities from funding and beneficiary parties, the components involved in each site and the sites in each package shifted relative to original plans.[35] A diverse set of components within each package broadly aimed to improve supply, reduce unaccounted-for water, and increase storage to help the various towns keep pace with increasing urbanization and a growing population. A summary of the final set of program components is presented in Table 6 and Figure 1..

By the time of Compact completion, not all of the construction of MCC-funded works had been finished (see Table 7). For the MP, this was due in part to the reliance on concurrent work of complementary funders who were not constrained by the five-year Compact period. For the UPUW Activity, this relates to the changing scope of project packages over time and other issues with unsatisfactory project implementation to be discussed further later in this report. The UPUW works were completed between March and June of 2014, and the unfinished MP works were finished well before the commissioning of the Metolong Dam in March of 2015. As Table 7 shows, where the MP and UPUW Activity just about met their targets for specific physical infrastructure outputs like pipeline coverage and households with provisions for connections by Compact end, exceeding targets for reservoir construction and rehabilitation. Although it is hard to be certain with the information available, it is likely that the targets for pipeline coverage and provisions for household connections were also exceeded as the unfinished works were completed in the years following Compact closure. While WASCO's non-revenue water (NRW) was reduced by the end of the Compact relative to the pre-Compact period, it did not fully reach the pre-Compact target. As discussed in more detail later in this report, NRW actually increased above pre-Compact levels following commissioning of the Metolong Dam, although the most recent figures suggest it has rebounded about to the level it achieved in September 2013.

Table 6. Summary of MCC Lesotho Compact urban water activities

Metolong Program	Urban and Peri-Urban Water Activity
♦ New Metolong water treatment works including a raw water transmission main from Metolong dam ♦ New transmission system to Maseru ♦ Bulk water supply components for Morija, Roma, and Mazenod ♦ Designs for Teyateyaneng conveyance system ♦ Metolong Program Management Unit ♦ Environmental and social mitigation measures	♦ New or rehabilitated infrastructure including reservoirs, pipelines, treatment works, filters, tanks, reticulation, chlorination, service roads, pumps, household provisions, and others ♦ 13 urban & peri-urban areas: Maseru, Mazenod, Roma, Morija, Semonkong, Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek, Mokhotlong, Butha-Buthe, Leribe, and Mapoteng

[33] See discussion on page ES-16 of MWH Project B Due Diligence Report (MWH Americas, Inc. 2007(b)).
[34] As detailed on page 38 of the UPUW Activity Design and Construction Supervision Engineer's contract.
[35] Maputsoe was removed from among the Package 4 locations, Roma, Morija, and Teyateyaneng were added to Package 1, and specific components tailored to the needs of each remaining site were added.

Figure 4. Map of MCC Lesotho urban water interventions, by package and site

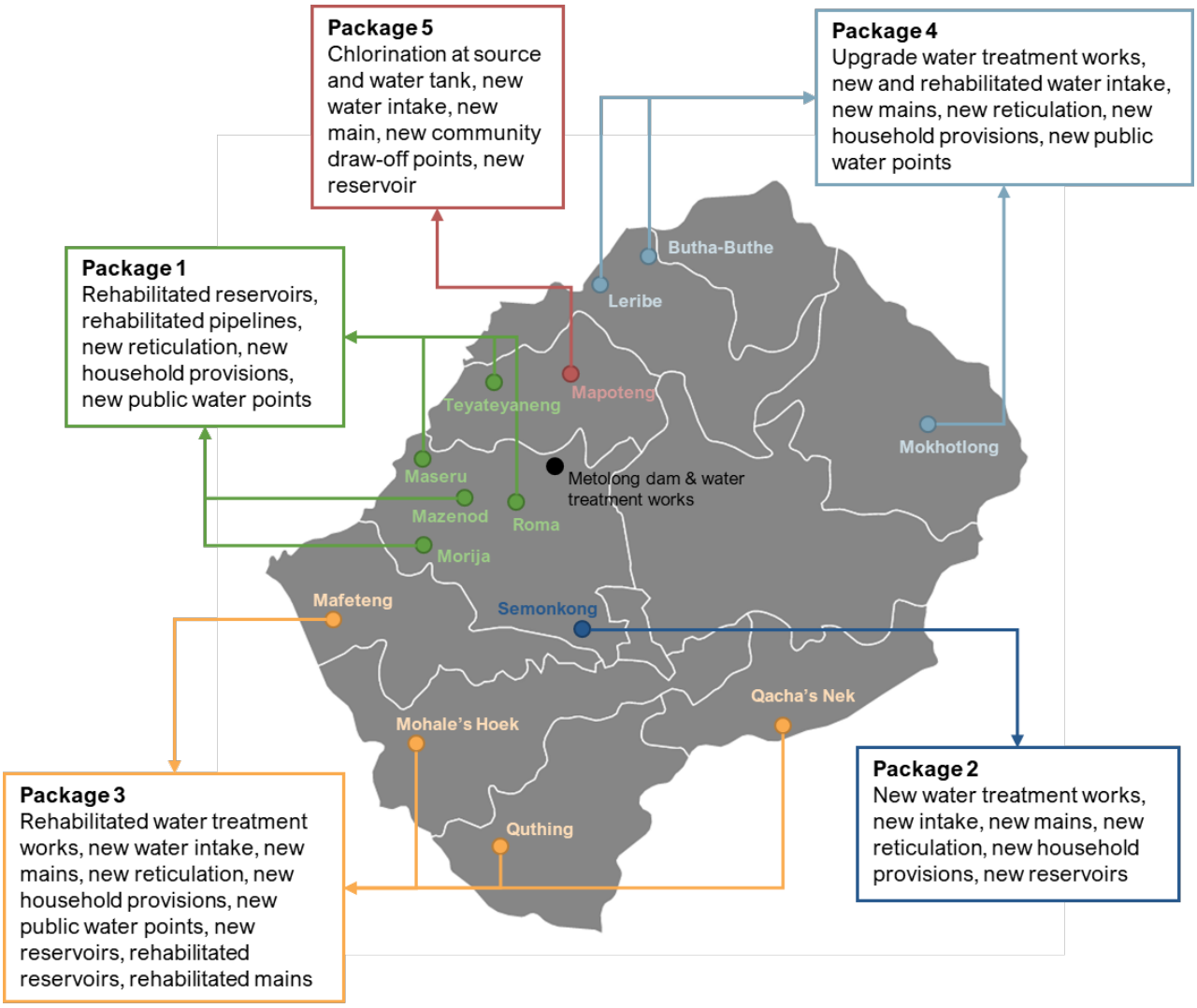


Table 7. MCC Urban water projects Indicator Tracking Table (ITT)

Level	Indicator	Unit	Baseline	End-of-Compact Target	Actual (Sep-2013)	% of Target (Sep-2013)
Outcome	NRW	Percentage	34%	25%	27%	78%
Output	Water pipes coverage	Kilometers	0	173.67	164.3	95%
Output	Households with provisions to connect to water networks	Number	0	2454	2312	94%
Output	Reservoirs Constructed	Number	0	8	13	163%
Output	Rehabilitated Reservoirs	Number	0	4	5	125%
Output	Upgraded pumping stations	Number	0	3	5	167%
Output	Functioning Metolong Water Treatment Plant	Date		30-Jul-2013	PENDING	PENDING
Process	Temporary Employment Created	Number	0	--	200	--
Process	Metolong WTW Contract signed and awarded	Date	--	30-Sep-2010	30-Sep-2010	COMPLETE
Process	Value of Metolong WTW contract	USD	0	$ 55,000,000	$ 61,165,487	111%
Process	Percentage physical completion of Metolong WTW contract	Percentage	0%	100%	82%	82%
Process	Amount of feasibility and/or detailed design contracts and construction supervision disbursed for Urban water systems	USD	$ 0	$ 4,464,586	$ 3,594,133	81%
Process	Physical completion of Package 1 (Maseru and Mazenod)	Percentage	0%	100%	100%	100%
Process	Physical completion of Package 2 (Semonkong)	Percentage	0%	100%	82%	82%
Process	Physical completion of Package 3 (Mafeteng, Mohale's Hoek, Quthing and Qacha's Nek)	Percentage	0%	100%	96%	96%
Process	Physical completion of Package 4 (Mokhotlong, Botha-Bothe, Leribe and Maputsoe)	Percentage	0%	100%	100%	100%
Process	Physical completion of Package 5 (Mapoteng)	Percentage	0%	100%	100%	100%
Process	Finalize designs and tender documents for the urban water project	Date		30-Apr-2010	9-Dec-2010	COMPLETE

2.3 Program Logic & Theory of Change

Below we summarize the project logic and theory of change as posited by MCC for impacts on households, industry, other enterprises, and the utility. The program objective related to the Water Sector Project was to improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management. Below we describe the theory of change for the urban water activities at the household, industry, and utility levels, This theory of change links the program objective of improved water supply with the Compact Goal of economic growth and reduced poverty, forming part of the economic rationale for the Project. The theory of change below also summarized below in Figure 5..

2.3.1 Household level

The household theory of change asserts that increasing the amount of water in an urban network, upgrading infrastructure, and improving and extending the network would lead to increases in access and coverage, reliability, and quality of water for households, which would result in time savings and reduced diarrheal illness, ultimately increasing the time and resources available for generating income.

The household-level benefit streams considered in MCC's economic rate of return (ERR) calculation for the UPUW activity include: (i) time saved in water collection, (ii) time saved in obtaining medical treatment for water-related illnesses, and (iii) reduced mortality for children under 5 due to water-related illnesses. The economic value of these benefits is assumed to be the value of incremental labor availability from time savings, and incremental increases in future income from the reduction in mortality. The ERR assumes a 50% reduction in time spent collecting water and obtaining medical treatment, and a 30% reduction in diarrheal illness mortality for children under five. MCC calculated an 8.5% ERR on UPUW, independent of any enterprise-level impacts.

2.3.2 Industry & Enterprises

Industry. MCC hypothesized that an increased supply of quality, reliable water would result in expansion and growth of industrial firms, ultimately leading to more employment opportunities and greater production. The MP ERR considered as its benefit streams the preserved and additional income resulting from the preservation and expansion of industry employment, and expansion of industry employment. The original ERR rested on an assumption that a local milling facility, which would not be possible without additional water supply, would be required to sustain the industry following the anticipated termination of the African Growth and Opportunity Act (AGOA) third country fabric provision.[36] In reality, AGOA was extended and this condition thus never came to pass. The ERR also assumed that increased water supply would be a requirement for further expansion of the textile industry at the new Tikoe industrial estate. MCC calculated an ERR of 24.1% for the MP.

Enterprises. Early Compact planning documents to which SI has access did not clearly differentiate between intended outcomes for textile and garment industry versus other enterprises. However, expected benefits to small and medium enterprises (SMEs) are considered in the UPUW ERR, rather than the MP ERR. The UPUW ERR posited that SMEs would invest further in productive capabilities because of improved water supply. This relates to the final benefit stream in the UPUW ERR: an increase in private

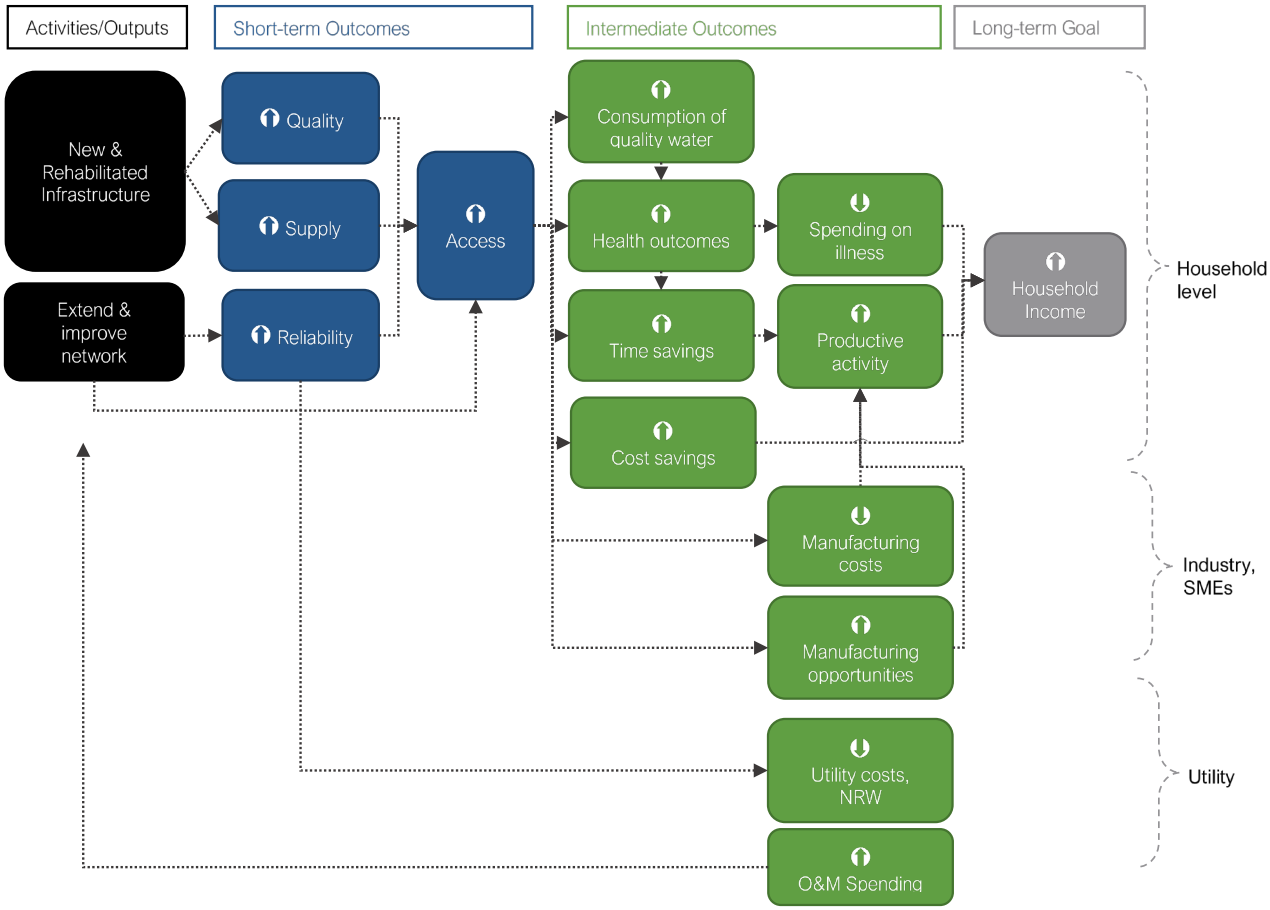
[36] AGOA is a trade act enhancing market access to the United States for sub-Saharan African countries including Lesotho, through which textiles and garments can be exported to the United States duty-free, allowing competition with cheaper firms from Asia.

investment due to greater water availability. At the outset of the project, Millennium Challenge Account-Lesotho (MCA-L) intended to use an enterprise survey to measure new enterprises opened due to the availability of water and new enterprises connected to the rehabilitated water network. However, these indicators were removed in a later amendment on the basis that the UPUW Activity would not count connections as a program output, and thus commercial water supply and consumption was no longer considered a direct outcome of the project.

2.3.3 Utility

MCC hypothesized that improved reliability would result in greater cost recovery for WASCO, which could then be allocated to operations and maintenance (O&M) to maintain the new infrastructure. In the Post-Compact M&E Plan, one outcome indicator tracked the amount of money budgeted for O&M by WASCO.

Figure 5. Theory of change



2.4 Program Participants & Beneficiaries

Early project documentation defined beneficiaries as the full population of each urban area targeted by the MP and UPUW activity. Elsewhere, MCC posits that the project would benefit "urban and peri-urban people who are currently not being served and who do not have access to reliable/consistent supply."[37]

[37] Millennium Challenge Corporation 2010.

In a later revision of the M&E plan, MCC references a new beneficiary analysis methodology, which results in a new estimate of 50% of the urban populations. The economic model focuses on the former, and estimates benefits for previously unserved households, which is assumed to be 40% of the urban populations. The original M&E Plan estimates that the UPUW activity had the potential to benefit up to 304,000 people (or 50,700 households), reflecting the entire population of the treatment areas. The final Compact M&E Plan revised this estimate downward to 124,248 people (around 20,700 households), including domestic and industrial consumers reflecting the redefinition of beneficiaries to include only the portion of the urban population that did not have existing piped, in-house water supplies.

MCC envisioned that the following entities would potentially benefit from the MP and UPUW Activity:

- Household beneficiaries: Any household with a connection to WASCO, whether pre-existing or new in the ten UPUW sites: - Maseru and surrounds, Semonkong, Mafeteng, Mohale's Hoek, Qacha's Nek, Quthing, Butha-Buthe, Leribe, Mokhotlong, and Mapoteng.
- SME beneficiaries: Owners and employees of any formal or informal SME with a connection to WASCO, whether pre-existing or new, in Maseru and surrounds.
- Industry beneficiaries: Owners and employees of firms located on the premises of the Tikoe or Thetsane industrial estates. Targeted beneficiaries were textile and garment firms.
- Utility: The urban water utility, WASCO, which manages and operates networks across all of Lesotho, including in all ten UPUW sites. According to MCC's definitions, the utilities are considered participants in the interventions, rather than direct beneficiaries.

For industry, the original M&E plan estimates that the MP would create employment opportunities for 39,750 people at the Tikoe industrial estate, although the ERR more conservatively estimates that 22,800 people would be employed. The MP ERR calculation assumes that 28,000 of knitted and fabric sector employees will benefit from preserved employment due to the bulk water supply. There was no estimate of how many or which businesses could be expected to benefit from the projects in original project documentation. Later versions of the MCC M&E Plan do not specify the number of people for whom employment opportunities will be created, with the beneficiary analysis stating only that the MP will provide 75 Ml per day of bulk water to the Thetsane/Tikoe industrial area and that industrial consumers are among the 124,428 individuals who will benefit from the increased urban supply. An employment indicator was stricken in the 2012 amendment to the M&E Plan saying that it was "no longer applicable as the result of de-scoping. The UPUW Activity will no longer result in water connections to industries, hence no impact on business activity and employment is expected within industries during the Compact period."[38] The ERRs retained assumed benefits to industry and businesses, however.

[38] Millennium Challenge Corporation 2012.

3 LITERATURE REVIEW

A review of relevant literature grounds the evaluation in the context of existing evidence, from Lesotho where available and from the literature on water and sanitation interventions more broadly. We present our review for expected impacts on household, industry, and SMEs. We conducted our review by searching databases of peer-reviewed academic journal articles including RePEc (IDEAS, EconPapers), ResearchGate, PubMed, Web of Science, PLoS Medicine, ScienceDirect, as well as for academic, gray literature, and other research papers through Google Scholar.[39] The full literature review is available in the Summative Evaluation Design Report on the MCC evaluation catalog.[40]

3.1 Summary of Existing Evidence

MCC's urban water activities in Lesotho were designed to support and extend urban water networks to improve and expand access to quality water for households, businesses, and industrial customers. Literature regarding the situation in the urban water sector in Lesotho prior to the Compact is somewhat mixed. By 2002, it was apparent that the Water and Sewerage Authority (WASA) would not be able to meet future demand for the critical industrial sector or the growing peri-urban populations given existing resources.[41] This analysis aligns with the problem diagnostic forming the basis for the Lesotho Compact investments.[42] A 2006 World Bank study noted that, while Lesotho performed better than average regionally with respect to access to improved water sources, infrastructure to meet all domestic water needs was lacking.[43] The same report suggested waste collection and treatment in urban areas was a comparatively larger issue.

3.1.1 Households

The project logic underpinning these activities posits that upgrades to urban water networks will improve the production, quality, and reliability of urban water supply. This was expected to lead to greater coverage and access to improved water, resulting in benefits to the community including reduced water-borne illness, time savings, an increase in productive activity and household income, and a reduction in defensive expenditures.

Many studies that examine the link between water, sanitation, and hygiene (WASH) interventions on outcomes evaluate small-scale, rural, household interventions of pilot programs that introduce new technology or information. In these cases, beneficiaries can usually be clearly identified and the 'treatment' is clearly defined. While the rural literature can provide some relevant evidence, context must be carefully considered in the urban setting of MCC's investments. It can be challenging to pinpoint *a priori* which households will benefit and to what degree. Further, urban households are more likely to have access and use multiple sources of water already, varying in terms of reliability, quality, and convenience, meaning that substitutions rather than discrete switches are more relevant.[44] Even less has been written about peri-urban settings, which may economically resemble urban areas but have a

[39] RePEc (http://repec.org/); ResearchGate (http://www.researchgate.net); PLoS Medicine (http://collections.plos.org/water-and-sanitation); Google Scholar (http://scholar.google.com) . Search includes direct searches from relevant journals including Environmental Science & Technology, Journal of Water and Health, Water Resources, Sci Total Environment, WHO Bulletin, J Tropical Medicine & International Health.
[40] Social Impact, Inc. 2018.
[41] Wason and Hall 2004.
[42] As synthesized in section 4.1 of this evaluation's evaluability assessment report (non-public document) produced in May 2017.
[43] Bogetic 2006.
[44] Cairncross and Kolsky 1997; Stoler et al. 2015; Bello et al. 2010.

substantially lower level of public service access.[45] A 2010 study estimating water demand in peri-urban areas of Lesotho found that the vast majority of sampled households used piped water; about half used a public tap, and a third used a neighbor's tap.[46] That study also notes the importance of reliable water to peri-urban households for gardening as a source of income.

Overall, the rural literature points to a causal link between improvements in water supply, improved health outcomes, time savings, reductions in coping expenditures, and productive activity.[47] However, meta-analyses and systematic reviews consistently find that source quality improvements are less effective in achieving improved health outcomes than point-of-use, sanitation, and hygiene interventions.[48] In some cases, an increased quantity of per capita water consumption has been linked to reductions in diarrheal illness, which is thought to be primarily related to the fact that increased water consumption is allocated toward sanitation and improving household environmental and health conditions.[49] A recent impact evaluation (IE) for MCC's rural water investments in Lesotho found that the interventions resulted in time savings of an average of 44 minutes per day, a significant reduction from 105 at baseline.[50] However, the rural evaluation did not find statistically significant impacts on diarrheal illness among children under five, illness-related expenditures, or the total number of hours worked. An older study of diarrheal illness in rural Lesotho found that households using improved water sources were less exposed to *E. coli*.[51]

In Lesotho, as is the case globally, the combination of continued urbanization, environmental changes, and aging infrastructure are increasingly putting enormous stress on public service provision in urban centers, including in water and sanitation.[52] Service expansions have lagged the pace of population growth, and utilities face institutional management challenges.[53] The project logic hypothesizes that an increased and reliable supply of quality water will lead to expanded coverage or access to improved water, through improved service for those with existing connections and new connections for those previously unconnected. The populations most likely to benefit from improved service are higher-income urban households, who are more likely to have existing connections.[54]

If achieved, new connections would be more likely to benefit poorer households.[55] However, there is limited evidence regarding the impact of improvements in urban piped network infrastructure on take-up rates for new household connections. There are several studies assessing willingness to pay (WtP) for new connections. Evidence from studies in Zambia and Kenya suggest low WtP for improved quality, while a study from Morocco suggests a high WtP for a tap on premises.[56] Citing WtP studies conducted in Lesotho in 1996 and 2002, the feasibility report for the UPUW Activity reports that unconnected households exhibit a high WtP for improved convenience and reliability but could be constrained by connection costs.[57] WASCO annual reports indicate the establishment of a credit policy around the same time as the start of the MCC Compact, allowing households to pay the initial connection fee in

[45] Norström 2007.
[46] Bello et al. 2010.
[47] Whittington et al. 1990.
[48] Waddington 2009; Fewtrell and Colford 2004; Falconi et al. 2017; Fan and Mahal 2011.
[49] Thompson et al. 2001.
[50] NORC 2017.
[51] Kravtiz et al. 1999.
[52] Bello et al. 2010; McDonald et al. 2014; J-PAL 2012; Gwimbi et al. 2011; Thompson et al. 2001; White et al. 1972.
[53] Molapo 2005; Hunter et al. 2009.
[54] Molapo 2005.
[55] Ibid.
[56] Zambia and Kenya - Ashraf et al. 2010; Kremer et al. 2011; Null et al. 2012; Blum 2014. Morocco - Devoto et al. 2012.
[57] MWH Americas, Inc. 2007(b).

installments, though it is not necessarily clear to what extent households across WASCO's service areas across the country know about the policy or are able to take advantage of it.

There is wide consensus in the literature that water quality from household taps is an improvement upon public taps or unimproved sources. One study published during the Compact studied water quality in a peri-urban area of Maseru found that protected sources were significantly less likely to contain *E. coli*.[58] Still, it is important to bear in mind that the designation of a given water source as improved does not guarantee that it is free from contamination with fecal bacteria and, moreover, household water collection, storage, environmental conditions and multiple sources use further complicate this relationship.[59]

The project logic also assumes that improved access to quality water will lead to an increase in consumption of quality water, resulting in improved health outcomes. One paper from Lesotho found results that validate this hypothesis, with a household average of about 500 liters per day for piped households, compared to 330 with a yard tap and 43 for unconnected households from a survey in Maseru,[60] which provides comparable estimates to those reported elsewhere in the literature.

Improved access to quality water is additionally hypothesized to result in time savings, due to time re-allocated from collecting water to productive activities, and cost savings, as a result of lower water expenditures and on treating water-borne diseases. There are mixed results in the literature. One study from Morocco found that time savings went to leisure and social activities, but a Kenyan retrospective study found time savings went to income generating activities.[61,62] Regarding water expenditures, a 2002 study in Lesotho found that about half of unconnected households paid for water at rates much higher than the lowest band of connected households.[63] This suggests the potential for cost savings associated with connections, which is consistent with Bisung and Elliot (2018), who found cost savings for households due to access to improved sources.

3.1.2 Industry

The ERR calculation for MP states that an increased water supply is required for the expansion of the textile industry in Lesotho. Due diligence documentation and concurrent WASCO reports from before the Compact provide ample evidence that industrial and consumer demand overburdened the urban water supply before MP infrastructure. Overall, literature regarding water constraints in this sector in Lesotho is relatively sparse.[64] A 2007 dissertation found that, in the whole of Maseru, 12 Ml of the 28 Ml per day supplied to the city in 2002 was consumed by textile industries.[65] One paper corroborates the finding that water shortages were a constraint to these industries before the Compact.[66] There are also mentions of water constraints in Lesotho's garment and textile industries in reports by the Overseas Development Institute and in a 2004 International Monetary Fund Country Report.[67] Review of the limited literature available therefore suggests that water access is a necessary but not sufficient condition for industrial

[58] Gwimbi 2011.
[59] Bain et al. 2014; Onda et al. 2012; Bartram and Cairncross 2010; Wright et al. 2004; Martínez-Santos 2017.
[60] Molapo 2005.
[61] Devoto et al. 2012.
[62] Bisung and Elliot 2018.
[63] Sechaba Consultants 1996, cited in MWH Project B final due diligence report (MWH Americas, Inc. 2007(b)).
[64] Other literature regarding industry relates to industrial effluents and pollution (Pullanikkatil and Urama 2011; Kamlana 2014).
[65] Masupha 2007.
[66] Lall 2005.
[67] Overseas Development Institute 2009.; International Monetary Fund 2004.

growth; for example, lack of wastewater treatment facilities is another ongoing constraint in Lesotho, among others.

3.1.3 Small and Medium Enterprises

The UPUW Activity's logic for improving the productivity of SMEs is poorly defined. Due diligence documentation does not establish the extent to which reliable water supply is a constraint to urban SMEs, it only provides an ERR calculation regarding expected private investment in response to the availability of water. A review of the literature on the linkages between water supply and SME growth in the region yields few insights. A 2011 study comparing "river towns" and arid towns in rural South Africa finds no major impacts of water abundance on the quantity or quality of enterprise assemblages.[68] Literature pertaining specifically to Lesotho is limited. MCC and the World Bank both implemented enterprise surveys before the interventions were completed, but each has its own limitations. The MCC enterprise survey contains a prohibitively small number of manufacturing SMEs in urban areas, and many of the useful indicators are encoded in ways that cannot be used for analytical purposes. The World Bank surveys contain a larger number of urban manufacturing firms, but do not measure water-related indicators as comprehensively as the MCC enterprise survey. We also assessed the results of a micro, small, and medium enterprises (MSME) survey conducted by Finscope post-Compact in 2015-2016 across Lesotho.[69] That report shows that water is ranked low on a list of constraints to growth among MSMEs in Lesotho, though their sample was primarily made up of informal micro-enterprises.

3.2 Evidence Gap

To our knowledge, this would be the first evaluation of its size, scope, and rigor to assess the effect of large-scale urban water infrastructure interventions in urban Lesotho. It will contribute to filling an evidence gap not only for Lesotho, but also add to a growing body of literature regarding the impacts of urban water infrastructure activities that aim to increase supply and expand access to quality water, both on existing and new customers. It also represents one of relatively few existing evaluations – including others previously conducted for MCC – that explicitly takes into account the dynamism of urban contexts including multiple source use, substitutions, spillover, and other practices and behaviors, including but going beyond standard indicators classifying households' main drinking water source. Through both the process and IE findings, it can also contribute to an evolving understanding about the specific nature and magnitude of benefits that can be expected through investments and interventions at different levels along the pathway from system-level water treatment through distribution and household consumption. Beyond potential contributions to the literature on impacts, results from the process evaluation document important lessons learned for MCC as well as other water sector stakeholders regarding the design and implementation of large-scale water sector interventions.

[68] Toerien and Seaman 2011.
[69] FinScope 2016.

4 EVALUATION DESIGN & METHODOLOGY

4.1 Evaluation Type

To answer all EQs posed by MCC, multiple methodologies and measurement approaches were necessary. As a whole, the evaluation included elements of both performance evaluations (PEs) and IEs, as defined by MCC's Monitoring and Evaluation Policy.[70] In practice, the evaluation was conducted in three distinct phases: first, an evaluability assessment, followed by a process evaluation, and concluding in a summative evaluation. The evaluability assessment was conducted in order to inform the design of the rest of the evaluation. The process evaluation addressed questions about program implementation and utilized PE methodologies. The summative evaluation addressed questions about impacts of the program on beneficiaries and other program effects and incorporated IE and PE methodologies.

4.2 Evaluation Questions

MCC posed eight EQs pertaining to the MP and UPUW Activity. The questions are listed below in Table 8, along with the evaluation design employed to address each of them.

The first EQ relates to the evaluability of the urban water activities in Lesotho, which was addressed early in the evaluation contract through an Evaluability Assessment. The next group of EQs (EQ 2 through EQ 6 and EQ 7d) relate to whether the interventions were implemented according to plan, the current status and functionality of the infrastructure, the status of management, O&M, and financial sustainability of the interventions, and the ultimate impact on consumers. These questions were addressed through PE methodologies including key informant interviews (KIIs), direct observation and site visits, and secondary data analysis. We refer to this component of the overall evaluation as the Process Evaluation.

Another set of EQs asks about the ultimate impact of the interventions on consumers (EQ 7a through EQ 7c), which were addressed through an IE, supplemented by additional information gathered through PE method. Altogether, we refer to this as the Summative Evaluation. The final EQ (EQ 8) asks about lessons learned and is addressed by synthesizing the results from all other EQs. Further detail about the designs and methodologies used to answer EQs are addressed in the Section 4.4.

4.3 Policy Relevance

To our knowledge, this would be the first evaluation of its size, scope, and rigor to assess the effect of large-scale urban water infrastructure interventions in urban Lesotho. The evaluation findings from sites where the interventions were implemented successfully add to a small but growing literature documenting impact of improved water supply and access in dynamic urban contexts. Results from sites experiencing challenges in implementation and where works are not functioning as expected provide lessons learned for MCC, along with other donors or sector stakeholders, about improving the design and implementation of future large-scale water sector interventions.

[70] Millennium Challenge Corporation 2017.

Table 8. MCC Evaluation Questions

Evaluation Questions	Evaluability Assessment	Process Evaluation	Summative Evaluation
EQ 1. Is the program evaluable?	♦		
EQ 2. Was the program implemented according to plan? Are interventions operating according to plan? If not, what are the major issues, and to what extent were they affected by implementation fidelity?		♦	
EQ 3. What is the current functionality, use, and plan for managing and maintaining the infrastructure under the MP and UPUW Activity?		♦	
EQ 4. To what extent has a management unit been established for the Semonkong water system? To what extent has WASCO HQ provided support to those managing the new system in Semonkong?		♦	
EQ 5. To what extent has support been provided to WASCO for the management of Metolong Dam, Water Treatment Works, and Pump Stations? If provided, who provided it, when was it provided, and how effective has this support and dam management been? Does a staffing plan exist for Metolong Dam? To what extent are positions occupied and what has turnover been to-date?		♦	
EQ 6. Do Operations and Maintenance plans exist for the MP and UPUW assets? How are these plans budgeted and funded? Are these O&M plans being observed and carried out?		♦	
EQ 7. What were program results on key short-term and intermediate outcomes? **a.** To what extent has access to quality water increased? What activities, if any, has WASCO conducted to encourage households to connect to the network? **b.** To what extent are community members (including businesses such as manufacturing firms) using water from the urban water network and how has this changed since the Lesotho Compact started? **c.** To what extent are community members experiencing cost and time savings, or reductions in water-related illness?			♦
d. How have the MP and UPUW programs impacted WASCO's income and costs? Has additional income been generated that can be directed to maintaining the new infrastructure?		♦	
EQ 8. What lessons can MCC or the Government of Lesotho apply to future programs related to program design, implementation, and sustaining results?		♦	♦

4.4 Methodology

This evaluation uses mixed methods, including elements of what MCC's Monitoring and Evaluation Policy refers to as evaluability assessment, PE, and IE, each of which are briefly described below.

4.4.1 Evaluability Assessment

To inform the design of the evaluation and address EQ 1, SI conducted an evaluability assessment. The methodology for the evaluability assessment generally followed MCC's Project Evaluability Assessment Tool. To determine the feasibility and value of proceeding with an evaluation of the MP and UPUW Activity, SI assessed whether the project addressed a well-defined problem diagnostic, whether it was described by a theory of change with plausible causal links between measurable activities, outputs, and outcomes, and whether it was possible to identify and geographically locate beneficiaries of the project with a reasonable degree of precision. In addition, SI assessed the availability of credible information to verify the degree to which interventions were implemented according to plan, and to verify whether any realized risks may have substantially affected project outcomes. Lastly, SI assessed the degree to which results indicators were well-defined with baseline data and targets, and whether key stakeholders exhibited buy-in to facilitate evaluation efforts.

The evaluability assessment was conducted through project document review, consultations with MCC stakeholders in Washington, DC, KIIs in Lesotho with local stakeholders, including former MCA-L staff and WASCO personnel, and site visits to a subset of sites included in the Compact urban water programs.

4.4.2 Process Evaluation

In this section we summarize the methodology employed for answering EQs pertaining mainly to implementation of the MP and UPUW Activity.

4.4.2.1 Design

The methodology for the process evaluation included an implementation fidelity exercise as well as a PE component. The former was conducted to answer EQ 2, specifically whether the program was implemented according to plan. The latter addressed other EQs related to additional aspects of implementation as well as the functionality, use, management of the MCC-funded interventions.

4.4.2.2 Data Collection

Data collection for the process evaluation included site visits to each of the urban areas, with structured observations of the infrastructure, KIIs, document review, and secondary data analysis. SI conducted 32 KIIs with 43 key informants and 11 site visits in September 2017.[71] All sites and key informants were purposively sampled. A detailed list of data sources are provided in Annex B: Methods & Additional Data.

Site visits. Each urban water network with observable[72] works funded through the MP and UPUW Activity was visited for structured observation, with key informants at the site sampled purposively based on their role, usually area manager and/or plant operator. Structured observation was done using standard templates developed prior to the site visits. Prior to site visits, a comprehensive document

[71] The municipal networks in Roma, Teyateyaneng, and Mazenod were not visited because funded infrastructure was unobservable.
[72] In some locations, including many of the UPUW Package 1 sites, the infrastructure funded included rehabilitation and/or extension of underground reticulation that is, by nature, unobservable.

review was used to populate design and function requirements for each set of works against which observed and reported functioning could be assessed. One structured observation template was created for each site and was populated during each in-person site visit.[73] Photographs were also taken during each site visit to provide supporting evidence. Where direct observation was not possible, findings are based on document review and KIIs alone.

KIIs. Key informants were likewise selected purposively based on their role in the implementation or ongoing management of the MCC funded infrastructure, including those with responsibilities and/or knowledge about O&M, training and support, construction and oversight, funding and sustainability issues, environmental issues, water quality, and other related topics. KIIs were conducted with plant managers, other plant staff, and WASCO staff. SI also interviewed stakeholders whose expertise was accessed during the Compact for specific purposes, e.g. firms hired to conduct independent design reviews. A list of KIIs is included in Annex B: Methods & Additional Data.

Document review. The evaluation team reviewed MCC planning documents, infrastructure designs, contractor progress reports, O&M manuals, WASCO reports and records, and other documents. This review informed the structured observation protocols as well as the overall findings.

WASCO data. WASCO connections and billing data were obtained through data queries of WASCO's EDAMS database, through direct consultation with WASCO HQ personnel.

4.4.2.3 Analysis

To analyze the implementation fidelity of each of the works of the MP and UPUW Activity, SI developed an implementation fidelity scoring system, which was applied to each site as a whole, as well as for each component within each site (e.g. reservoirs, reticulation, intakes, chemical dosing). The scorecard assessed four dimensions of implementation fidelity including (i) design, (ii) installation, (iii) management/O&M, and (iv) funding, listed in Table 44 in Annex B.[74]

Scoring was conducted on the basis of the structured observation protocols populated during site visits. An aggregate score was also calculated, as a weighted sum designed so that the four dimensions contributed equally to the aggregate, given their different scoring scales. The scoring system was designed as a way to summarize findings and communicate the overall success or failure of each site, and to construct a system by which sites could be easily compared, given the variation between them in terms of the specific nature of the MCC-funded interventions.

4.4.3 Summative Evaluation

In this section we summarize the methodology employed for analyzing impacts at the household level and assessing other project effects among industry and enterprises. For the household level, any sites not included in the IEs were subject to a customer survey. As part of the household level component, we also used other household survey data plus qualitative data to assess spillover, and qualitative data to

[73] Structured observation templates are included as annexes in the process evaluation design report, available on the MCC Evaluation Catalog, available at https://data.mcc.gov/evaluations/index.php/catalog/221/download/1130.
[74] More detailed standards used for specific aspects of the infrastructure (e.g. design/installation standards for river abstraction vs. raw water pipelines, etc.) are available in the full process evaluation design report on the MCC Evaluation Catalog, available at https://data.mcc.gov/evaluations/index.php/catalog/221/download/1130.

assess one prominent unintended effect of the activities. Methods are discussed below with greater detail on some topics in Annex B: Methods & Additional Data.

4.4.3.1 Households

To measure the impact of the UPUW Activity on households in certain sites, we carried out a quasi-experimental design, estimating impacts through propensity score analysis. For sites not subject to an IE, a customer survey was implemented. Each is further described below.

The impact of the urban water interventions was hypothesized to occur through two potential pathways: by improving access/coverage (through new connections), and through improved supply (for existing connections). Thus, for this evaluation, we can conceptualize two types of treatment households: (A) households newly connected to the network, and (B) those with existing connections prior to the interventions. Groups A and B would be expected to benefit in different ways and to different degrees. As such, each requires its own comparison group. We thus designed and carried out two distinct IEs, referred to as Design A and Design B corresponding to the two pathways described above.

Based on consultations with MCC and stakeholders in Lesotho, process evaluation results, assessment of available administrative data, and findings from early qualitative focus group discussions (FGDs), SI determined that an IE would only be feasible in a subset of sites. These sites include Maseru urban (supply – Design B), Roma and Morija (access – Design A), and Semonkong (access – Design A). Customer surveys were carried out in all sites without an IE, as well as for customer groups not covered by the IE in Design A and B sites.

For Design A, Semonkong was selected primarily because it transitioned completely from a town with no piped water access to piped water access, as a direct result of MCC Compact funding, resulting in a clear and strong case for attribution of any observed impacts to MCC. Maseru peri-urban sites were selected for Design A given one of project's stated objective to support WASCO expand access to new customers in rapidly growing peri-urban areas, as well as satisfy the growing demand in these sites. Among the peri-urban sites in Maseru targeted by the activities, Roma and Morija were selected while Mazenod and Teyateyaneng were excluded, based on assessment during the design stage that indicated a potential lack of a suitable number of valid comparison units in the latter two sites, given the relatively higher coverage by WASCO service in Mazenod and Teyateyaneng relative to Roma and Morija.

An IE to assess the impact of supply was not feasible in sites outside of Maseru, since we know that most interventions in the UPUW sites were system-level and had the potential to impact households across the network – e.g. a repaired pipe impacts households downstream and upstream, not just those in its immediate vicinity. For this reason, we are not able to separate areas of the majority of UPUW sites into "exposed" and "not exposed." Maseru urban is different because, while all townships were intended to be connected to the Metolong supply, to date only some townships have been connected. The main reason some have remained unconnected is that the GoL would be responsible for funding pressure-reducing valve systems to enable the network in these areas to accommodate the high pressure from the nodal high terminal reservoirs supplied by Metolong, which they have declined to do to date despite requests from WASCO. These valves appear not to have been considered during Compact development, perhaps because of an ongoing hydraulic assessment of the Maseru reticulation at the time of Compact signing. WASCO staff interviewed for the evaluation did not think that there was any reason that the townships served by Metolong were connected while those yet to be connected were still served by the

pre-existing supply. In other words, it is nearly as if the areas connected first to Metolong were selected by chance, facilitating the conditions for an IE. Likewise, the reason for excluding them from Design A comprised (i) only one site (Leribe) included network extensions or provisions for household connections that would make the UPUW Activity directly responsible for increased access; and (ii) many of the sites had poor implementation fidelity, reducing their usefulness in terms of illustrating the validity of MCC's desired theory of change.

The customer survey measured the current level of service delivery and outcomes of interest among connected households in those sites. The customer survey was stratified by new and existing customers (defined by the UPUW commissioning date in each site), in order to ensure that the samples contained representation from customers who are likely to have benefited in different ways or to different extents in the content of the UPUW Activity. A summary of the evaluation designs is provided in Table 9, followed by elaboration on sampling, data collection, and analysis with greater detail in Annex B: Methods & Additional Data.

Table 9. Summary of Designs for Household Level Evaluations

	Design A – improved access	Design B – improved service	Customer Survey
Identification	Treatment (T): Connected households, with connection installed after UPUW commissioning Comparison (C): Unconnected households eligible to connect to the network	Treatment (T): Connected households living in townships connected to the Metolong supply Comparison (C): Connected households living in townships not connected to the Metolong supply	n/a
Sites	Semonkong Roma and Morija (together)	Maseru urban	New & Existing customers: Mazenod, Teyateyaneng, Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek, Leribe, Butha-Buthe, Mokhotlong, Mapoteng New customers only: Maseru urban; Existing customers only: Roma, Morija
Sampling	Sampling frame constructed through a listing activity. Random sample from eligible households was intended; in practice, insufficient number of eligible units resulted in census of all eligible households in all three sites.	Randomly sampled from WASCO customer database; separated by townships with and without Metolong supply.	Randomly sampled from WASCO customer database; stratified by existing and new, defined by connected date relative to UPUW commissioning date in each site.
Data Collection	Household survey FGDs with newly connected and unconnected households Water quality testing	Household survey Water quality testing	Household survey FGDs with newly connected households Water quality testing
Analysis	Propensity Score Matching Qualitative	Propensity Score Matching	Descriptive analysis Qualitative

4.4.3.1.1 SAMPLING

The Design B sample includes households with connections installed before the interventions were completed, and those residing in townships now served by the Metolong supply (treatment households),

and those residing in townships not served by Metolong (comparison households). The list of townships was directly obtained from consultation with WASCO HQ staff. The WASCO customer information database included township, installation data, customer name and phone number, and GPS coordinates. Households were randomly sampled from the customer information database, for treatment and comparison groups. GPS coordinates were pre-loaded with other customer information in the electronic data collection platform and used to locate the households for the survey. Eligibility criteria were confirmed at the start of the survey. The final sample size surveyed for Design B was 765.

The Design A IE sample includes households connected after the completion of the interventions (treatment), and households *eligible for a connection* that have remained unconnected since prior to the interventions (comparisons), all of whom have resided in their respective town since before the interventions were completed. Eligibility for a connection, among unconnected households, was defined for this evaluation as living within 300 meters of the WASCO network; the official WASCO eligibility buffer is 150 meters, but we learned during early qualitative data collection that WASCO does connect households further away than this for a fee, so the study buffer was thus expanded accordingly. Thus, for Design A, there are not treatment and control *areas* but rather treatment and control households sampled from within the *same areas*.

A sample frame had to be constructed for Design A, given the specific geographic requirement and eligibility criteria for this evaluation. SI constructed a sampling frame through a listing activity, which involved a listing survey that asked about each eligibility criterion and other basic information allowing the teams to re-locate them if sampled for the survey, including a photo of the dwelling's front door that was used to pre-load the subsequent household survey electronic data collection form. The listing activity covered relevant areas within any enumeration area (EA) that intersected with the 300-meter buffer around the network in each site. To establish this buffer within relevant EAs, SI overlaid WASCO network shapefiles, obtained from WASCO's GIS department, with enumeration shapefiles obtained from the Lesotho Bureau of Statistics. SI further overlaid Open Street Maps building footprint data on the aforementioned spatial layers and extracted a list of all building footprints within the 300-meter buffer for each relevant EA, and assigned unique random identifiers to each one. The full list of buildings for listing was then used as a pre-loaded dataset in the electronic data collection platform and SI's local quantitative data collection partner conducted the listing in Roma, Morija, and Semonkong.

Following the listing activity, we intended to randomly sample treatment and comparison units from the list. However, we ultimately deployed a census approach for Design A sampling, since there were fewer eligible households in the study areas than we required according to our sample size calculations. Further details on the changes to the sample size can be found in Annex B: Methods & Additional Data. The final sample size surveyed for the Design A IE in Semonkong is 617 households and the final sample size surveyed for the Design A IE in Roma and Morija is 1,296.

For the customer survey, for sites in Packages 3-5, existing and new customers were sampled from the WASCO database, proportionally according to the share of customers they represented in each site. "Existing" and "new" were defined according to the UPUW commissioning date of the works in each site. Since the IEs already included existing customers in Maseru urban, new customers from Maseru urban were also sampled from the WASCO database for the customer survey. Likewise, existing customers were sampled for the customer survey from Roma and Morija since new customers were already sampled as part of the IE. Semonkong was not included as part of the customer survey since the network is new, there are no existing customers, and new customers are covered by the IE. Sampling weights were

applied to customer survey data to adjust the populations to the correct proportion of existing and new customers before estimating statistics.

4.4.3.1.2 DATA COLLECTION

Household Survey. A household survey was conducted to collect information on household demographic characteristics, water use and related practices in the household, and to measure the outcome variables of interest. Since valid baseline data for this IE design was not available,[75] the household survey also collected recall information to reconstruct the baseline situation representing the pre-intervention period. Household surveys were conducted in face-to-face interviews, with data captured on mobile phones using the electronic data collection platform SurveyCTO, which builds upon the Open Data Kit platform. Household surveys and listing surveys for Design A were carried out by SI's local quantitative data collection partner, Forcier Consultants. SI programmed the electronic data collection tool. Prior to data collection, SI conducted a training of trainers and attended enumerator training, pre-testing, and piloting. Maps of all surveyed households are included in Annex B: Methods & Additional Data. The household survey tool is included as a separate attachment to this report.

FGDs. Qualitative data collection was also conducted with households in the Design A treatment and comparison groups – staggered prior to the quantitative household surveys – in order to inform the final IE design, as well as to gather information that would eventually explain, validate, and/or contextualize the IE results from these sites. FGDs were carried out by SI's local qualitative data collection partner, MJK Consultants. Prior to data collection, SI conducted a training of trainers and attended enumerator training, pre-testing, and piloting. A total of 52 FGDs were carried out across Lesotho in all project sites. Since FGDs were carried out prior to household surveys in order to help inform the design, FGD categories did not perfectly align with evaluation design groups. In Maseru, FGDs were conducted with unconnected households, newly connected households, households with existing connections in townships supplied by Metolong, and households with existing connections in townships supplied by other sources. In Roma, Morija, and Semonkong, FGDs were carried out with treatment and comparison households in alignment with the evaluation design. In all other peri-urban sites, FGDs were carried out only with newly connected households and unconnected households. The list of focus group topics is included in Annex B: Methods & Additional Data; focus group tools are included as a separate document.

Water Quality Testing. Water quality tests were conducted for a subset of households sampled for our evaluation. The objective of these tests was to determine the compliance of water used for drinking with World Health Organization (WHO) standards—namely, to test for the presence of *E. coli* and free chlorine residual (FCR), which is added to water at the treatment plant to bond with and neutralize any harmful pathogens present in the water. Connected households sampled for testing received (a) a 100 ml presence/absence test of *E. Coli*, (b) a 1 ml test designed to detect particularly high levels of *E. Coli* contamination, and (c) an FCR test for water directly from their WASCO tap. These households also received a 100 ml presence/absence test of *E. Coli* and a 1 ml test designed to detect particularly high levels of *E. Coli* contamination on their point of consumption (e.g. the location from which household members usually take water for drinking; this is often stored water within the household). Unconnected households received the *E. Coli* tests for water taken directly from their point of consumption. Together, these tests signal the quality of water as delivered to connected customers taps and as consumed by connected and unconnected households. The water quality testing activity aids in describing service

[75] For a full explanation, see the Summative Evaluation Design Report https://data.mcc.gov/evaluations/index.php/catalog/221/download/1129.

delivery as well as contextualizing results regarding health outcomes. Even for connected households, quality can deteriorate from the tap to the point of consumption depending on household storage, sanitation, and hygiene practices. In total, 2,472 water quality tests were taken from taps and 1,693 were taken from points of consumption. These tests covered 2,812 households in total: 1,119 connected households with tests from their tap only, 1,353 connected households with tests from their tap and point of consumption, and 340 unconnected households from the point of consumption.

4.4.3.1.3 ANALYSIS

Impact Evaluation. Our analysis aims to estimate the impact of improved access and service on households in UPUW sites through analysis of household survey data, contextualized by administrative and qualitative data. The household survey data allows us to estimate the presence and quantity of any impact on household-level beneficiaries. Administrative and qualitative data help us answer 'why' and 'how' questions and assist us to understand the role of MCC relative to other factors influencing or potentially confounding any of the observed changes in our outcomes of interest. The main outcomes of interest connected to the ERR benefit streams at the household level are time savings and diarrheal illness among children under five. Other outcomes of interest, including water consumption, volume of water collected outside the home, and water expenditures are also assessed. The definition and measurement of key outcomes is listed below in Table 10.

Table 10. Outcomes of interest for household-level impacts

Outcome	Definition	Measurement
Time Savings	Average time (minutes) spent collecting water per household per day	For each source collected outside the home, round-trip time to the source (including queuing) is multiplied by the frequency of trips and standardized to minutes per day. Questions are asked in reference to 'average' behavior for each season, with separate variables constructed for each season.
Health	Prevalence of diarrheal illness among children under five, last two weeks	Using a household roster administered to capture demographic information about all household members, follow-up questions were asked about each child<5 in every household. Respondents were asked to indicate whether each child had experienced any episodes of diarrheal illness in the last two weeks (14 days).
Consumption	Liters per capita per day (lpcd)	For sources collected outside the home, the number of liters collected per source per trip was multiplied by the frequency of trips and standardized to liters per day. Piped water consumption was calculated using WASCO's most recent domestic consumption tariffs, whereby average monthly billing* was converted from Maloti per month to liters per day of water consumption. The consumption amounts were added and divided by the total number of household members.
Expenditures	Expenditures on water, from all sources, per household per month	Includes average monthly billing for WASCO customers, as recalled by respondents. For sources collected outside the home, the amount paid per container was multiplied by the number of containers per trip and the number of trips, standardized to Maloti per month. These two amounts were added, where relevant, along with any payments to hired water collectors. For households who reported re-selling water to neighbors, we calculated a second version of this indicator which subtracts the monthly amount the household receives from neighbors to whom they re-sell water from their tap, as applicable.
Volume Collected	Liters per household per day	For sources collected outside the home only, the number of liters collected per source per trip was multiplied by the frequency of trips and standardized to liters per day.

*This is a backup methodology from our originally planned measurement method for piped water consumption, which was to take consumption information directly from WASCO bills and/or connect the household's account number to the WASCO consumption database. Only 12% of surveyed respondents could present their bills, so we instead used their recollection of their average monthly payment to approximate consumption. We also used this recollection to measure expenditure.

At the core of our impact analysis is the estimation of the counterfactual through propensity score matching techniques. This analysis estimates the average treatment effect on the treated (ATT), which represents the estimation of the effect on the treated units, had they not experienced the interventions. To carry out propensity score matching, we first use logistic regression with the treatment variable as the dependent variable and predict the likelihood of treatment on the basis of a range of covariates including demographic information and reconstructed baseline values of the outcomes of interest. Baseline values had to be reconstructed for the evaluation since no valid baseline data existed for the groups of interest; see the Summative Evaluation Design Report for greater detail on that matter. Through that logistic regression, propensity scores are calculated, which can be interpreted as the probability – given a set of observed covariates, of being assigned to treatment. On the basis of those propensity scores, we deploy different matching techniques to identify units comparable to each other, and then compare the outcomes of interest using each of those different techniques. The matching techniques used include nearest neighbor (five neighbors), caliper, and Gaussian kernel. Results from Gaussian kernel are presented in the body of the report, while the full results can be found in Annex B: Methods & Additional Data.

Customer Surveys. As agreed with MCC during the evaluation design stage, the customer surveys are meant to be a representative sample for two aggregated groups of customers: those in Package 1 sites, receiving UPUW Activity outputs as well as water from the Metolong Dam, and those in Package 3-5 site, receiving UPUW Activity outputs alone. All customer survey indicators are thus descriptively analyzed and discussed, for newly connected and pre-existing WASCO customers separately. Statistical analysis was not conducted for customer surveys.

FGDs. FGD transcripts were all separately coded by at least one individual, using a codebook developed by the evaluation team with 37 codes, using Atlas.ti software. Themes were analyzed by running queries of combinations of codes on groups of transcripts. Evaluation team members reviewed the query reports systematically and developed findings accordingly to supplement the quantitative analysis.

Spillover & Unintended Effects. Spillover was assessed using qualitative data from household FGDs as well as household survey data. Descriptive data is used to characterize the frequency and extent of spillover, along with support from thematic analysis using the above approach. For unintended effects, local stakeholders signaled over the course of the process evaluation that communities in villages along the Metolong DCS who consumed water from the DCS pipeline free of charge represented a potential unanticipated direct beneficiary group. Therefore, as part of the summative evaluation, we conducted FGDs with households and KIIs with chiefs in two of these villages to investigate unintended program outcomes in these communities.

4.4.3.2 Industry & Small and Medium Enterprises

The evaluation team employed PE methods to assess program effects on industry as well as SMEs. Given the changes in project M&E plans, in later versions removing indicators and targets for these groups, and due to the infeasibility of establishing valid comparison groups, an IE was not deemed feasible or worthwhile for these groups. Instead, the team used an *ex post* thematic analysis methodology triangulating information from qualitative interviews, case studies and site visits, and an analysis of secondary data to assess effects on these groups.

For textile industry beneficiaries, who are smaller in number but instrumental to the pre-intervention ERR benefit streams, case studies were conducted with the largest textile firms in the Tikoe and Thetsane

industrial areas. The case studies included KIIs with management, site visits and direct observation of textile factories, and analysis of historical WASCO consumption and Lesotho National Development Corporation (LNDC) employment data. For SMEs, who are more disperse than larger industrial firms and whose hypothesized benefits from the MP and UPUW Activity are less clearly depicted in project documentation, KIIs were conducted with government and who have a broad view of the state of SMEs in Lesotho. Secondary data for the industry and business components were obtained from WASCO and LNDC and included overall employment, accounts by commercial type, and water consumption and billing information on a monthly basis from 2007 to 2017 (LNDC) or 2018 (WASCO).

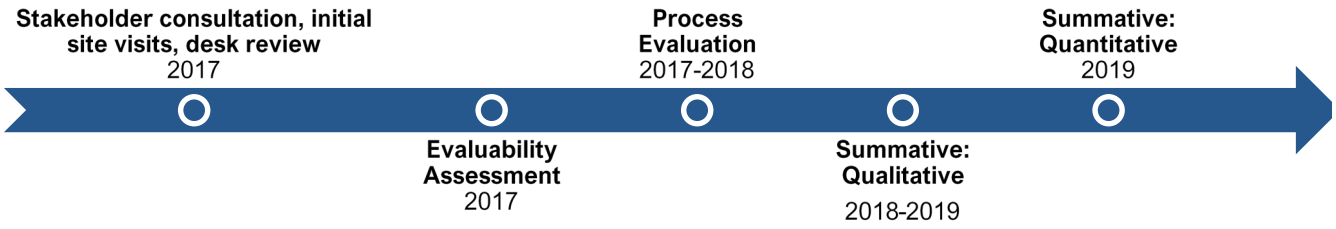
The analysis strategy for our summative evaluation varies by beneficiary group. We combined analysis of qualitative data from KIIs and case studies for industry with analysis of longitudinal trends from secondary data on water consumption and other variables where available. We assessed trends in industrial and business water accounts over time as well as their consumption, with specific reference to changes after March 2015, when the Metolong Dam was commissioned, as well as in the context of information gathered through the qualitative interviews.

4.4.4 Evaluation Timeline, Sequencing, and Exposure to Treatment

Although the Lesotho Compact closed in 2013, this *ex post* evaluation did not begin until November 2016. During evaluation work planning and development of the evaluability assessment, it became clear that some of the MP and UPUW Activity outputs were not performing as originally intended. MCC and SI agreed that the evaluation should be sequenced such that implementation fidelity could be analyzed and taken into account before making decisions about the final scope and nature of any summative evaluation. SI and MCC also agreed to sequence qualitative data collection ahead of quantitative data collection to investigate the validity of potential counterfactual constructions before committing to a large-scale data collection activity.

The *ex post* endline survey took place in 2019. This timing implies that households have been exposed to the MP and UPUW Activity interventions for four to six years, as the contracts for UPUW Activity construction ended between 2013 and 2014 and the Metolong Dam was commissioned in 2015. In some cases, some components of the works will have been completed prior to that date. However, in several cases, as described in the process evaluation findings, WASCO has been remediating issues and challenges often due to ineffective design or construction of the UPUW works, and thus households have been exposed for varying amounts of time to better or worse situations depending on the site. There is essentially no precedent in the literature in terms of what to expect the trajectory of the main outcomes of interest to be over such a lengthy period of time for this type of intervention in similar contexts.

Figure 6. Evaluation Timeline



5 FINDINGS

5.1 Evaluability Assessment

- EQ 1: Is the program evaluable?

An evaluability assessment was undertaken to understand the feasibility of conducting an evaluation, based on MCC's project evaluability assessment template. Findings are based on review of project planning documents, Compact progress reports, and consultation with key stakeholders involved in Compact implementation. Key findings are summarized below in Table 11.[76] The main result of the evaluability assessment was the decision to proceed with an evaluation, and to complete the process study prior to embarking upon any IE or other summative evaluation activities.

Table 11. Evaluability Assessment Summary of Findings

KEY: Technical feasibility or value of conducting evaluation ● **High** ● **Moderate** ● **Low**
Dimension 1: Problem Diagnostic - Project clearly addresses a well-defined problem diagnostic
● Problem of insufficient water supply to meet demand in urban areas was well supported with quantitative evidence ● Problems of water quality & reliability were not well supported with quantitative evidence
Dimension 2: Theory of Change & Project Logic - Causal links plausible; activities, outputs, outcomes defined & measurable
● Many causal hypotheses are logically plausible, well-defined, and can be verified or tested for both activities ● Reliability and quality for UPUW sites were not measured pre-intervention, limiting possibility of measuring changes ● Hypothesized UPUW impacts on households involve implicit assumptions of WtP for new connections
Dimension 3: Risk Mitigation - Risks mitigated /effects of realized risks do not jeopardize project outcomes
● For Metolong, risks to successful completion of activities and outputs were appropriately mitigated ● For UPUW, some designs may not have been appropriate for the context, partly due to lack of comprehensive design review ● Much UPUW infrastructure is problematic or not operational, with troubleshooting limited by WASCO capacity constraints ● WASCO may not be financially equipped to assume responsibility for maintaining all new infrastructure into the future
Dimension 4: Beneficiary Analysis - Beneficiaries can be identified & geographically located with reasonable precision
● WASCO customer database could provide record of all new connections over time and by installation date ● Inventory of as-built GIS files may assist in identifying areas with beneficiaries of pipeline rehabilitations ● It may be challenging to locate beneficiaries of network rehabilitations with precision, as-built GIS files may assist ● Definitions of beneficiaries in due diligence documentation and Compact M&E plans do not fully align with ERR
Dimension 5: Monitoring & Evaluation - Credible information available to verify implementation fidelity; Results indicators well-defined, with baselines & targets; clear M&E strategy; Key stakeholders exhibit buy-in; Evaluation results practically applicable; Questions clearly stated/prioritized; Link with prior M&E efforts; Accountability & learning benefits outweigh costs of evaluation
● Current operational status of UPUW infrastructure can be verified through site visits and comparison of designs and as-builts ● M&E plans include clearly-defined indicators to be tracked in ITT; stated goals of independent evaluation therein is fairly clear ● MCC committed to accountability and learning, especially regarding implementation and applying lessons to future Compacts ● Evaluation would contribute to evidence base on impacts of large-scale water infrastructure interventions in urban settings ● Indicators related to diarrheal illness not specifically linked to urban interventions in Compact indicator framework ● Previously-conducted baseline survey may not be usable or meet data requirements for current evaluation ● Decision to evaluate downstream impacts of UPUW on household should first consider results of a process study ● Some key indicators do not include baselines or targets

[76] The full results are documented in SI's evaluability assessment report (non-public document) produced in May 2017.

5.2 Process Evaluation Findings

In this section we present results of the process evaluation, which addresses EQ 2 through EQ 6 and EQ 7d, pertaining to implementation, current functionality and use, and ongoing management of the MCC-funded works. We discuss corresponding implications for the sustainability of project outputs and outcomes. These findings are the result of combined analysis from site visits and structured observations, KIIs, and document review.

5.2.1 Implementation Fidelity & Major Issues (EQ 2)

- EQ 2: Was the program implemented according to plan? Are interventions operating according to plan? If not, what are the major issues, and to what extent were they affected by implementation fidelity?

To assess implementation fidelity, SI evaluated the design and function requirements of the infrastructure in each site along four dimensions including design, installation, management/O&M, and funding, through a scoring system detailed earlier in Section 4.4.2. To compare sites, a single aggregate score was calculated as a weighted sum of the dimension scores.

5.2.1.1 Implementation Fidelity

The main findings from this exercise are that the major outputs funded by MCC under the MP were implemented well with a high degree of implementation fidelity, while results are considerably more mixed for the UPUW Activity. Works in Packages 1, 2, and 5, were largely implemented as planned with minimal issues in infrastructure design or installation, which can be remedied with minor modifications. However, there were significant issues with implementation for Packages 3 and 4 which have required, or still require, major remedies in order to allow the plants to meet intended design and function requirements. These issues are compounded by shortcomings in O&M and funding. A summary of the implementation fidelity scores for each site are provided below in Table 12. Detailed scorecards, listing each of the infrastructure components by site, are included in Annex A: Implementation Fidelity Scorecards. Detailed scoring criteria for the assessment of the design, installation, O&M, and funding of the various works is available for reference in Table 44 of Annex B.

5.2.1.2 Major Issues

Frequently observed failures in program implementation relative to plans at UPUW sites include inadequately designed river abstraction works that failed shortly after commissioning (observed in Quthing, Mokhotlong, Leribe, and Mohale's Hoek), absence of tailored O&M manuals for the network as a whole, with no operating or diagnostic guidance and commercial manuals only available for individual infrastructure components (observed at nearly all UPUW sites), inappropriate equipment selected and installed for function requirements (such as the clariflocculators in Mafeteng and Mohale's Hoek, pumps in Butha-Buthe, Mafeteng, and Mohale's Hoek, and chemical dosing equipment in Qacha's Nek), and commissioning of equipment which failed upon installation without subsequent resolution of snags.

Table 12. Implementation Fidelity Scores

MP (MCC-funded infrastructure components*)	Design [0-2]	Installation [0-4]	O&M [0-2]	Funding [0-2]	Aggregate [0-10]
Metolong High Lift Pump Station	2	4	2	2	10.00
Metolong WTW	2	4	2	2	10.00
UPUW Activity	**Design [0-2]**	**Installation [0-4]**	**O&M [0-2]**	**Funding [0-2]**	**Aggregate [0-10]**
Maseru, Morija, Roma, Mazenod, Teyateyaneng (Package 1)	1	3	2	2	8.17
Semonkong (Package 2)	2	3	1	2	8.17
Mapoteng (Package 5)	2	4	1	1	7.33
Qacha's Nek (Package 3)	2	3	1	1	6.83
Butha-Buthe (Package 3)	2	3	1	1	6.83
Quthing (Package 3)	1	2	1	1	5.00
Mokhotlong (Package 4)	1	1	1	1	4.50
Leribe (Package 4)	1	1	1	1	4.50
Mafeteng (Package 3)	0	1	1	1	3.17
Mohale's Hoek (Package 4)	0	0	1	1	2.67

*Although its construction was MCC-funded, the DCS was not scored due to the infeasibility of assessing infrastructure almost entirely underground and spread across an expansive geography. Furthermore, it was designed with external funding.
Note: Presented in descending order based on Aggregate Score. For definitions of each score, see Section 4.4.2.

5.2.1.3 Effect of implementation fidelity on major issues

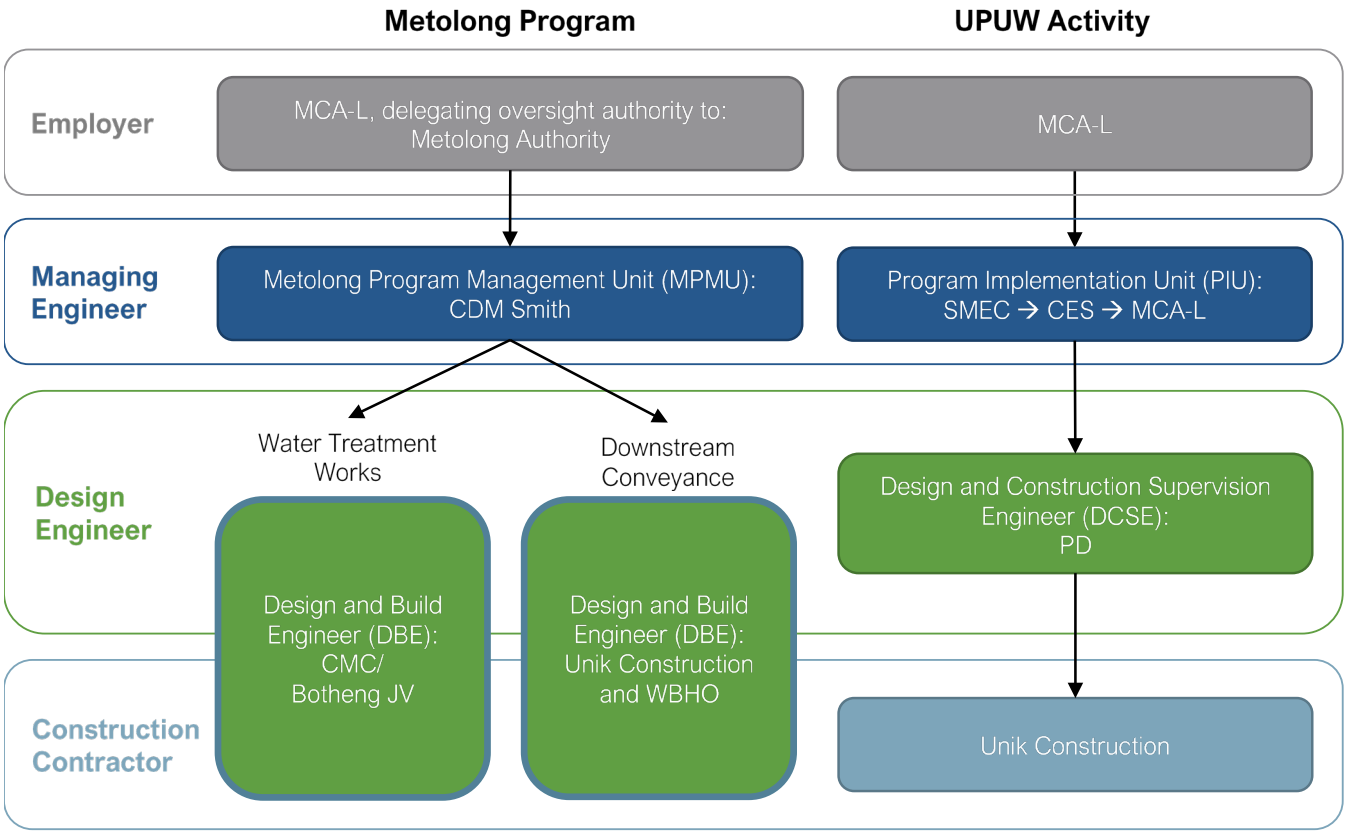
The end result of these issues in many of the UPUW sites, according to perceptions shared by many of the WASCO staff responsible for managing these networks, was difficulty in supplying water to meet demand without significant remediation at WASCO's expense. WASCO staff expressed an original expectation for "turn-key" solutions to improve water supply, and instead found that old installations, which at least worked moderately well, were replaced with new, problematic installations that, at times, had to be bypassed altogether. In some cases, the severity of the issues has reportedly rendered service delivery worse off compared to before and has even temporarily prevented service. Even in Semonkong, where water delivery is currently meeting demand, ongoing issues with the main sand filter beds inhibit efficient processing of water and would become problematic if demand increased considerably.

There were redeeming aspects of the infrastructure funded under the UPUW Activity. WASCO staff nearly universally felt that, despite some leaks and troubles with installation, new reservoirs improved the reliability of the water supply and extended or rehabilitated reticulation pipelines increased access to water for new customers. However, in Packages 3 and 4, these benefits were counteracted by great difficulty or inability to draw raw water from rivers and/or streams and inefficiencies in delivering water due to the need to bypass or cope with poorly designed or malfunctioning equipment. Fortunately, to date, even where plants have experienced issues filtering and treating raw water, the raw water quality for many sites is sufficiently good that they can still effectively treat the water delivered to customers. However, abstraction and treatment of early seasonal flood flows has proved impossible or very difficult in some cases.

5.2.1.4 Explanatory factors for implementation fidelity results

Critical differences in the management and oversight of implementation for the MP compared to the UPUW Activity likely contributed to the observed results. To contextualize these findings, it is necessary to first describe the set of entities involved and summarize their roles. The entities and their roles and relationships are described below, following their depiction in Figure 7..

Figure 7. Entities involved in oversight and implementation of MP and UPUW Activity



Note: [a] PIU Contract was originally held by SMEC; their contract renewal option was declined by MCA-L. The contract was then briefly held by CES (Consulting Engineers Salzgitter). MCA-L ultimately decided to take on this role themselves.

For both the MP and UPUW, all entities were contracted by MCA-L. The contract entities and their roles include: (1) Managing Engineers, who oversee and manage other contracted engineers, approve designs, and commission works; (2) Design Engineers, who are responsible for designing and supervising construction of the works; and (3) Construction Contractors, responsible for constructing and installing the works as designed. A distinct aspect of the MP arrangement was a fourth entity, the Metolong Authority (MA),[77] which coordinated oversight efforts across the various funders and works involved in the commissioning of the dam, the advanced infrastructure, the Environmental and Social Management Plan, and the design of the DCS. MCA-L delegated nearly all of their oversight authorities as employer of the other three entities to MA, although MCA-L officially held the contracts.

[77] The MA is a statutory entity established by the GoL for the express purpose of implementing the larger Metolong Dam and Water Supply Programme through the Metolong Authority Act Number 15 of 2010.

For the MP, the Design Engineer and Construction Contractor were combined into a Design and Build Engineer (DBE) role, with different entities performing this role for the water treatment works and DCS. For the UPUW Activity, the Design Engineer was separate from the Construction Contractor. In that case, the Design Engineer is referred to as the Design and Construction Supervision Engineer (DCSE). Although both programs had a Managing Engineer at the outset, the MPMU and the Program Implementation Unit (PIU), respectively, MCA-L ultimately took on this role for the UPUW Activity by the end of the Compact. Although it is unusual for an entity such as MCA-L to fulfill the Managing Engineer role in place of a professional engineering firm, the broad spread of responsibilities between the Employer, Managing Engineer, Design Engineer, and Construction Contractor as described above are typical for this type of programming.

Other entities were hired to provide independent review of one aspect or another of project implementation. For the purposes of this report we will focus on these entities described above, as their interaction and performance was the critical determinant of the ultimate functioning of the works.

Metolong Program. In the case of the MP, this arrangement functioned as intended. DBEs were efficient and professional, submitting appropriate designs and supervising construction adequately. CDM Smith, in its role as the MPMU under the supervision of the MA, provided sound technical assistance in approving designs, managed the work of DBEs efficiently, and ensured that any defects were addressed adequately during the defects and liability period. They were sure not to commission any works that were not performing to function requirements. For example, when the initially installed high lift pumps did not perform as intended, the pumps were replaced at no additional project expense prior to commissioning.

Contractors installed works as they were designed and corrected defects raised by the MA and MPMU. There were different contractors assigned for different works, which enabled each set of works to be given adequate attention. Although the MA and WASCO each felt that WASCO's participation in the design, construction, and commissioning process was sub-optimal – with differences of opinion regarding the reasons or culpability of different entities for this reality – all parties ultimately felt that WASCO rose to the occasion of managing the works once project handover was imminent.

UPUW Activity. In contrast to MP, the Managing Engineer role of the UPUW Activity PIU was never held consistently, and key informants reported that it was never executed competently by the various entities who held it. Two engineering firms were hired to fill this purpose, and MCA-L either terminated them or declined to extend their services based on perceived poor performance. MCA-L then took on this role in-house, but many stakeholders, including some previously associated with MCA-L, felt that they did not have the expertise required to approve designs and commission works. The MCA-L-led PIU was meant to serve as a forum or committee, in which participants could voice agreement or concerns regarding designs, construction quality and costs, timeframes, and possible additions to or variations from stated plans. WASCO, independent engineers, and MCA-L staff formally participated in this forum, but many felt the PIU leadership took a dictatorial approach and disregarded inputs from other forum members.

PD Naidoo & Associates (PDNA), in their role as the DCSE, exacerbated this situation by designing works that were flawed and inappropriate, many of which failed at the first real test under high turbidity flood conditions. Where such flawed designs might have been caught and remedied prior to construction by a highly experienced and functioning PIU, instead they were constructed and installed as designed.[78]

[78] Former MCA-L staff report that an independent review commissioned by MCA-L and conducted by Gibb found that Unik, in its role as a construction contractor, installed works as designed and thus could not be held liable for the works' shortcomings.

The DCSE was employed on a lump-sum fixed term contract, which ended before the conclusion of the defects and liability period and left no responsible party for the remediation of serious defects.

There were two attempts made by MCA-L to form a PIU to conduct design reviews and manage the DCSE. The contract with the first ended after MCA-L declined to exercise a contract option period based on pace and disagreements over conclusions regarding early designs. Second, MCA-L formed a PIU by committee, headed by the UPUW technical lead in the MCA, employing seconded staff from WASCO, and contracting an expatriate engineer from an external firm to conduct design reviews and mobilize to construction sites intermittently. This arrangement was also ineffective, according to interviews with informed stakeholders. Ultimately, near Compact completion, MCA-L hired another independent engineer to help adjudicate responsibility for remaining defects, and this engineer determined that the Construction Contractor could not be held liable for further remedy since the works were constructed and installed as designed. Eventually, these design, management, and oversight issues resulted in problems in supplying water at most UPUW sites. Some of the required remediation, essential for the supply of water to consumers, required complete replacement of river infrastructure to different and suitable designs at WASCO's expense.

Stakeholders with knowledge of the DCSE's operations noted that contracting decisions made by MCA-L constrained their ability to fulfill their roles effectively. Specifically, the award of Package 2-5 work to a single contractor reportedly led to difficulties in construction supervision due to a lack of dedicated staff and equipment in each site, especially toward the end of construction.

Apart from the issues described above, multiple entities involved in implementation also described perceived shortcomings of the MCC implementation model and the effect these had on their ability to deliver results as intended. For example, key informants from the UPUW DCSE expressed that many of their performance issues stemmed from the atypical use of a lump sum contract for large-scale engineering work combined with (1) significant re-working due to indecisiveness in project scope brought on by the breakdown of the intended forum between MCA-L, the PIU, PDNA, and WASCO, and (2) inflexibility in funding available for investigating design alternatives to previous feasibility studies.

Stakeholders from both projects felt that the fixed five-year Compact period negatively affected implementation fidelity. Stakeholders with knowledge of UPUW PIU and DCSE operations expressed that this timeline rushed due diligence and design review and played a role in the inadequacy of UPUW designs. Stakeholders from both projects felt this fixed period did not allow sufficient time to adequately address defects and ensure proper commissioning. The MA and MPMU addressed this complication by finding external funding to adequately complete these activities. However, for the UPUW Activity, the DCSE simply discontinued this work at the expiration of their contract and WASCO was left with the cost of remediation. WASCO staff in charge of operating the new MP infrastructure lamented that MP-funded training was inadequate because the impending Compact closure dictated that training on the operation of certain infrastructure components, such as the high-lift pumps, be conducted while defects in the infrastructure were still being addressed and the subject infrastructure of the training was not operational.

5.2.2 Current Functionality, Use, and Maintenance (EQ 3)

- EQ 3: What is the current functionality, use, and plan for managing and maintaining the infrastructure under the MP and UPUW Activity?

5.2.2.1 Metolong Program

The Metolong Dam and associated infrastructure have succeeded in increasing the water supply available to Maseru and surrounding areas. Prior to the commissioning of the Metolong Dam in 2015, WASCO was capable of producing an average of 60 megaliters (ML) per day to serve Maseru,[79] which was about 10 ML short of the 70 ML per day projected demand in 2015.[80] The Metolong WTW alone is now capable of supplying these areas with on average an additional 75 ML per day, with a peak of 94 ML per day. This additional supply was intended to satisfy demand in Maseru and surrounding areas through at least 2020, and perhaps longer, depending on the pace of demand increases over time. According to WASCO's own data, these areas consumed an average of around 50 ML per day from April 2017 through March 2018, up from about 37.5 ML per day in 2009. This suggests that if this level of demand persists, the Metolong Supply will be comfortably sufficient for these areas for the forseeable future.

According to direct observation and independent laboratory testing,[81] WASCO operation of the WTW is conducted by well-capacitated staff and results in the production of high-quality water. Although there have been issues with the quality of the Metolong Water Supply in the form of midge flies appearing in some customers' water, this was related to downstream issues at the Mpilo reservoir and not to any issues with infrastructure or compliance with water testing standards in the laboratory.

WASCO staff have two main complaints about the Metolong supply. First, introducing the new high-pressure supply to the network's aging reticulation frequently results in bursts, requiring repairs at one part of the pipeline that can cause bursts a few meters downstream shortly after the first repair. This affects service reliability for some customers. Second, where many WASCO and other stakeholders hoped that the Metolong supply would be available to all consumers in Maseru, in practice there are still townships that are served by the older Maseru Water Supply treatment facilities. WASCO headquarters staffed had hoped these facilities would be retired following commissioning of the Metolong Dam. While this does not affect WASCO's ability to meet demand for water in Maseru, it does increase their operating costs since they have to staff and operate these supplemental facilities.

According to the MA, both of these stresses are not implementation failures, but rather a natural byproduct of the "nodal" design of the MP. This design meant that the MP was only responsible for supplying and conveying water to "nodes" in the form of reservoirs supplying Maseru and the surrounding areas, after which point it would be the responsibility of WASCO and other national authorities to ensure adequate integration with the existing municipal network and interconnection with townships not already connected to Metolong reservoirs. The GoL has signaled their willingness to fund this interconnection themselves, but at the time of this evaluation, that interconnection had not yet been funded.

[79] WASCO n.d.(d), pg. 1. Prior to Compact and until the commissioning of the Tikoe/Thetsane Water Supply project in December 2011, WASCO could only produce an average of 34 to 40 Ml per day.
[80] Mott MacDonald, Ltd. et al. 2007, pg. S-7 Figure S.1.
[81] LogiProc 2017. Study conducted by LogicProc in relation to SANS 241:2006 standards and reported on pg. 3 of the 2017 *Test After Completion* Report, which states that Laboratory Technicians and Process Managers "successfully monitored treatment processes and the final water quality."

Indeed, the MCC Investment Memorandum states that a comprehensive hydraulic assessment of the Maseru water distribution system was underway as of May 2007.[82] While SI does not have access to this assessment, in theory it should have uncovered the problematic effect that the Metolong Supply would introduce to the aging reticulation. If so, it would have been incumbent on WASCO to consider the increase in static pressures on the existing reticulation systems and to install pressure reducing or pressure maintaining installations in their downstream infrastructure. WASCO's complaints could have been avoided, and could still be addressed, by installing offtakes from the bulk supply main with pressure reducing/sustaining valves to control pressure. There are very low associated maintenance and capital costs for these multiple valve installations, and these costs could potentially be offset by a reduction in plant operating costs in two to three years. The Maseru Water Treatment Plant (WTP) could be dismantled or at least mothballed until it is needed to supplement the Metolong supply.

As described more fully in Sections 5.2.4 and 5.2.5 in response to pertinent EQs, the ad hoc plan for managing the MP-funded infrastructure is a remote, ad hoc arrangement, where the WASCO Central Region Manager serves as the Maseru-based focal point for managing the dam and associated works, informed by reporting from the on-site managers of the Metolong Laboratory, ICT, Production, Maintenance, and Corporate Service teams. Meanwhile, the maintenance of the infrastructure is robustly prescribed between a dedicated Operation and Maintenance Manual (OMM) and a Computerized Maintenance Management System (CMMS). Although there are reportedly some inefficiencies in this arrangement from a lack of central, on-site leadership, it has largely functioned to date.

5.2.2.2 UPUW Activity

As implementation fidelity results suggest, the current functionality and use of UPUW infrastructure varies according to the specific network. Below we summarize, for each site, the current functionality and use of the MCC-funded infrastructure, as well as any major remediations that would be necessary, at the time of evaluation inspection, for proper functioning of plants. It is important to note that most of this information is current as of September 2017, when process study site visits were conducted. In a few cases, the evaluation team has been made aware of updates or changes regarding status and functionality since that time, which are integrated into the findings below.

Current Functionality and Use. Below we summarize the current functionality and use of the MCC-funded infrastructure within each package and site, noting any substantial improvements or challenges in service delivery as applicable.

Maseru, Mazenod, Morija, Roma, Teyateyaneng (P1): UPUW infrastructure in these sites is generally functioning well and being used as intended, with minor ongoing issues. The new and rehabilitated reservoirs, despite some leaks, allow for sustained supply for at least two days in the event of an outage. Expanded reticulation and connection of reservoirs to the Metolong Dam supply have allowed for the connection of new customers in Maseru and surrounding peri-urban towns. Ongoing issues at the time of the process evaluation were pipe bursts from the high-pressure supply from Metolong-connected reservoirs and continued reliance on previous water supply sources in townships not yet connected to reservoirs served by the Metolong Dam, but these are considered to be minor relative to the advantages allowed by the increase bulk supply.

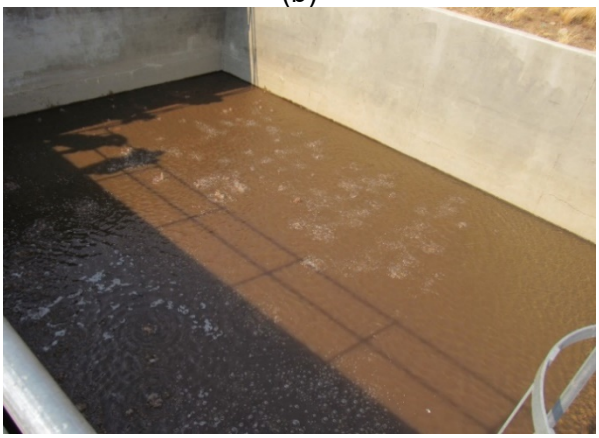
[82] Millennium Challenge Corporation 2007.

Semonkong (P2): Some ongoing issues inhibit the ability to deliver water as intended and operate the plant efficiently, but the plant is overall capable of producing water in a quantity that reliably satisfies customer demand. The WTP can deliver design capacity if it operates 18 hours per day, but to date it has only needed to operate about 8 hours per week to meet demand, producing between 1,481 and 2,440 cubic meters per month. Plant telemetry, allowing for remote monitoring of infrastructure, has never functioned and in-person visits to infrastructure are required for visual monitoring. The main sand filter beds and backwash continue to malfunction (Figure 8.), which is not problematic for meeting demand to date but could complicate the plant's ability to meet demand if it increases in the future. Customers in the new Semonkong network have grown steadily over time.

Figure 8. (a) Semonkong main sand filter beds; (b) Demonstration of uneven backwash

(a)

(b)



Qacha's Nek (P3): UPUW infrastructure has generally helped the network keep pace with demand, and operators are largely content with the current functioning of the treatment plant. The only major ongoing issue is of water losses in the plant from sedimentation tanks, but these were not UPUW-funded. The chemical dosing equipment funded by the UPUW Activity malfunctioned and was replaced at WASCO expense (Figure 9.a).

Quthing (P3): The plant is able to keep up with increasing demand due to increased reliability from improved storage, despite issues with the intake that reduce the plant's ability to draw water from the river in rainy conditions. The UPUW-funded river intake failed, but WASCO remediation currently allows for drawing water from the river effectively in low turbidity conditions. This temporary remediation involves protection of the intake by a sand dam that is vulnerable to significant flooding (Figure 9.b). When significant rain increases turbidity in the river, the intake struggles with filtration and the plant occasionally must shut down. The UPUW-funded clear water tank increased storage time such that the plant can supply water for up to three days without interruption. Thus, when it rains, the plant shuts down and relies on the clear water tank until turbidity decreases.

Mafeteng (P3): Overall, UPUW infrastructure has reportedly improved water quality and helped to increase the supply capacity from 60,000 cubic meters per month to around 75,000 per month, but reliability problems are occasionally introduced from the failure of the UPUW-funded clariflocculator. The clariflocculator, which was not designed suitably for high turbidity/sediment loads, like what is found in the raw water at Mafeteng, requires manual desludging at least once per month that necessitates plant

shutdown for three days at a time. Plant managers report that the plant capacity probably would be even higher if not for issues with the booster pump installations to a reservoir at Likhoele and stand-by generator, which are not generally delivering as required.

Mohale's Hoek (P3): Overall the introduction of the UPUW infrastructure has not affected the treatment plant's capacity of 33,000-42,000 cubic meters per month and it generally left the plant unable to meet customer demand—estimated at 45,000 cubic meters per month—due to acute failure of the river intake works and clariflocculator. WASCO still must operate the plant using a makeshift engagement pumping through temporary pipelines to extract water from the river. The intake fails altogether in flood conditions, leaving the town without water until flooding recedes. The intake design is inappropriate for the riverbed load characteristics, with sump flooded and filled with silt and detritus ingested through the intake and exacerbated by its location below the flood line. De-sludging pumps have failed, and the raw water rising main has been occluded and requires replacement. As in Mafeteng, the clariflocculator must be de-sludged frequently, requiring shutdown of the plant.

Figure 9. (a) Qacha's Nek replacement chemical dosing equipment; (b) Quthing improvised intake sand dam

(a) (b)

Figure 10. (a) Mafeteng Clariflocculator with excess sludge; (b) Mohale's Hoek improvised intake

(a) (b)

Leribe (P4): UPUW infrastructure has increased plant capacity, reliability of service, and allowed for new connections, but still is not functioning or used as intended due to the failure of UPUW-funded intake infrastructure and pump operation problems. Plant production has increased from around 1.1 ML per day to around 1.8 ML per day, but the plant is still unable to meet an estimated demand of 3 ML per day due to the failure of UPUW-funded intake infrastructure. The existing sub-surface infiltration intake system was replaced by a new one of incompetent design which allowed ingress of sand and rapidly clogged. A supposed backwashing system was ineffective, so the whole intake was not functioning as intended. A new intake was also installed upstream, reliant on two small strainers (which cannot be backwashed) for silt and sand removal and only one transfer pump. This intake is vulnerable to sand mining, low flow, and turbid river conditions. There is now little surety of supply under abnormal river conditions, where the old sand intake was competent, especially in drought periods. UPUW-funded high lift pumps function, but must be operated manually instead of automatically, as intended. The UPUW-funded storage tanks helped considerably and allow for two-day storage without additional pumping. The new distribution line allowed for 400 new connections.

Butha-Buthe (P4): The UPUW infrastructure, which is less extensive than in the other sites, is largely unused at present. Specifically, new pumps and pipeline installations have not operated as intended, through poor pump and motor selection and inadequate operation instruction at hand-over. The old replaced high lift pump was re-installed by WASCO to enable water delivery via the old delivery main and operating staff decided to bypass the new high lift pumps and new main entirely.

Mokhotlong (P4): Additional reservoirs and reticulation have helped WASCO expand their local customer base from 1,300 households prior to intervention to around 2,100, but WASCO's ability to deliver water as intended is in jeopardy due to a highly vulnerable remediation to failed UPUW-funded intakes. The UPUW-funded river and spring intakes clogged to virtually no inflow after the first significant flood following construction. However, WASCO remediation, including cutting open the spring intake at the surface and repeatedly blowing the river intake using submersible pumps, allows water to be drawn. This remediation is vulnerable to additional significant flooding and is unlikely to be sustainable.

Mapoteng (P5): The plant is functioning as intended and being used according to plan. Due to the additional UPUW intake infrastructure, production has increased from 12,000 to 40,000 cubic meters per month since 2013. Over the same period connected households increased from around 140 to 400.

Managing & Maintaining Infrastructure. In terms of the plans for managing and maintaining UPUW infrastructure in the future, the upgraded plants will continue to be managed as they were prior to the intervention. This stands to reason, as the UPUW outputs outside Semonkong were mostly refurbishments or minor additions to the water networks, which would not necessarily trigger changes to pre-existing management structures. However, managers largely report that budget and staffing constraints lead them to focus reactively on repairs and crises as issues arise, rather than focusing on preventive maintenance, as they would like to do. Details on the plan for management and maintenance of the new WTP constructed in Semonkong will be elaborated on in the following section.

Maintaining the MCC-funded infrastructure, especially that which has required remediation, is a relatively insignificant concern in many of the sites because the Five Towns Project is currently being funded by the Ministry of Water to upgrade or replace the WTPs in Leribe, Butha-Buthe, Mafeteng, Mohale's Hoek,

and Qacha's Nek in 2020.[83] Thus, in these sites, the current focus as far as maintenance is concerned is to make sure that the plants can supply water adequately until the improvements through the Five Towns project are completed.

The cost-benefit analyses for the MP and UPUW Activity envisioned WASCO O&M spending on MCC-funded assets to increase gradually from around 10 million Maloti per year at Compact closure to around 20 million Maloti per year by 2033. According to annual reports, WASCO budgeted between 12-20 million Maloti per year on maintenance between 2014 and 2017, although MCC's M&E team could not verify the budgeted or spent figures for the purposes of their Post-Compact ITT. Supposing the figures in the annual reports are accurate and supported by the remediation needs identified by our process evaluation, the financial burden of maintaining the Compact-funded infrastructure appears to be larger than anticipated.

Figure 11. (a) Leribe remediated river intake; (b) Butha-Buthe defunct pumps

(a)

(b)

Figure 12. Mokhotlong (a) river abstraction by submersible pump; (b) spring intake cut open by WASCO

(a)

(b)

Remediations. Based on our findings above, we summarize the remediations needed for UPUW Activity infrastructure to allow the plants to function properly below in Table 13. Remediations by site are listed by severity and urgency. These remediations are in addition to those already conducted by WASCO.

[83] See: https://www.water.org.ls/portfolio/five-towns-water-and-sanitation/.

Table 13. Summary of Remediations Needed to UPUW Activity Infrastructure

Site	Remediations Needed
Mohale's Hoek (P 3)	♦ Redesign and replace slotted raw water abstraction pipe on weir outfall ♦ Reshape/replace pump well to handle deposition of entrained silt and removal of accumulated sludge ♦ Provide agitation of sludge for removal by pumps ♦ Provide suitable sludge pumps ♦ Replace rising raw water main to have higher velocities to prevent silt, etc. deposition in the pipe ♦ Provide for initial dosing and sedimentation of very turbid water in existing unused sedimentation tanks before feeding to clariflocculator. ♦ Modify clariflocculator to give necessary hydraulic gradient to old sedimentation tanks and enable better sludge removal ♦ Review high lift pump installation design and modify installation accordingly
Mafeteng (P 3)	♦ Clariflocculator needs to be integrated into the process flow better to allow bypassing for cleaning and enable easier de-sludging—probably by a different sludge valve system set lower to increase scour velocities ♦ Modify raw water delivery to the clariflocculator via old sedimentation tanks and enable better sludge removal from high turbidity water ♦ Second air blower must be installed ♦ Filter backwash must be improved – may need to change the sub-filter collector drain / backwash pipes systems ♦ Booster pump station for Reservoir 1 needs to be relocated 10m lower down the hill side to obviate currently occurring cavitation in the pumps ♦ Generator set at WASCO offices is not rated at high enough amp output to start the booster pump
Leribe (P 4)	♦ Sub-sand collector not working and needs to be replaced / re-designed completely. Blower for "backwash" inadequate for the methodology shown on drawings ♦ New stream intake design not robust and may be vulnerable to sand mining anyway, no way of easily cleaning intake ♦ Provide for sludge removal/sludge pump in pump well ♦ Provide for standby raw water pump ♦ Automatic start/stop of clear water high lift pumps needs to be reinstated and cause of motor burn-out to be determined
Mokhotlong (P 4)	♦ River Abstraction must be redesigned and replaced ♦ Spring/stream abstraction needs to be redesigned and modified ♦ Standby generator amp capacity too low for pump start – needs to be replaced ♦ Fit flow meters with proper reducers and 10 diameters straight pipe upstream and 5 x D downstream
Quthing (P 3)	♦ Redesign and replace river intake ♦ Replace chemical dosing equipment
Butha-Buthe (P 4)	♦ Pumps operate but cut out – considered to be because of overload of undersized motors, incorrect cross connections with the rising main, and issues with motor control center ♦ Operation manuals and proper delivery description required
Semonkong (P 2)	♦ Filter bed performances and backwash efficiencies need to be addressed and may need to change sub-filter collector / backwash system ♦ Telemetry needs to be remediated and an uninterrupted power supply provided ♦ Valve chambers need to be rebuilt to enable valve removal and replacement and give space for flange bolt tightening

5.2.3 Management and Support for the New System in Semonkong (EQ 4)

- EQ 4: To what extent has a management unit been established for the Semonkong water system? To what extent has WASCO HQ provided support to those managing the new system in Semonkong?

As described in Section 2.2, the Semonkong water system was a brand-new system constructed under the UPUW Activity. Semonkong has been newly designated as a peri-urban area, subsumed into WASCO's purview, whereas the population was previously served under the Department of Rural Water Supplies (DRWS). The Semonkong network is now integrated into WASCO's Central region along with the Maseru, Roma, Mazenod, Morija, Teyateyaneng, and Peka service centers.[84] In all, the management unit of the Semonkong plant is capable of carrying out its work and has the ongoing support of WASCO HQ but it is vulnerable due to understaffing. The current staff complement would be unable to manage the plant operating at peak capacity in the event that the customer base increases. The staff reports a focus on corrective rather than preventative maintenance, a de-prioritization of health and safety SOPs in favor of expedience, and occasional operational mistakes due to fatigue.

The plant has an operational, full-time management unit, consisting of two full-time personnel as of September 2017: an area manager and an individual responsible for connections, operation and maintenance, and other catch-all tasks. This is complemented by temporary laborers, when the budget allows, who are hired mostly to support new connections and other labor-intensive tasks when there is an acute need. In the eyes of those managing the plant, an ideal management unit staff complement would include ten full-time staff comprising the area manager, two operators, a driver, a cleaner, a meter reader, and three casual laborers. As with all WASCO service centers, the Semonkong area manager is responsible for preparing and managing the budget for the plant.

Although WASCO personnel generally consider this management structure to be capable of day-to-day operation, they also feel it is highly vulnerable. As mentioned before, short-staffing has led to fatigue and expediency in plant operation and maintenance. The current area manager had past experience as an operator, allowing him to effectively assist in the operation of the plant when manual operation of infrastructure is required. If someone with a different background were to fill the role, the arrangement may not be as successful. Compounding all of this is the failure of the plant's telemetry, which necessitates in-person visits to remote reservoirs on a daily basis for regular monitoring that could be conducted remotely using the telemetry under normal conditions. Aside from the time that this requires that cannot be allocated to other important tasks by limited personnel, visiting these reservoirs requires use of the single truck that the management unit possesses, meaning that other staff are left without transportation for their other tasks until this in-person monitoring is complete.

Staff in Semonkong feel that WASCO headquarters and Central Region staff are as responsive and supportive as possible of the new system, in terms of responding to issues. When issues are raised, HQ reportedly calls or sends contractors to resolve them as soon as possible. The electromechanical staff from WASCO HQ are also as supportive as possible, although the Semonkong team reports that they can be slow to respond to issues due to their own issues with under-staffing constraints.

With regard to training, staff generally feel more reliant on their own previous experience than on HQ-issued training to do their work. They felt the training offered by WASCO HQ was generic and not tailored to the specific operation of the Semonkong plant. Furthermore, they lament that WASCO HQ has been

[84] Peka was not targeted as part of the MCC Compact.

unable to help them in compelling contractors to fix issues in construction and installation that led to malfunctioning parts of the plant. They understand that WASCO has limited power to compel the contractors without litigation because a certificate of completion was issued prior to Compact closure.

5.2.4 Support to WASCO for managing Metolong infrastructure (EQ 5)

- EQ 5: To what extent has support been provided to WASCO for the management of Metolong Dam, Water Treatment Works, and Pump Stations? If provided, who provided it, when was it provided, and how effective has this support and dam management been? Does a staffing plan exist for Metolong Dam? To what extent are positions occupied and what has turnover been to-date?

Overall, both the MA and WASCO are satisfied with the management of the Metolong Dam and associated works to date. Although the WTW and DCS were complete at Compact closure, progress on the Dam and other externally funded-works lagged behind. Thus, staff responsible for the management and operation of these works could not be practically trained with Compact funds and required European Investment Bank-funded practical trainings and operational assistance after the Compact when the dam was commissioned. Thanks in large part to this support, responsible staff are deemed competent to manage and operate the dam under normal conditions, although potentially not to the extent that would be required to address abnormal or challenging repairs.[85] Of course, abnormal or challenging repairs may require the employment of specialized consultants, anyway, so any shortcomings of regular staff for this purpose may not introduce much more risk than would be standard.

A full staff complement exists for the dam but there is an insufficient number of staff filling many roles to effectively accommodate extended leave or turnover, unless these events are sufficiently staggered throughout the year to minimize their impact. The dam is quite vulnerable to turnover, in that budget constraints often dictate that staff with lower qualifications than are standard be hired and trained up to their roles. When they achieve a high-level of competency, there is a concern that they will be priced out and drawn to higher-paying opportunities elsewhere in WASCO or in South Africa. Although some roles have experienced turnover thus far, many critical roles such as Dam Safety Engineer are still occupied by the originally hired staff.

5.2.4.1 Support to WASCO for management of Metolong infrastructure

Support for the management of Metolong infrastructure has mostly come in the form of externally-funded trainings for key staff. Some trainings were offered by the MA to WASCO staff managing the Metolong Dam and associated works prior to Compact closure, but the efficacy of these trainings was limited by the fact that the Dam was not yet operational and defects were still being remedied; thus, there could be no practical element to trainings or verification of trainee competency. Additionally, stakeholders external to and within WASCO felt that WASCO was not proactive enough in hiring to have sufficient staff available in time to benefit from training delivered during the Compact. In some cases, staff responsible for management of the dam and associated works were hired so late that they only received six months of capacitation within the one-year Assisted Operation phase following the Compact, during which key staff were accompanied by subject-matter experts.

[85] This competence was assessed not only by the key informants we spoke with for the process study, but in a formal independent assessment of training outcomes conducted by LogiProc under the supervision of the MA (LogiProc 2017). LogiProc was hired to operate the Metolong WTW for 12 months and train WASCO to take over operation after their 12-month scope of work expired in 2017.

Subsequent to Compact closure and commissioning of the Metolong Dam, three separate, non-MCC-funded trainings were offered to WASCO staff during the Assisted Operation phase between April 2016 and April 2017 targeting the production, maintenance, and laboratory and process teams. LogiProc, who was responsible for training WASCO to take over operation of the works, report in their Test After Completion Report that twenty-four of twenty-five production staff, ten of ten maintenance staff, and four of four laboratory staff were deemed competent following training.[86] The content of these trainings included recommended reading, assignments, coaching, and discussion. LogiProc assessed that the Laboratory Manager and WASCO Maintenance staff all demonstrated sufficient understanding of the training content and the capability to handle standard elements of their responsibilities following training, although they suggested all might need further capacitation to handle more atypical, advanced situations relevant to their roles. In our opinion, however, this shortcoming poses limited risks to the operation of the dam and associated works since the most atypical, advanced situations would call for employment of external consultants to support regular staff.

Further technical assistance and mentorship was provided by the World Bank to dam staff, most critically the Dam Safety Engineer, between December 2016 and December 2017. This support was received well and trainees found it effective and helpful. The MA and WASCO felt it was critically important in ensuring that staff were capable of carrying out their duties, especially because some were hired with less expertise than would normally be expected of someone in their position. Apart from the emphasis on support to the Dam Safety Engineer, assistance was also provided to an Asset Management Specialist, NRW Specialist, Pipeline Specialist, and Treatment Plant Specialist.

According to the Dam Safety Engineer, important aspects of this training and mentorship program included instrumentation analysis, visual inspections, and general risk analysis for the dam as well as training in applying this risk analysis on maintenance activities. Aside from this World Bank mentorship, the Dam Safety Engineer was also scheduled to take advantage of Dam Safety Training provided by the Lesotho Highlands Development Authority at the Katse Dam. He hoped to attend South Africa National Committee on Large Dams conferences and seek further training and mentorship to enable professional registration as an engineer, although at the time of the process evaluation it was unclear to what extent WASCO would fund this continued professional development.

As discussed above, LogiProc recommends in their Test After Completion Report that WASCO pursue further continued assistance to externally address and/or raise WASCO's capacity to internally address more abnormal or challenging conditions or repairs.[87] Specifically, LogiProc suggested additional training for staff working in management information areas, for WTW operators on themes related to chemical dosing, and for pump station operators on pumps, valves, generators, and supervisory control and data acquisition (SCADA). Although LogiProc found that maintenance staff had sufficient competencies in understanding the mechanical and electrical components of the Dam and associated works, their demonstrable work experience is technically not aligned with what is recommended for a Class B plant, such as the Metolong WTW. For example, an Electrician working at a plant of the Metolong WTW caliber is normally expected to be Section 13 Trade tested with a minimum experience of 10 years, medium-voltage certified, and have experience with basic pneumatics. Although not all Metolong Electricians have these qualifications, they nonetheless have demonstrated competency in their regular responsibilities

[86] LogiProc 2017, pg. 28.
[87] LogiProc 2017, pg. 29.

thus far. However, LogiProc recommends that WASCO pursue specific training to keep electrical and mechanical maintenance staff's skill sets aligned with the artisan expertise required for this technology.

5.2.4.2 Staffing and Turnover at Metolong Dam

The staffing plan of the Metolong Dam and associated works seems to exist only in ad hoc basis, according to LogiProc's Test After Completion Report and corroborated by KIIs. LogiProc finds that the ad hoc structure that has emerged is one where management is siloed within the Laboratory, ICT, Production, Maintenance, and Corporate Service teams all report remotely through their managers to the WASCO Central Region Manager. This individual has other responsibilities outside the Metolong works and is further not consistently stationed at the works. According to LogiProc, a superior structure would be one where the Production Manager serves a central reporting and overall accountability function for the entire staff, chairing a steering committee that also includes the Laboratory, Process, and Maintenance Managers. This would allow for staffing and management decisions to be made by well-informed, on-site personnel and enable clearer lines of communication between the Metolong works and WASCO HQ. However, at least at the time of the Process Study, the staffing and management of the Metolong works remained in the ad hoc, siloed basis observed by LogiProc.[88]

Although WASCO staff responsible for managing key elements of the Metolong Dam and associated works generally feel that they have the staff required to fulfill their duties, they share a concern that this situation is vulnerable. First, as discussed previously, even if they have been able to train staff to adequate levels of competency, they have struggled to recruit and staff individuals with industry-standard experience. Especially given budget constraints, they must necessarily hire under industry-standard experience and train up competencies, which leads to the concern that talented individuals will soon find higher-compensated opportunities elsewhere and they will need to again sink considerable training resources into someone else. Two of the operators trained during the Assisted Operation phase resigned less than six months later. In another case, the technician/engineer trained under the Compact to be responsible for the DCS received an internal promotion within WASCO after the training, leaving only two casual laborers trained in the operation of the DCS for the post-Compact period.

Secondly, the staffing structure in place is sufficient with all hands at work but is generally vulnerable when individuals take leave for health or personal reasons. Especially when managers go on leave, backstopping staff are frequently missing some key competencies for their temporary role that introduce risks to standard operations until managers return. The only exception to this rule at the time of the Process Evaluation was at the raw water pump station, where there were reportedly sufficient operators to cover for leave without lapses in staff capabilities. Even so, LogiProc's report expresses concern about the lack of dedicated personnel to address after-hours maintenance needs, given that the complexity and advanced technology of the Metolong Dam and associated works require monitoring on a 24/7 basis.[89]

5.2.5 Operations and Maintenance Plans (EQ 6)

- EQ 6: Do Operations and Maintenance plans exist for the MP and UPUW assets? How are these plans budgeted and funded? Are these O&M plans being observed and carried out?

[88] LogiProc 2017, pg. 24.
[89] LogiProc 2017, pg. 5.

At the time of the process study, four years after Compact closure, there was no articulated, company-wide plan for maintenance of WASCO infrastructure. Site-specific O&M manuals and systems existed, but these were mostly ad hoc with the exception of a robust manual and CMMS for the Metolong WTW. WASCO was in the process of assembling a plan using regional workshops at the time of the process study, but it is unclear what this plan was intended to cover and how far it has progressed in the time since. Although O&M is funded through a central WASCO HQ-based budget, initial budget estimates are made at the service center level before being rationalized and aligned with business plans at WASCO HQ.

5.2.5.1 WASCO O&M Planning, Budgeting, and Funding

One element of WASCO's Strategic Plan for 2015-2020 included developing a policy for planned preventative maintenance of WASCO infrastructure.[90] Interviews with informed WASCO staff confirmed that there was still no articulated, company-wide plan for maintenance of WASCO infrastructure at the time of the Process Evaluation. The Director of Operations was convening workshops of area managers by region at that time to develop SOPs for maintenance, but this person has since moved on from their role and it is unclear if the project was ever completed for any individual service center (i.e. town-level water treatment system) or at the corporate level. Instead, based on direct observation and interviews with area managers, O&M decisions at any individual network are made ad hoc by area managers.

WASCO HQ maintains a dedicated internal fund for maintenance, split into a consolidated expenditure budget for routine O&M costs and a capital expenditure budget for major costs like replacing large-scale equipment and extending reticulation. O&M budgets initially emanate from the service centers, where each year area managers for each service center assemble a budget (including for O&M) based on their local needs and present their budget requests to the head office. WASCO HQ then consolidates these budgets and determines how much of the consolidated budget they will be able to fund based on an annual business plan. When cuts are made, it is generally up to the three regional managers to prioritize how these cuts will be allocated across their constituent service centers.

5.2.5.2 Metolong Program O&M Manuals

Despite the absence of an articulated WASCO-wide maintenance plan, O&M of the Metolong WTW is fairly robustly prescribed between a dedicated OMM and a CMMS. SI's direct observation of these resources and a more intensive independent review of their content by LogiProc both find them to be complete, relevant for operation of the WTW, and well-implemented. These resources go beyond description of trivial details about the equipment to prescribe basic maintenance procedures and troubleshooting techniques. Staff were trained on the practical use of the OMM both for routine maintenance and equipment breakdowns and appeared to be following prescribed procedures at the time of the process evaluation.

The CMMS was developed under the MP to supplement and reinforce the OMM by capturing direct measurement of the compliance of actual maintenance activities with manufacturer and OMM prescriptions. The CMMS covers all equipment and infrastructure at the plant and was fully functional and effectively operated at the time of the Process Evaluation according to SI's direct observation and LogiProc's independent reporting. At that time the CMMS had not been tested under abnormal water

[90] WASCO 2015, pg. 9.

quality conditions or maintenance challenges, but WASCO's effective handling of water quality issues since the time of the Process Evaluation suggests that the system is capable.

In all, LogiProc concluded in their extensive review that WASCO is capable of effectively managing basic maintenance as required by the Metolong WTW. They recommended that WASCO hire a contractor for more advanced reactive and proactive maintenance assistance and that personnel responsible for mechanical and electrical components of the plants should obtain additional training to keep up with the maintenance requirements for the advanced electrical and mechanical technology deployed at the WTW.[91] Based on our interviews, these conclusions continue to hold. Some additional capacitation of Dam staff has taken place through partnerships with the Lesotho Highland Development Authority but interviewed individuals suggest they could benefit from even more training and mentorship. In our assessment, a retired generalist engineer could serve as a manager or "water bailiff" and bring a broad spectrum of expertise to provide mentorship across these various specialized role.

5.2.5.3 UPUW Activity O&M Manuals

O&M manuals for the UPUW infrastructure delivered by the UPUW Activity, to the extent they existed, were largely viewed as inadequate, based on KIIs and site visits. There are exceptions to this view, such as the manual in Mapoteng, which appeared adequate and valued by plant staff, and manuals for Package 1 networks that were largely unchanged relative to before the UPUW Activity except for additional reservoirs and reticulation. The inadequacy of these manuals is likely linked to the premature ending of the DCSE's fixed-term, lump sum contract. Normally, the DCSE would have been responsible for reviewing, augmenting, and approving the O&M manuals so that they were relevant to the plant as a whole and not just populated by manufacturer's literature on plant components.

However, manuals delivered for UPUW infrastructure in other sites provide basic manufacturer information on individual plant components, rather than being tailored to the plant's overall operation and do not aid in troubleshooting problems when they arise. At the time of SI's site visits, existing O&M plans were reported to inadequate to such a degree that O&M was reportedly carried out ad hoc under the direction of area managers. To respond to this situation, WASCO funded workshops to develop formal SOPs for O&M at the plants that were ongoing at the time of SI's visit in September 2017. SI has not seen these SOPs to date to verify if they have improved the O&M situation since. Unlike the Metolong CMMS, there is no formal mechanism to ensure compliance with O&M expectation at these plants aside from checklists maintained by plant managers.

5.2.6 WASCO Income and Costs (EQ 7d)

- EQ 7d: How have the MP and UPUW programs impacted WASCO's income and costs? Has additional income been generated that can be directed to maintaining the new infrastructure?

At the time of the process evaluation, WASCO accounting systems were incapable of reporting on net revenue for each individual network under their management and can report only at the corporate level. Although expenses from the Metolong Dam and associated works are feasible to separate as discrete costs, remediation of issues on UPUW assets as described in previous sections are not differentiated in WASCO's records from other maintenance and repair costs in annual budgeting or accounting. Likewise,

[91] LogiProc 2017, pg. 5.

it is difficult to isolate the portion of NRW that comes from any one network, as a single figure is reported for WASCO's overall operations. Given all of this, it was not feasible to specifically quantify changes to WASCO's finances resulting from the MP and UPUW Activity. However, it is possible to discuss how issues stemming from these programs are perceived by WASCO stakeholders to have altered income and costs; that discussion follows below.

5.2.6.1 New Sources of Revenue & Reduced Costs

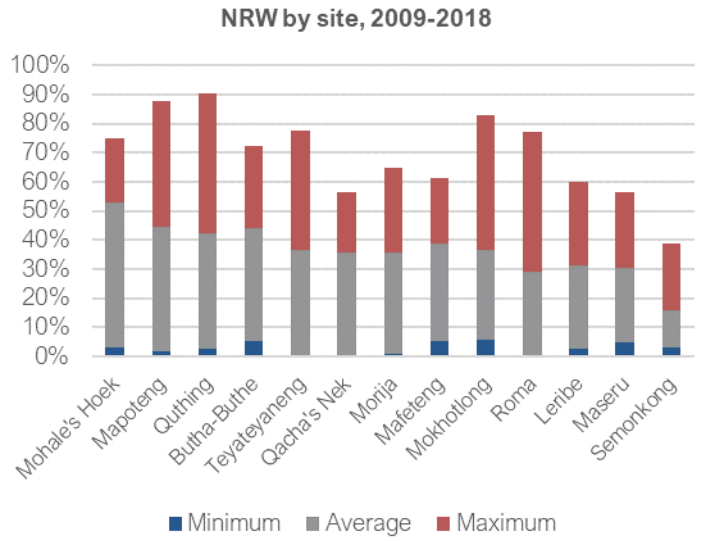
According to WASCO finance staff, the Semonkong plant contributed an average of around 42,000 Maloti (almost $3,000) in additional revenue between the time it opened and September 2017. In addition, although the net quantity is uncertain, staff believe that there is additional revenue from Mapoteng and Package 1 areas especially, implemented due to new customers being connected as compared to before the UPUW Activity was. Due to the shortcomings in the way WASCO finances are documented, direct verification of changes attributable to MCC funding is not possible.

Staff report that the MP allowed for some previous water treatment works in Maseru and surrounding areas to be retired, which obviated the cost of staffing and running these works, although some water treatment works must remain open to serve townships that were not interconnected with the Metolong Supply. These continue to incur routine expenditure in terms of staffing and materials and capital investment costs for maintenance that would be removed if the townships were connected to the Metolong source, which provides sufficient supply on its own.

5.2.6.2 New or Increased Costs & Decreased Revenue

On the other hand, while NRW decreased from a pre-Compact annual figure of 34% to a Compact-close figure of 27% in 2013, it rebounded to over 40% after the commissioning of the Metolong Dam, which WASCO operations staff attribute chiefly to vandalism of the DCS and pipe bursts in Maseru. It has since settled to around 31% in early 2018, the most recent data available (see Figure 13. for more detail regarding NRW at the MP and UPUW-assisted networks over the past 10 years). Likewise, given the considerable and unprecedented size of the Metolong Dam and associated works in WASCO's history, the reduced costs in closed water treatment works surrounding Maseru were offset by M700,000 (almost $50,000) per month in new electricity costs in addition to increased and more expensive staff and a significant increase in essential staff transport costs. Finally, there continue to be large costs to WASCO to remediate or institute temporary solutions to the issues with UPUW works, especially the failing abstraction points at many plants. It was not possible for SI to determine, in consultation with WASCO, the specific value of additional investment required by WASCO for these remediations, but they report that their O&M costs have increased directly as a result of that work.

Figure 13. Historical NRW, by MP and UPUW-assisted Water Network



Site	Apr. 2009	Sep. 2013	Mar. 2018
Mafeteng	32%	43%	47%
Mokhotlong	22%	53%	45%
Morija	49%	29%	43%
Quthing	46%	44%	41%
Butha-Buthe	33%	38%	40%
Mapoteng	42%	30%	39%
Mohale's Hoek	54%	61%	37%
Roma	21%	25%	31%
Qacha's Nek	43%	40%	31%
Maseru	33%	23%	31%
Semonkong	N/A	N/A	26%
Leribe	26%	39%	23%
Teyateyaneng	42%	41%	23%

Note: Data source is administrative production and consumption records provided by WASCO; illogical NRW figures (below 0%) have been excluded. Estimates in table are four-month averages corresponding to earliest records in WASCO data, the date of Compact closure, and latest records in WASCO data.

5.2.6.3 Perceived Net Benefit

Anecdotally, WASCO Finance staff perceive that the MP is likely to have contributed a net benefit to WASCO's finances, given the substantial additional water that is consumed and the new customers that have been able to connect to Maseru-area networks. Meanwhile, they perceive that revenue from new customers connected partly in response to the UPUW Activity outside the Central region have been insufficient to offset the significant remediation costs of faulty UPUW outputs. WASCO's M&E data on their total revenue and costs are shown in Figure 14., with a revenue breakdown in Figure 15..

Given the scale of the MP relative to the UPUW Activity, it is reasonable to speculate that the net benefit from the MP exceeds the net cost incurred from UPUW, but WASCO staff interviewed as part of the study were not able to say with certainty that this was the case, due to the aforementioned consolidated reporting of WASCO's accounting system which does not allow for breaking out the granular revenues or costs related specifically these MCC-funded works.

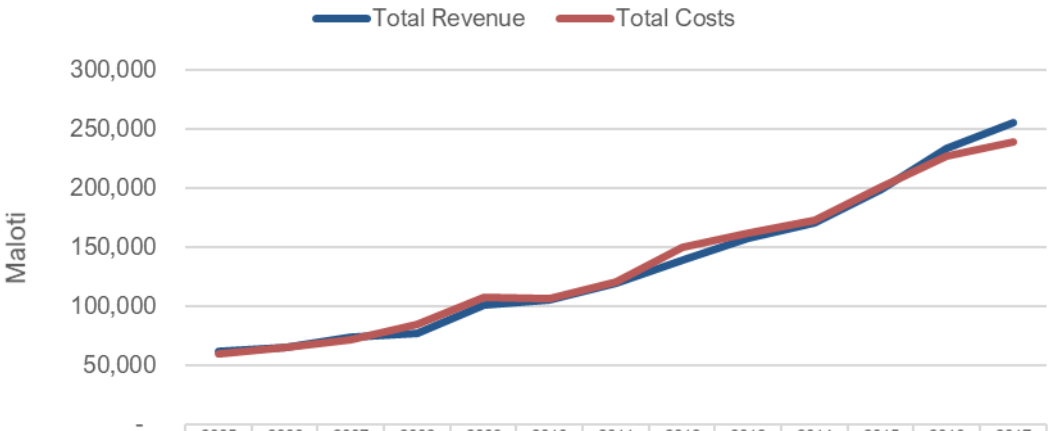
More generally, there are two levers available to WASCO to definitively improve the balance of the revenue and costs in their favor: reducing NRW and increasing consumer tariffs. NRW is reduced by either limiting the physical losses from water that escapes the system through leaks before it is charged to the customer or by capturing more revenue from losses to non-paying customers who consume the water through informal or vandalized access points and from which it would be difficult, at present, for WASCO to recover revenue through tariffs.[92] However, WASCO would benefit immensely if some other

[92] Aside from the intended uses of the MP infrastructure by urban households and industry, unintended uses have reportedly arisen as well. Most notably, although the DCS was always designed to have take-off points for tertiary pipelines to supply rural areas through which the DCS passed with water from the Metolong supply, to be funded separately from the MP, these pipelines were never constructed and as a result communities along the DCS vandalized the pipeline to obtain water in a period of severe drought in 2014. Eventually, given the ubiquitous and frequently-used nature of these vandalized points of the pipeline, formal taps were constructed along the DCS from which rural communities

institutional mechanism could be devised to recover revenue, or at least the cost of production, for this water. Possible arrangements could include reimbursement from the DRWS or some apportionment of tax revenue for this purpose. To our knowledge, no such arrangements are under discussion at this time.

With regard to the second lever, WASCO could increase tariffs on paying customers and increase their revenue for the same amount of water consumed. However, increased tariffs must be approved by the water regulator, the Lesotho Electricity and Water Authority, which has historically limited the tariff increase allowed to WASCO due to WASCO's asset liabilities, high NRW, and the inapplicability of the new Metolong costs to rural customers.

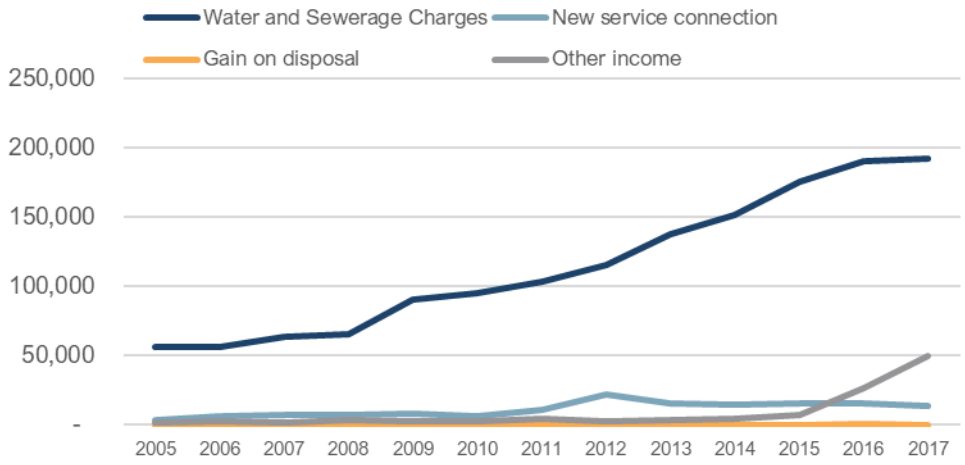
Figure 14. WASCO Revenue and Costs, between 2005 and 2017



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Revenue	61,673	65,706	73,830	77,667	101,32	105,27	119,36	139,70	157,75	171,23	198,66	233,85	256,04
Total Costs	60,240	64,709	71,714	84,777	107,18	106,86	120,59	150,29	161,74	173,01	201,82	227,29	239,93

Source: WASCO Annual Reports, 2005-2017

Figure 15. Breakdown of WASCO Revenues, between 2005 and 2017



Source: WASCO Annual Reports, 2005-2017

and passers-by could draw Metolong Water for free. This practice continues to this day and will be discussed further in section 5.3.2.6 as an unintended outcome of the MP.

5.3 Summative Evaluation Findings

- EQ 7: What were program results on key short-term and intermediate outcomes?
- EQ 7a: To what extent has access to quality water increased? What activities, if any, has WASCO conducted to encourage households to connect to the network?
- EQ 7b: To what extent are community members (including businesses such as manufacturing firms) using water from the urban water network and how has this changed since the Lesotho Compact started?
- EQ 7c: To what extent are community members experiencing cost and time savings, or reductions in water-related illness?

As discussed earlier in section 2.3, the logic underpinning MCC's urban water sector projects in Lesotho hypothesized that in the short-term, increases in water supply, water quality, and reliability would lead to greater access to quality water. In the intermediate term, the logit posited that this would result, at the household level, in increased water consumption, time savings from water collection, and improved health outcomes. The ERR for the UPUW Activity used the latter two intermediate outcomes as benefit streams and assumed that project investments would lead to a 50% reduction in time spent on water collection, and a reduction by 30% in under-5 mortality rates as result of increased water supply.[93]

The project logic also assumed that the improvements would allow for greater private sector investment to utilize the improved availability and reliability of water in urban areas. Specifically, in Maseru, it was assumed that the Metolong Dam Activity would help secure the continuity of the current industrial base through preserved and new employment as well as provide the technical feasibility of future economic expansion including through new foreign direct investment.[94] In addition, the UPUW ERR posited additional private sector investment in response to the improved availability and reliability of water in urban areas, with an assumed 50% likelihood of occurring.[95] However, later in the Compact, M&E plans removed or downgraded expectations for impact in these sectors for reasons discussed earlier.

SI's summative evaluation employs IE and PE methods to evaluate whether the MP and UPUW Activity achieved key short-term and intermediate outcomes. We structure our findings below as follows. Question 7 is addressed in full by specific findings provided for sub-questions 7a, 7b, and 7c. First, we examine program results on short- and intermediate term outcomes at the household level. We describe our findings from a set of IEs conducted in a subset of project sites assessing the effects of increased access and increased supply. In sites where an IE was not feasible, we present findings from a set of customer surveys, which measured the current level of short- and intermediate term outcomes among households connected to the piped water network (i.e. WASCO customers). Discussion of outcomes at the household level is concluded with a discussion of potential spillover effects and unanticipated outcomes.

Following this, we discuss potential program results on industrial manufacturing firms in the textile and garment industry, as well as other businesses. This portion of the summative evaluation was conducted using an *ex post* thematic analysis PE methodology, which triangulates findings across KIIs, site visits and case studies, and secondary data analysis.

[93] MCC Urban Water ERR Close-out Final n.d., 'Costs & Benefits Summary' tab (.xls) https://www.mcc.gov/where-we-work/err/lesotho-compact.
[94] MCC Metolong ERR Close-out n.d., 'Activity Description' tab (.xls) https://www.mcc.gov/where-we-work/err/lesotho-compact.
[95] MCC Urban Water ERR Close-out Final n.d., 'ERR & Sensitivity Analysis' tab (.xls). https://www.mcc.gov/where-we-work/err/lesotho-compact.

5.3.1 Short-term Outcomes

- EQ 7a: To what extent has access to quality water increased? What activities, if any, has WASCO conducted to encourage households to connect to the network?

Below we provide findings and descriptive statistics showing changes in access to quality water over time, using a combination of WASCO administrative data, household survey data, and qualitative data from household FGDs. Access to quality water is primarily defined here as a piped connection to the WASCO network. In sum, information from the WASCO database and household survey show an increase in access to piped water over time. WASCO annual reports describe a number of efforts that WASCO took over approximately a decade which, collectively, are likely to have contributed to the observed increase in new connections over this period. Beyond increased access to WASCO taps, we also provide additional descriptive statistics from the household surveys carried out for this evaluation showing reported changes over time in favor of other piped and improved sources, as well as characteristics of households who have become connected recently and those that remain unconnected. Although we analyzed WASCO administrative data regarding changes in production by service center over this timeframe, these were generally too erratic to use for drawing conclusions regarding potential improvements from MCC investment – see Annex B: Methods & Additional Data for more information.

5.3.1.1 Improved Access to Quality Water

Overall, WASCO data shows an increase in connections across all sites during the time period of interest (Table 14; and Figure 16. through Figure 21.).[96] In some cases, the trend begins near the Compact start-date, toward the end of 2008, potentially suggesting anticipatory effects of the MCC-funded works. This appears to be the case in Maseru urban, Package 4 and 5 sites, and to a smaller extent in Package 3 sites. In some sites, this trend continues on the same path after the commissioning of the works (Maseru urban, Mafeteng, Qacha's Nek, Quthing, Butha-Buthe, Mokhotlong, and Mapoteng), while in other sites, the trend appears to increase again toward the end of the Compact or around the time of the commissioning of the works (Roma, Mazenod, Mohale's Hoek, Teyateyaneng, and Butha-Buthe). In Morija, a spike appears later after these milestones, in 2016.

With regard to attribution, the MCC projects can be described most accurately as one of several contributing factors driving this trend, rather than a direct cause. MCC due diligence documentation described that the projects were largely aimed to help meet already-increasing demand. As with other MCC investments, the projects are meant to support, facilitate, and supplement other efforts by the utility, including through its own funding as well as other government or donor support. In some sites, MCC did directly fund provisions for new household connections (Leribe, Maseru, Mazenod, and Semonkong), though this was a relatively small component of the overall works. In other cases, new connections were facilitated through components of the works including network extensions and new reticulation (Leribe, Maseru, Mazenod, Roma, and Semonkong) or new transmission pipelines (Morija). With this perspective and also bearing in mind findings from the process study showing that the MCC-funded works in many sites did not actually function as intended upon commissioning, the observed trends showing increasing connections over time are likely due to a combination of several factors, including but not limited to the MCC-funded works (or perhaps in the less successful cases, despite the challenges with the MCC-funded

[96] Figures show the number of active customers per month in the database, based on WASCO's consumption database, rather than their customer information file; the consumption database was used due to larger amounts of missing data in the customer information file. The figures thus are a proxy for new connections by installation date.

works). The main exception to this is Semonkong, where increased access is entirely attributable to the MCC-funded network and water treatment works since prior to this, no households in Semonkong had their own connection.

Comparing population with rates of new connection it appears that Lesotho has succeeded in expanding water access to urban residents, even as increasing urbanization is drawing more and more people to cities. Where the population of Maseru reportedly increased by around 67% from 2006 to 2016, the number of active domestic water connections nearly quadrupled between 2008 and 2015 and nearly quintupled between 2008 and 2018. Similar differential rates of growth occurred even outside Central Lesotho. Towns like Butha-Buthe, Leribe, Qacha's Nek, and Quthing experienced similar or higher rates of urban population growth to Maseru between 2006 and 2016, but connection rates outstripped this growth rate everywhere except for Butha-Buthe. As we will establish in sections to follow, WASCO has succeeded in most of its service centers in maintaining a high level of service or improving service, even as it is increasing access in the context of population growth and urbanization.

5.3.1.2 WASCO Efforts to Connect New Customers

WASCO staff, through KIIs and other consultations during the course of the evaluation, reported to SI that there have been no systematic campaigns undertaken to connect new customers during the time period of interest. Nonetheless, a careful review of WASCO annual reports from 2005 to present indicates that WASCO implemented a range of efforts and policy changes that are likely to have contributed substantially to the increasing trend of new connections.

WASCO reports indicate that annual target-setting for new connections began in 2010-11, and states explicitly that the UPUW activity was one of at least two projects (along with the "Three Towns" project) contributing to that process. The annual target was doubled from about three to six thousand after 2010-11: "To improve service delivery, WASCO signed an agreement with Government of Lesotho whereby the Company sets targets to be achieved per year. Since the signing of the agreement, the organization has been exceeding the target. The target is 3,000 connections per year and this year the division achieved 4,101 connections. It is anticipated that 6,000 connections will be installed in 2011-2012 after the completion of Three Towns Water Supply and Sanitation Project which covers Maputsoe, Teyateyaneng and Roma and the Maseru Peri-Urban Water Supply Project Phase II."[97]

> **"The slow pace in the implementation of reticulation extension projects is stifling our efforts to increase the number of water and sewer connections and this contributes to the long-standing backlog of water and sewer connections…**
>
> **Another major challenge is that of inadequate and old infrastructure which is doubled by the influx of population into the urban areas…We are however, trying to address this with implementation of projects such as the Urban and Peri Urban Water Supply Project and many others at different stages of implementation."**
> – WASCO Annual Report 2013-14

Reports further indicate that in each subsequent year after target-setting began, WASCO continued to exceed its new elevated annual target. However, it is also noteworthy that in most cases WASCO did not

[97] WASCO n.d.(a), pg. 20.

manage to meet the full extent of new demand despite surpassing their target, partly due to the compounding issues of aging infrastructure, growing urban population, increasing demand, and other issues such as shortage of required parts; for example, in 2012-13, nearly eight thousand connections were applied for and paid for, but just over six thousand were installed.[98] Increasing the annual target likely set in motion the process of directing or aligning incentives, budget, and/or other institutional resources to increase the number of household connections each year.

However, WASCO reports also describe other policy changes prior to or during the Compact that may have contributed. Of those, one of the most potentially influential is a credit policy described in the 2009-10 WASCO annual report: "The introduction and subsequent promotion of the credit policy whereby customers are given an opportunity to pay for new water and sewer connections in affordable instalments," which "has significantly increased the volume of customers who are now handled by the Water and Sewerage Authority (WASA) on a daily basis."[99] Given that the cost of connection is often a major barrier for households to connect, the timing of this policy around Compact start is likely to have been at least as important as any anticipatory effect of new target setting – there is also a possibility that one facilitated the other. The evaluation was not able to determine that in conversation with WASCO staff. The credit policy could also have formally codified a practice that was already occurring, since in the 2007-08 annual report, WASCO noted that: "90% of customers who apply for a new water connection do so through a credit plan."[100]

Apart from increased target setting and the formalization of a credit policy, other supplemental efforts were mentioned in WASCO's reports over the course of several years prior to and during the Compact, mainly aimed at information dissemination and customer relations, such as print and radio marketing to advertise their services, detail the steps involved in obtaining a connection, and encourage households to connect,[101] development of new informational material to encourage new applications,[102] and efforts to make application and bill payment more user-friendly and available online and via mobile phone.[103] The extent to which any of these individual efforts described were meant to amplify the potential impacts of new infrastructure projects, including but not limited to the MCC-funded works, could not be discerned from consultations and interviews with WASCO staff. It is likely that all factors contribute to the observed trends, underlining again the role of MCC funding as just one contributor to WASCO's broader strategic goals to increase their customer base and improve service delivery.

[98] WASCO n.d.(b), pg. 17; WASCO n.d.(c), pg. 10, 14; WASCO n.d.(b), pg. 17.
[99] WASA n.d.(b), pg. 11.
[100] WASA n.d.(a), pg. 15.
[101] WASA n.d.(a), pg. 15.
[102] WASA n.d.(b), pg. 11.
[103] WASCO n.d.(a), pg. 14.

Table 14. Number and rate of new connections over time, by package and site

P #	Town	# Active, domestic connections [a]			(b)-(a)			(c)-(b)		
		(a) Compact start	(b) UPUW complete [b]	(c) March 2018 [c]	Diff.	% change	# new/mo. (avg.) [d]	Diff.	% change	# new/mo. (avg.) [d]
1	Maseru	7,492	27,447	36,024	19,955	266%	255.8	8,577	31%	238.3
1	Mazenod	0	692	1,638	692	-	12.1	946	137%	16.6
1	Morija	110	218	421	108	98%	1.9	203	93%	3.6
1	Roma	211	813	1,246	602	285%	10.6	433	53%	7.6
1	Teyateyaneng	937	2,221	3,651	1,284	137%	22.5	1,430	64%	25.1
2	Semonkong	0	0	408	0	-	0.0	408	-	8.9
3	Mafeteng	1,245	3,101	4,351	1,856	149%	28.6	1,250	40%	25.5
3	Mohale's Hoek	496	1,549	2,764	1,053	212%	16.2	1,215	78%	24.8
3	Qacha's Nek	279	689	1,145	410	147%	6.3	456	66%	9.3
3	Quthing	433	790	1,167	357	82%	5.5	377	48%	7.7
4	Butha-Buthe	753	1,222	1,891	469	62%	7.2	669	55%	13.7
4	Leribe	637	1,267	2,440	630	99%	9.7	1,173	93%	23.9
4	Mokhotlong	386	710	1,329	324	84%	5.0	619	87%	12.6
5	Mapoteng	340	665	1,200	325	96%	5.7	535	80%	9.4

[a] Based on WASCO's consumption database; [b] Varies by package and site, usually in 2013-14; [c] Most recent data provided to SI; [d] Average rate of new connections per month, net of any disconnected customers, during the specified time period.

Figure 16. Total number of active domestic WASCO accounts, Maseru Urban

Red line = UPUW commissioning; Maroon line = Metolong commissioning; Dotted gray lines = Compact dates

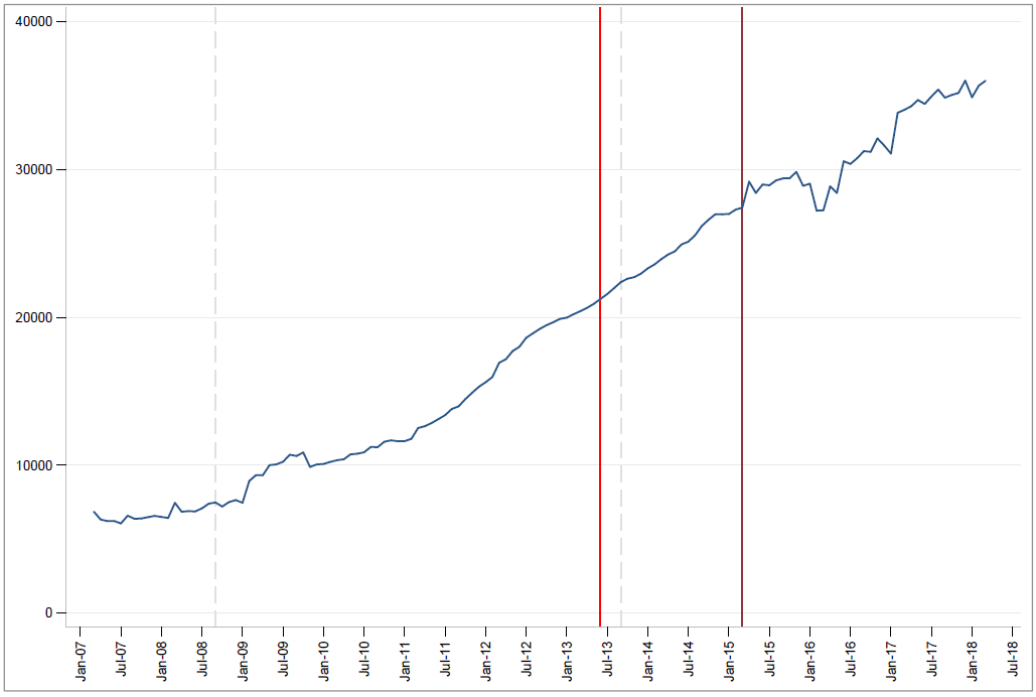
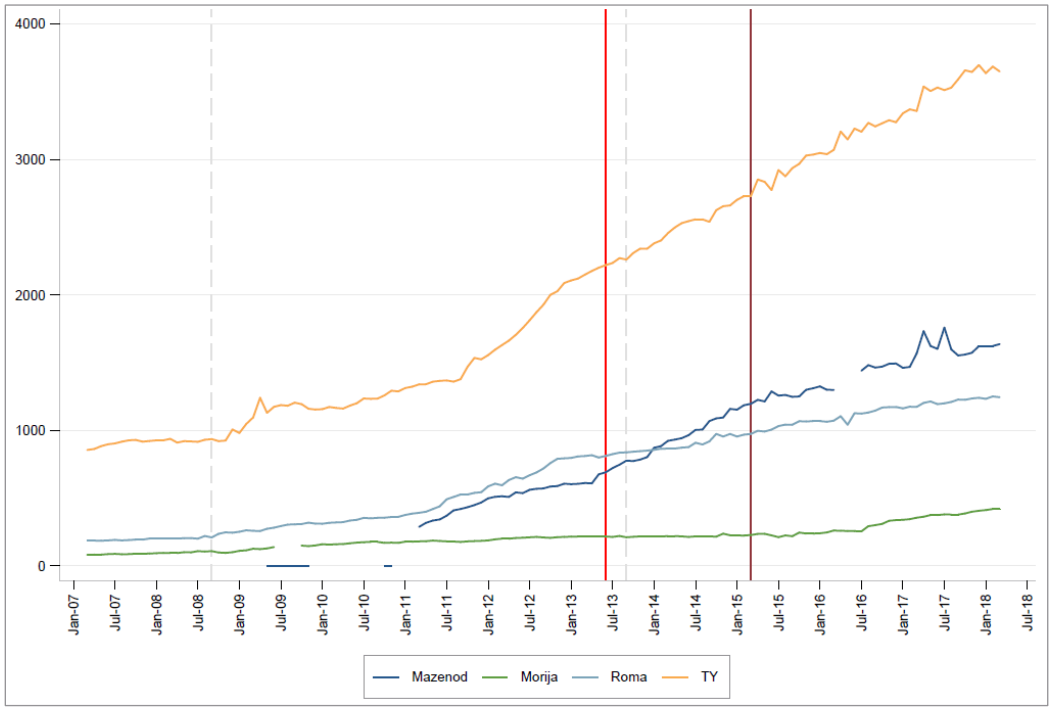


Figure 17. Total number of active domestic WASCO accounts, Package 1 (Maseru peri-urban)

Red line = UPUW commissioning; Maroon line = Metolong commissioning; Dotted gray lines = Compact dates



Note: Breaks in the graph = data excluded due to clerical issues in the database for those months.

Figure 18. Total number of active domestic WASCO accounts, Package 2 (Semonkong)

Red line = commissioning date of UPUW works; Dotted gray lines = Compact dates

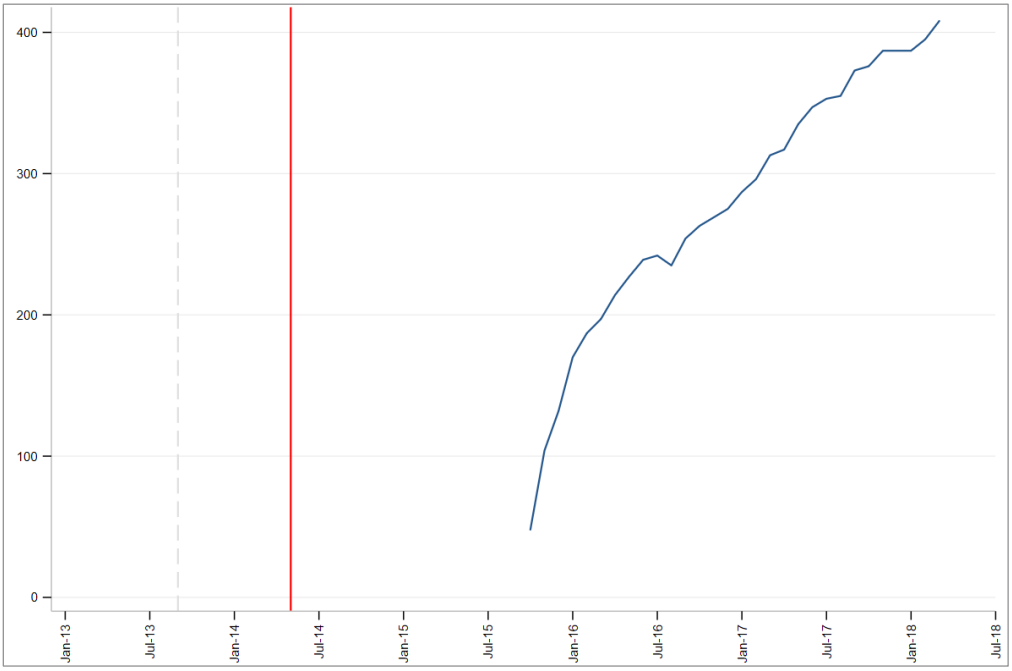


Figure 19. Total number of active domestic WASCO accounts, Package 3

Red line = commissioning date of UPUW works; Dotted gray lines = Compact dates

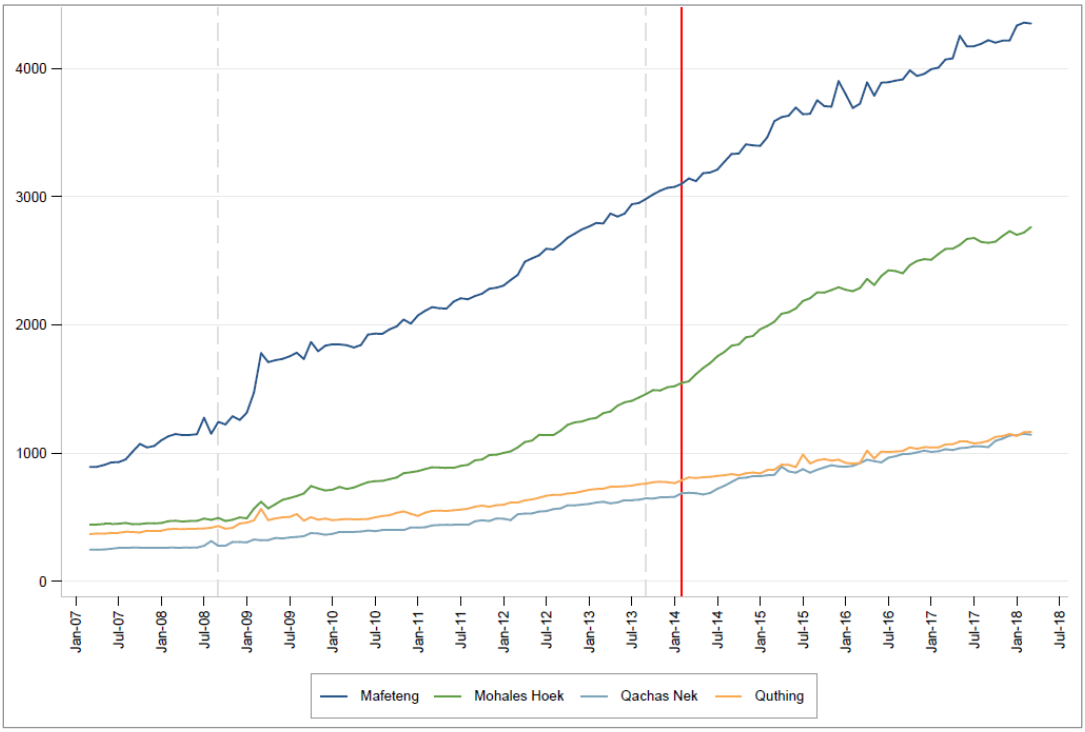
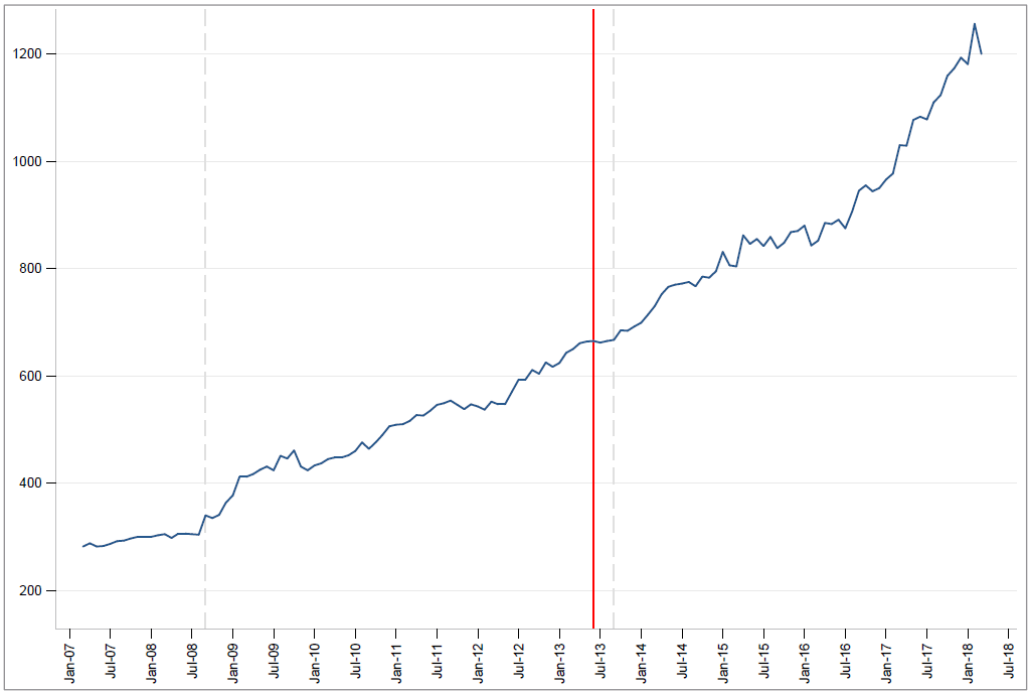


Figure 20. Total number of active domestic WASCO accounts, Package 4

Red line = commissioning date of UPUW works; Dotted gray lines = Compact dates

Figure 21. Total number of active domestic WASCO accounts, Package 5

Red line = commissioning date of UPUW works; Dotted gray lines = Compact dates



5.3.1.3 Insights from primary data collection

The household surveys conducted for the purpose of this evaluation provide some additional context regarding households' decision to connect.[104] Despite the existence of WASCO's credit policy, most (between 50-70% depending on the site) reported paying for their connection all at once, rather than in installments. Between about 10% in Semonkong and 23% in Morija reported paying in installments. In Roma, other Package 1 sites, and Semonkong, most households paid between 1500 and 3500 Maloti for their connection. In Morija, the amounts paid varied more widely between 1500 and 4500. Customers in Package 3-5 sites mostly paid 2500 Maloti or less for connection. In all sites, a sizable proportion (at least one fifth) of respondents did not know or remember how much they had paid for their connection.

Among newly connected customers (gained a connection after commissioning of MCC-funded works), the main reasons cited for obtaining a new connection in Morija were reliability of service (28%) and that the network was extended to that area (28%), followed by a desire to save time collecting water (18%). In Roma, the main reason cited was to save time collecting water (48%). Package 1 customer survey sites outside of Morija and Roma cited improved reliability of service (60%), water quality (43%), and time savings in water collection (52%) as reasons for connection. In Semonkong, the main reasons were reliability of service (29%), save time collecting water (25%), and network extended to the area (23%). For Package 3-5 sites, the most important motivation was to save time collecting water (65% of new connections), followed by reliability of service (48%), water quality (47%), extension of the network into their area (29%), and becoming able to afford the connection fee (26%)

[104] Note that the household surveys conducted for the IE were sampled according to the needs of the IE, and thus were not population-representative surveys of the project sites. Unconnected households in our survey are only those located within 300 meters from the network (based on eligibility for the IE); these comparisons do not speak to unconnected households in these sites outside of that geographical area.

Qualitative data from our IE sites in Semonkong, Roma and Morija provide further insight. Focus group participants in Semonkong said that their previous sources, primarily uncovered wells and rivers, were far away and had begun to dry up. They had also wanted individual connections to be able to raise animals, grow vegetables and water plants and lawns. In Roma, participants said that they were primarily motivated by the need for a close, clean, reliable source of water. Their previous sources, primarily wells, were far away, dirty, and ran dry due to drought. Similarly, participants in Morija were also motivated by the need for a closer and cleaner source of water. Their previous sources, primarily streams and public taps, had long lines and ran dry in drought conditions. Households also wanted individual connections to raise animals, grow vegetables and expand small businesses, such as homebrewing.

Comparing households with existing connections, new connections (as defined by the commissioning date of MCC-funded works), and those that remain unconnected (within the eligible 300m buffer for connections), we find that overall new connections have expanded in a pro-poor direction, especially in some sites, while those that remain unconnected are more likely to be of lower socioeconomic status (SES) (Table 15; for site-specific tables see Annex B). This is especially apparent in Semonkong. There were no existing customers given the network was entirely new, but those who remain unconnected are substantially more likely to be of lower SES than those who have become connected.[105] The difference in SES between existing and new customers also holds in Package 3-5 sites, although to a lesser extent. While this pattern holds at a site level for all Package 1 sites, the difference in SES for Package 3-5 sites is mostly driven by differences in Leribe, Quthing, and Mokhotlong – the differences were less apparent in the other P3-5 sites.

Table 15. SES of existing, new, and unconnected households

SES quintile	Roma/Morija Existing	Roma/Morija New	Roma/Morija All Connected	Roma/Morija Unconnected	Semonkong New	Semonkong Unconnected
1 (lowest)	8.5%	13.7%	11.5%	47.6%	39.4%	71.6%
2	16.3%	20.2%	18.8%	25.2%	30.9%	22.7%
3	23.4%	26.6%	24.3%	14.0%	14.0%	4.0%
4	22.4%	25.0%	23.6%	7.7%	10.4%	1.4%
5 (highest)	29.5%	14.6%	21.9%	5.5%	5.2%	0.4%
Chi-squared test	p<0.001		p<0.001		p<0.001	

SES quintile	All P1 Existing	All P1 New	All P3-5 Existing	All P3-5 New
1 (lowest)	4.5%	15.2%	7.5%	10.0%
2	12.8%	15.8%	16.0%	22.6%
3	24.6%	21.4%	23.2%	19.5%
4	28.3%	20.9%	21.2%	22.8%
5 (highest)	29.7%	26.7%	32.1%	25.1%
Chi-squared test	p<0.001		p=0.038	

Those who were unconnected were told that households usually pay about 1500 to 3000 Maloti for a new connection, depending on their distance to the network. They were then asked how much they would be

[105] Note that one limitation of this comparison is that SES was measured at the time of the survey using an asset register; ideally, SES *prior* to connection would have been the better comparator, since there is the possibility that access to water contributes to increased wealth at the household level through a number of pathways. However, asset registers are largely expected to be insensitive in the short to medium term to this kind of intervention.

willing to pay for a new connection in one single payment, as well as how much they would be willing to pay for each of 12 monthly installments toward a new connection. Though unconnected households largely cite the cost of connection as the main barrier to becoming connected, the average WtP for a single installment is about 1212 Maloti in Roma and Morija (1600 in Roma and 906 in Morija) and 1655 Maloti in Semonkong. The average WtP per installment, for 12 installments, was about 169 Maloti in Semonkong and 234 Maloti in Roma and Morija. The result should be interpreted with some caution as we did not implement a full-scale WtP module or compare variations in WtP results using different methodologies. Results could point to the influence of information (as provided in the survey question) on actual WtP, or at least on reported WtP (converging to the lower bound of the range provided in the survey question). Most focus group participants from unconnected households also described the connection costs as their main barrier. Between two thirds and three fourths of unconnected respondents, depending on the site, say that cost is the main barrier to connection.

Apart from the above discussion regarding expanded access to piped water through WASCO, the household survey provides additional context regarding households' reported changes in use of different water sources over time. In Roma and Morija as well as Semonkong, we see that newly connected households appear to be relying on their piped connection almost exclusively for drinking, having shifted mostly from other piped and other improved sources. Unconnected households (unmatched sample) primarily use other piped sources, along with other improved sources. Importantly, even among unconnected households we see a reported shift toward greater use of piped sources, pointing to potential spillover (to be discussed in section 5.3.2.4). These shifts in drinking water, depicted below in Figure 22. and Figure 23., are representative of similar shifts across other domestic activities as well.

Measures of quality and reliability at the system level were not measured at baseline, either by the Compact M&E plan and indicator tracking table or by the original baseline data collection efforts undertaken by another evaluator. Therefore, no baseline values or targets were established for improvements in quality and reliability of any of the networks. Within the household survey, we asked households about reliability, their perception about water quality as well as changes in reliability over time,[106] and we also directly measured water quality from household taps as well as the point of consumption (e.g. stored water within the household). We discuss aspects of these measurements in more detail in the following sections, regarding findings from the IEs.

[106] Survey-based measures of reliability in water service (average hours per day of service) are already limited to some extent by the fact that respondents do not directly observe availability, and such responses are always, to some extent, estimates. Likewise, this response error is potentially magnified by recall error when respondents are asked to recall such quantities for several years in the past. We present our findings while acknowledging these potential limitations in measurement.

Figure 22. Use of better-quality drinking water sources over time, Semonkong

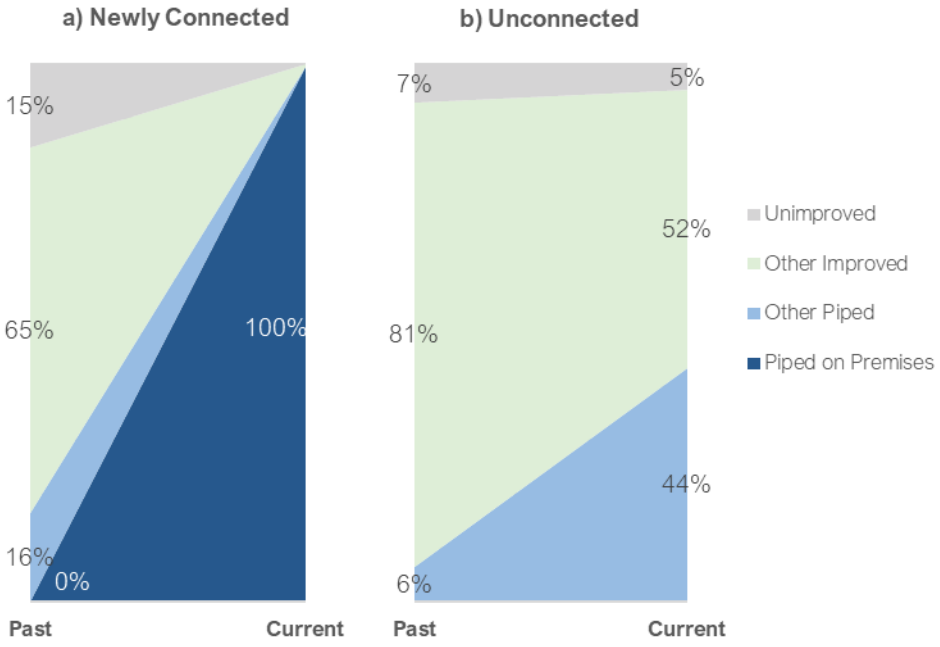
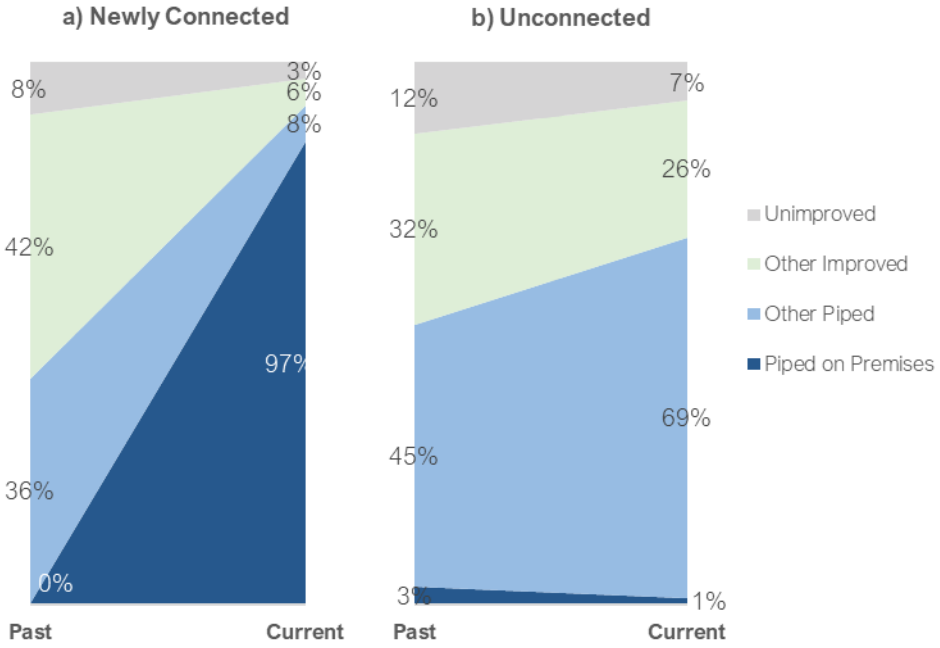


Figure 23. Use of better-quality drinking water sources over time, Roma and Morija



Notes: The 1% of unconnected households who currently use piped water on premises are not WASCO customers, but have access through a place of employment where they live, such as a school. The 3% in the past are previous WASCO customers (disconnected).

5.3.2 Intermediate Outcomes – Household Level

- EQ 7b: To what extent are community members using water from the urban water network and how has this changed since the Lesotho Compact started?
- EQ 7c: To what extent are community members experiencing cost and time savings, or reductions in water-related illness?

As described earlier, the IE examined impacts of Metolong supply in Maseru urban (Design B), and of new access to household taps in Semonkong as well as two peri-urban sites in Maseru, Roma and Morija (Design A). Separate models were run for Semonkong and Maseru peri-urban, given their important differences in terms of water supply pre-interventions.

In this section, we present findings from the IEs. We examine impacts on intermediate outcomes including time savings (time spent collecting water outside the home), water consumption (lpcd), prevalence of diarrheal illness for children under five, and water expenditures (Maloti per household per month). Time savings and diarrheal illness prevalence are the outcomes linked to benefit streams in the ERR. We also discuss other descriptive and qualitative data collected as part of the household survey and focus groups which contextualize and aid in interpretation of the main findings. The sub-sections below the overview of findings below elaborate each of the two IEs. Following the discussion of the IE findings, we discuss spillover and unintended effects.

5.3.2.1 Overview of Findings

Findings from both IEs are summarized below in Table 16. Our findings indicate no significant impacts on outcomes of interest in townships supplied by Metolong, compared with those not supplied by Metolong. The results may appear unexpected given the process evaluation findings that the MP was implemented successfully. However, the IE results may mask a "smoothing" effect of Metolong supply, such that its main impact was system-wide and served a purpose of averting shortage in the long-term, rather than having immediate or acute impacts at the household level. Furthermore, many of the household-level outcomes expected in MCC's original theory of change, such as increased time savings and reduced diarrheal illness, are more associated with network extensions than with central network upgrades, as detailed in MCC's updated Water Supply and Sanitation Sector Cost-Benefit Analysis Guidance.[107] While central upgrades can theoretically improve reliability, we find that reliability was already quite good before the Metolong Dam was commissioned, although perhaps the Dam and associated works will enable it to stay this way for longer.

Results from the IE of improved access in Semonkong show large and significant impacts for households who have gained a new connection, as a result of the MCC interventions. Connected households in Semonkong have essentially eliminated all water collection from outside the home, while increasing their per capita water consumption substantially, to a level that is generally expected to meet all domestic needs.[108] Households that have remained unconnected continue consume at a level sufficient only for basic consumption and hygiene. Connected households pay significantly more than unconnected households for water, an unsurprising result in Semonkong given their complete transition from free water

[107] Osborne 2019.
[108] Howard and Bartram 2003.

provision to WASCO service provision. Connected households reported a lower prevalence of diarrheal illness among children under five, but the difference was not statistically significant.[109]

Similar to Semonkong, in Roma and Morija, results show that households with new connections have reduced water collection outside the home and increased water consumption. The impacts on time savings and volume collected from water collection outside the home were less strong than in Semonkong, which is understood in the context that households in Roma and Morija may have had other, closer sources of water available to them prior to the interventions as compared with households in Semonkong. Like in Semonkong, connected households reported a lower prevalence of diarrheal illness among children under five, but the difference was not significant. Unlike Semonkong, households in Roma and Morija did not have statistically different water expenditures than their unconnected counterparts.

Table 16. Summary of findings from IEs

OUTCOMES	SUPPLY MASERU URBAN	ACCESS SEMONKONG	ACCESS ROMA & MORIJA
TIME SAVINGS	☒	☑ + 24 min./day	☑ + 12 min./day
WATER COLLECTION	☒	☑ - 83 liters/day	☑ - 62 liters/day
WATER CONSUMPTION	☒	☑ + 46 liters per capita per day (lpcd)	☑ + 73 lpcd
DIARRHEAL ILLNESS	☒	☒	☒
WATER EXPENDITURES	☒	☑ + 35 Maloti/mo.	☒
RELIABILITY	☒	n/a	n/a

It is important to note limitations in attribution involved in both designs. For the IE focused on Metolong supply in Maseru urban, it is practically impossible to separate the MCC-funded components of the MP from the rest of the works; therefore, attribution would be relative to the totality of the MP and Package 1 interventions. For Design A (access) in Maseru peri-urban, the household connections that define the treatment group cannot be solely attributed to MCC. It is not feasible to link *specific* household connections or connections in specific *areas* to MCC funding. The commissioning date of the UPUW works in each site is used as a threshold to define connections that occurred before and after the completion of the MCC-funded works, an admittedly imperfect measure of treatment in these sites. This

[109] However, as is discussed in subsequent sections, the model was likely under-powered to detect the difference observed due to the relatively small number of households with children under five.

threshold is used as way of indicating which households were *most likely* to have benefited from the MCC-funded infrastructure *via* their new connection. On the other hand, attribution in Semonkong is not subject to these same limitations since there was no network at all prior to the Compact and all new connections in Semonkong, and any benefits conferred, can therefore be fully attributed to the MCC interventions.

5.3.2.2 Detailed Findings: Impact of Metolong Supply in Maseru urban

To assess the impact of Metolong supply on households in Maseru, our evaluation defines treatment as residing in a township receiving Metolong supply and having had a connection prior to the commissioning of the Metolong works. The comparison group includes households residing in a township not receiving Metolong supply who had a connection prior to the commissioning of the Metolong works. Information about which townships were supplied with Metolong water was obtained via consultation with WASCO staff. Based on consultations with WASCO, there is no systematic reason that some townships are supplied with Metolong while others are not. In fact, all townships in Maseru were intended to be supplied by Metolong. The main reason some have remained unconnected is that the GoL would be responsible for funding pressure-reducing valve systems to enable the network in these areas to accommodate the high pressure from the nodal high terminal reservoirs supplied by Metolong, which they have declined to do to date despite requests from WASCO. In other words, it is nearly as if the areas connected first to Metolong were selected by chance, facilitating the conditions for an IE. Treatment and comparison households were sampled randomly from each group of townships, using WASCO's customer database. Following the survey, we employed statistical matching techniques to establish comparability and estimate impacts, as described below.

5.3.2.2.1 SELECTION INTO TREATMENT & MATCHING

A household survey was conducted to collection information on household demographic characteristics, water use and related practices in the household, and measure the outcome variables of interest. Since valid baseline data for this IE design was not available,[110] this household survey also collected recall information to reconstruct the baseline situation representing the pre-intervention period.

The first step in the matching process is establishing a comparable group of treatment and comparison households in order to remove bias on observable characteristics. We first estimate the propensity score, i.e. a household's likelihood of being part of the treatment group (living in areas supplied by Metolong). This is done through logistic regression using variables including household demographic information as well as recall data on water sources, reliability, and key outcomes (full specifications in Annex B).

Few variables included in the model predicted treatment, suggesting that treatment was assigned non-systematically, at least relative to the observable characteristics measured in our survey. Selection into treatment was associated with larger household size (OR=1.262, $p<0.05$), finished wall material (OR=2.605, $p<0.1$), and being in the fourth quintile (second highest) of SES (OR=2.589, $p<0.01$). On the basis of this selection model, propensity scores were estimated for all households. Households within the region of common support (the region where distribution of propensity scores for treatment and comparison groups overlap) were retained for analysis. Once the group of comparable treatment and comparison units were identified through the selection model, matching models were run to estimate the impacts of the treatment, supply from Metolong, in these areas. The models estimate the ATT. Following

[110] Social Impact, Inc. 2018.

best practices, we conducted the matching analysis comparing multiple matching algorithms; results were consistent and full results can be found in Annex B. Findings below are presented from the Gaussian kernel matching method.[111]

5.3.2.2.2 IMPACT ESTIMATES

Overall, we did not find any significant impacts in Maseru urban on outcomes of interest (see Table 17). Households in areas supplied by Metolong, as well as those not supplied by Metolong, report similar average levels of water collection time (0 minutes per day) and volume of water collected from the home (0 liters per day). Reconstructed baseline values are already low (between 1 and 4 liters), indicating that water collection outside the home was already not common for households in Maseru urban.

Likewise, there were no statistically significant differences between matched treatment and comparison households with regard to water consumption, diarrheal illness prevalence among children under five, and water expenditures. When asked directly about their perception of changes in main outcomes, household responses validated these results. Nearly all treatment (90%) and comparison (81%) households reported that they spend "about the same" amount of time collecting water compared to five years prior. Only about 4% of Metolong-area households said they spend "a little less" or "much less" time, and about 10% of non-Metolong-area households said the same. Among those few households who reported spending less time collecting water, the vast majority reallocated their time to rest or leisure, or household chores. Overall, 14% and 13% of households in Metolong and non-Metolong areas who said they spent less time also said they reallocated that time to paid work.

Most households said that they believe they use the same amount compared to pre-Metolong (66% in Metolong-supplied areas, 57% in non-Metolong); and about a fifth of households in both groups said they use "a little more" now. Nearly all households said that they have, and already had previously, a sufficient amount of water previously for domestic use. When asked to compare water expenditures, both Metolong supplied and non-Metolong supplied households' most frequent response is "about the same" (40% and 42%, respectively). Another one fifth of each group say they pay "a little more" now.[112]

Given the nature of the Metolong interventions, increased reliability may be one potential pathway, as a short-term outcome, through which any potential impacts on intermediate outcomes above may have materialized. Thus, for this IE, we also compared reliability between treatment and comparison groups, defined as average service hours per day.[113] However, results show no significant difference between treatment and comparison areas. Reliability is reported as 22 hours per day in both areas, and reconstructed baseline values (survey recall) indicates 22 hours per day in both groups prior to the interventions as well. When asked directly to list any improvements or problems with their water supply experienced in the preceding five years, 28% of Metolong-area households and 20% of non-Metolong area households reported better reliability (fewer cuts, more regular and predictable supply) 12% and 7%, respectively, reported worse reliability. Respondents from both areas reported better water quality –

[111] Best practice is to compare results from multiple propensity score algorithms, on the basis of how well each does to improve balance of the two groups being compared, and because different algorithms treat the data and propensity scores differently in the estimation of the ATT. As all the algorithms we compared produced similar results, we present results from just one in the report for simplicity; the full results from all algorithms compared can be found in Annex B. Results from the Gaussian kernel method are shown in the report as it produced good balance between treatment and control and it is generally expected that kernel methods are able to use more of the information that is available within the data to produce estimates.

[112] Regarding expenditures, large proportions of each group (29% and 20%, respectively), said they do not know.

[113] As this is measured through the survey, it is acknowledged that recall can be imperfect, noisy, or biased; however, we have validated the exact wording used here in other surveys and found it to perform reasonably well against direct measures such as pressure sensors.

specifically, 10% and 8%, respectively, reported better color – an indicator of turbidity which is clearly visible to households, suggesting better water treatment from both of their supplying plants.

Table 17. Estimated impacts of Metolong supply in Maseru urban

Households in Maseru who receive water supply from the new Metolong works experienced…	
TIME SAVINGS	**No statistically significant difference in time spent collecting water** Metolong households: 0 min./day, Comparison households: 0 min./day
WATER COLLECTION	**No statistically significant difference in volume of water collected** Metolong households: 0 liters/day, Comparison households: 0 liters/day
WATER CONSUMPTION	**No statistically significant difference in water consumption** Metolong households: 77 lpcd, Comparison households: 86 lpcd
DIARRHEAL ILLNESS	**No statistically significant difference in diarrheal illness prevalence among children under 5[a]** Metolong households: 6.1%, Comparison households: 6.1%
WATER EXPENDITURES	**No statistically significant difference in water expenditures** Metolong households: 65 Maloti/mo., Comparison households: 88 Maloti/mo.
RELIABILITY	**No statistically significant difference in average daily service hours** Metolong households: 22 hours/day, Comparison households: 22 hours/day.
…relative to households in Maseru who do not currently receive Metolong supply.	

Note: [a] Sample size for illness 127 children; thus the evaluation is underpowered to detect differences of the desired magnitude. [b] Impacts reported are relative to a sample of matched comparison households in Semonkong. Impact estimates in table above produced with Gaussian kernel matching method; ATT is reported. Quantities above for all outcomes other than diarrheal illness are in reference to values estimated for summer season. Winter season values are similar and presented in Annex B.

It is important to remember that the lack of observed impacts in areas supplied by Metolong compared specifically with those supplied by older water treatment plans does not necessarily communicate the full story of the Metolong impact. It is likely that the supply from Metolong had a "smoothing" effect in Maseru (and surrounding areas), such that even other areas of the city not yet connected to the Metolong supply experienced some benefit. Further, it is possible that such a benefit is not felt by households in real terms, because the benefit is a complete avoidance of further deteriorating service. In that context, Metolong would confer a benefit better characterized as potentially preserving the status quo and securing Maseru's water supply for the long-term, rather than having had acute effects at the household level.

5.3.2.3 Detailed Findings: Impact of Improved Access in Semonkong & Maseru peri-urban

For households with a new connection, our evaluation defines treatment as having a new household connection on premises installed after the commissioning of the MCC-funded works. The comparison group is conceptualized as households that were unconnected prior to the intervention and are still unconnected now, and which are comparable to treatment outcomes on a range of observable characteristics. This comparison group was constructed by drawing a sample of unconnected households from the same areas as the newly connected households, within 300 meters from the network based on eligibility criteria for a household connection. Following the survey, we employed statistical matching techniques to establish comparability and estimate impacts, as described below.

5.3.2.3.1 SELECTION INTO TREATMENT & MATCHING

The first step in the matching process is establishing a comparable group of treatment and comparison households in order to remove bias on observable characteristics. We first estimate the propensity score, i.e. a household's likelihood of being part of the treatment group (self-selection into the group of households who obtained a new household connection). This is done through logistic regression (logit) using variables including household demographic information as well as recall data on water sources, reliability, and key outcomes (full specifications in Annex B). Separate logit models were run for Semonkong and Maseru peri-urban (Roma and Morija together).

In Semonkong, treatment was predicted strongly by SES – the more wealthy a household, the more likely they were to have become connected (q2 OR=1.594, p<0.1; q3 OR=3.398, p<0.01; q4 OR=5.653, p<0.01; q5 OR=5.231, p<0.01).[114] Households who reported their baseline sanitation facility was improved/private were more likely to have become connected (OR=3.523, p<0.01), relative to those who had no sanitation facility. Other significant factors included distance in meters from the network (OR=0.991, p<0.01),[115] household head who was married or cohabitating (OR=1.612, p<0.01), and a dwelling with finished flooring material (OR=2.536, p<0.1). In Roma and Morija, treatment was predicted by having any member of household with a tertiary education (OR=5.391, p<0.05), baseline drinking water source (other improved vs. unimproved OR=0.391, p<0.05), and baseline sanitation facility (improved/private vs. none OR=2.311, p<0.05; improved shared vs. none OR=4.896, p<0.01). Though the model indicated that households in the third SES quintile were more likely to obtain a connection than those in the first (OR=4.341, p<0.05), there was no other pattern across SES more generally. Other significant factors included a larger number of rooms for sleeping (OR=1.564, p<0.1), a dwelling with a finished flooring material (OR=4.805, p<0.1), and distance in meters from the network (OR=0.989, p<0.01).

Based on this selection model, propensity scores were estimated for all households. Households within the region of common support (the region where distribution of propensity scores for treatment and comparison groups overlap) were retained for analysis. Once the group of comparable treatment and comparison units were identified through the selection model, matching models were run to estimate the impacts of the treatment in these areas. The models estimate the ATT; results are generalizable within the range of common support. We ran three models using different matching algorithms; results were consistent and full results can be found in Annex B. Findings below are presented from the Gaussian kernel matching method.

[114] Odds ratios are relative to a reference group of the first (or lowest) SES quintile.
[115] With distance censored at the 300-meter limit of eligibility for a WASCO connection.

5.3.2.3.2 IMPACT ESTIMATES: SEMONKONG

We find significant impacts in Semonkong on most outcome indicators of interest in the desired or expected direction (Table 18).

Our estimates indicate that households who gained a new connection in Semonkong, as a result of MCC-funded interventions, experienced time savings, increased per capita water consumption, and decreased water collection from sources outside the home. All of these effects are in line with the theory of change. Specifically, with regard to time savings, we estimate that treatment households in Semonkong experienced time savings of 24 minutes per day in water collection outside the home, relative to matched comparisons – treatment households report no time collecting water daily, compared to 24 minutes among comparisons.

The reconstructed baseline value among the matched sample is about one hour per day, suggesting that both groups experienced time savings. This points to substantial spillover among unconnected households in terms of time savings (to be discussed in section 5.3.2.5.) and in turn suggests that the impact reported here is likely a lower bound as it does not account for the full reduction of collection time, in real terms, among treatment households nor that among comparison households.

Table 18. Estimated impacts of improved access in Semonkong

Households in Semonkong connected as a result of the MCC programs experienced…	
TIME SAVINGS	**24 minutes per day in time savings, for collecting water outside the home** Connected households: 0 min./day, Unconnected households: 24 min./day.
WATER COLLECTION	**84 liter per day reduction in volume of water collected outside the home** Connected households: 0 liters/day, Unconnected households: 84 liters/day.
WATER CONSUMPTION	**46 lcpd increase in water consumption** Connected households: 67 lpcd, Unconnected households: 21 lpcd.
DIARRHEAL ILLNESS	**No statistically significant reduction in diarrheal illness prevalence among children under 5[a]** Connected households: 3.3%, Unconnected households: 7.9%.
WATER EXPENDITURES	**35 Maloti per month increase in water expenditures** Connected households: 69 Maloti/mo., Unconnected households: 34 Maloti/mo.
…relative to comparable households in Semonkong who remain unconnected.[b]	

Note: [a] Sample size for illness 80 children. [b] Impacts reported are relative to a sample of matched comparison households in Semonkong. Impact estimates in table above produced with Gaussian kernel matching method; ATT is reported. All estimates provided above for outcomes other than diarrheal illness are statistically significant at the 1% level (p-value <0.01). Quantities above for all outcomes other than diarrheal illness are in reference to values estimated for summer season. Winter season values are similar and presented in Annex B.

When asked directly about their perception of any change, 92% of connected households said they now spend "a little less" or "much less time" collecting water. In contrast, 46% of unconnected households say they spend about the same amount of time, though 41% of unconnected households say they now spend a little or much less time collecting water.

The project logic assumed that time savings would be reallocated to productive activity. Households who said they spent less time than previously collecting water were asked to specify all the ways in which they allocated that extra time. Overall, the most common responses included household chores (61%), rest or leisure (27%), unpaid work (21%), and unpaid work (9%).[116] Thus, the evidence in Semonkong does not point to substantial reallocation of realized time savings to productive activities.

Both connected and unconnected FGD participants in Semonkong validate the findings regarding time savings from access to individual taps. Connected households reported spending extra time doing chores and resting. Unconnected households reported some time savings, however, it varied by individual as some report still needing to use older, farther sources, such as streams, for some activities, such as laundry. This is also consistent with findings from the assessment of spillover detailed in a subsequent section. Additionally, unconnected households feel they are at the mercy of their connected neighbors for water access, who set limits on the time and quantity of water collection for neighbors. For those that reported time savings, they mentioned having additional time to garden, sell vegetables, and get to work on time. One focus group participant raised a contrasting perspective, asserting that having piped water sources nearby has shifted behavior in such a way as to reduce water storage, given assumptions that it will be available, leading to a shortage of water in the household when service is unexpectedly cut. This anecdote illustrates that even in the context of a strong impact, behavioral responses to the change, however logical, may not fully align with the reality of service delivery, which is still characterized by occasional interruptions.

"We had no decent wells from which to collect water except for the small uncovered streams where we shared water with animals (dogs, horses, cows). People who passed by that stream would even stir the water such that it becomes very dirty. Still we would come and collect that water, despite its condition because we had no other option."

"We used to walk up hill to Maponeseng – very far away to collect water. It was a long travel which could not be afforded by aged people. We were indeed desperate for water here."
– Connected households in Semonkong on previous challenges

In line with the result on time savings, we find a significant impact on the amount of water collected from sources outside the home. Treatment households in Semonkong collect an average of zero liters of water per day outside the home versus 84 liters per day among comparisons. The reconstructed baseline value for the matched sample is approximately 75-78 liters per day, suggesting no change (or a slight increase) for comparison households, alongside the elimination of water collection for treatment households.

[116] Survey question was select all that apply, so percentages may exceed 100.

Treatment households in Semonkong consume 46 lpcd more than comparison households. Households with a connection in Semonkong report an average of 67 lpcd, compared to 21 among unconnected households. The reconstructed baseline value for lpcd in the matched sample is about 20 lpcd, indicating an increase only for treatment households in Semonkong. Literature suggests that 20 lpcd is the minimum quantity required for basic health and hygiene, while after 50 lpcd consumption, hygiene, laundry, and bathing should be assured, with 100 lpcd representing "optimal" consumption.[117] This means that treatment households in Semonkong have been able to increase their consumption nearly reaching levels of optimal consumption while unconnected households remain at the basic level. When asked directly about their perception of changes in consumption, 76% of connected households said that they now use "much more" or "a little more", whereas 45% of unconnected households said that they now consume "about the same" as previously, with another 45% said "much more" or "a little more".

Among connected households, 96% said that they have sufficient water for all domestic activities. Just 9% of them said that they used to have sufficient water. In contrast, 40% of unconnected households said that they have sufficient water for all domestic activities – a minimal change from previously (37%). In line with the hierarchy of water consumption described above, FGD participants also confirmed that they are now able to bathe more and do more laundry with the increased quantity of water from their new connection.

> **"In terms of any meaningful and direct benefit on the use of this time for any income generation activities, well there is no tangible benefits that we have gained. In fact it is much worse with the water close-by the household because we sometimes even forget to store it and when there is water shortage, you find that we do not have enough water to even cook, unlike in the past when we would make sure we have enough water in the house."**
> – Connected households in Semonkong on behavior changes

There are two results from this IE which are not in line with the theory of change. First, water expenditures increased. Treatment households spend approximately 35 Maloti per month (2.4 USD) more on water than comparison households, with treatment households spending 69 Maloti per month (4.8 USD) compared with 34 Maloti per month (2.4) among comparisons. However, this is logical in the context of Semonkong. Semonkong was only recently designated as peri-urban, previously under the authority of the DRWS, with residents receiving water through community standpipes and also relying to a large degree on springs and wells. The reconstructed baseline value for the matched sample is about 8 Maloti per month (0.6 USD[118]), again indicating a relatively large increase for both comparison and treatment households. When asked directly about their perception of these changes, 73% of connected households from Semonkong say that they now pay "a little more" or "much more", along with 28% of unconnected households.

FGD participants in Semonkong validate the findings above and report being generally satisfied with their taps and the associated benefits. Despite the switch from unpaid to paid water supply, FGD participants in Semonkong say they are satisfied with the trade-off overall in the context of increased expenditures but have grievances with the billing process and lack of transparency. Frequently bills are not delivered

[117] Reed and Reed 2013; Howard and Bartram 2003.
[118] At current conversion rate.

on time, however, connected households are still expected to pay which can lead to over- or under-balances. One participant noted that their WASCO bill was initially higher than expected, but decreased over time; however, most other participants claimed that their WASCO bill was too high. This has led to residents using a lot of water, with one resident saying, “Even if you try to use it sparing, you find that the bill still comes out high.” The previously used water sources were free, so the majority of residents are paying more, but a few residents noted that they had to pay others to collect the water for them or pay their neighbor and are now paying the same or less than before.

Second, treatment households reported a lower prevalence of diarrheal illness among children under five (3.3%) than comparison households (7.3%), but the difference was insignificant. Importantly, however, our sample for this outcome was underpowered relative to initial expectations, since only 34% (186) of households in Semonkong overall contained any children under five, and fewer children were available for the calculation given the reduced sample due to the matching procedure. Connected households are more likely to report that diarrheal illness has decreased over time (68%), relative to unconnected (32%), who mostly reported that diarrheal illness has stayed the same (68%) over time; however, sample sizes here are low as only households with children under five were presented with this question.[119] Given the small sample size of households with any children under five, it was not possible to meaningfully compare defensive or medical expenditures or caregiving time for households with sick children, as the theory of change hypothesized.

Although connected and unconnected households have similar safe water storage habits, they have substantially different hygiene resources, with connected households possessing much healthier hygiene resources than their unconnected counterparts. Connected households – regardless of whether they reported illness or not – were considerably more likely (14%) to have a fixed facility in the dwelling or on their plot for handwashing relative to unconnected households (1%), and much more likely to have water available for handwashing (80%) when observed (compared to 15% of unconnected). Unconnected households were substantially more likely to lack a handwashing station in the household entirely (61%) compared to newly connected households (21%).

On the other hand, though unconnected households were more likely to say that their main drinking water source was “always” safe to drink (50%) compared with connected households (40%), both groups rarely treat their drinking water – 81% of connected households and 74% of unconnected households report “never” treating their main source of drinking water, similar levels to those reported for prior to the intervention. Data show a slight increase in the percentage that never treat among connected households, from 76% previously – an increase that could potentially signal greater trust of their new piped water source compared with their previous sources, though it is prudent not to overstate this given the relatively small magnitude of the difference. Among those who ever treat their main drinking water, the vast majority boil (83% of connected and 93% of unconnected), while some unconnected households also report using a simple filter (13%).

Likewise, water storage in the household was reportedly ubiquitous for both types of households, and unconnected households were actually slightly more likely to use their main drinking water container only for drinking (12%) compared with connected households (9%). Though largely uncommon overall, unconnected households were slightly more likely (2%) to mix treated and untreated water in storage containers compared to connected households (0%). Other behaviors including how long water is stored

[119] n=34 for unconnected, n=38 for connected.

before drinking (about a day or less), how often containers are cleaned (daily or weekly), and compliance with safe storage practices (ubiquitous partial compliance, with wide-mouthed but covered containers) are similar between the two groups of households.

More concretely, such behaviors are likely to influence the quality of water consumed by household members. Despite relatively similar water treatment behaviors, *E. coli* results differed substantially between the two groups – with 96% compliance, i.e. lack of contamination, for newly connected households' point of consumption[120] compared to only 70% compliance from unconnected households' point of consumption. Although many unconnected households use neighbors' taps as their primary source of drinking water, only three of the twenty-four positive tests in the unconnected group came from households with such a source. The remainder came from households using public boreholes, springs, or other sources away from the home.

Connected households' taps were also tested for *E. coli* and FCR, which adheres to particles in the water to aid in removing pathogens potentially harmful to health. Most (75%) household taps tested in the newly connected group had a low level of FCR (0.1-0.2 mg/L), 19% had non-detectable levels (<0.1 mg/L), and just 6% had the WHO recommended level (0.2-0.5 mg/L). Despite generally low levels of chlorine, tap water was largely compliant with *E. coli* standards, with 97% of tap tests conducted containing no *E. coli* colonies. This suggests a possibility that connected households may benefit from higher quality water from the tap than alternative sources for unconnected households, despite similar treatment and storage practices. However, the differential hygiene resources discussed previously may have as much or more to do with the discrepancy in water quality.

Any lack of significant impacts on health outcomes, affected as the conclusion may be by an under-powered sample, would not necessarily be surprising as there is a growing body of literature supporting the notion that water infrastructure, alone, and particularly in urban areas, is necessary but not sufficient on its own to effect meaningful changes in health outcomes. As Cairncross et al. (2003) note, much diarrheal disease is transmitted via hands, food, utensils, etc. rather than water-borne and as a result, infrastructure interventions should be accompanied by hygiene and sanitation promotion in order to affect health outcomes.[121] Even in the context of improved water quality, it is difficult to assign causality to UPUW for any potential reduction in diarrheal illness without an explicit link between the project and changes in hygienic practices.[122] In this case, the different hygienic practices between newly connected households and unconnected households may pre-date the UPUW Activity.

5.3.2.3.3 IMPACT ESTIMATES: ROMA & MORIJA

We find significant impacts in Roma and Morija on most outcome indicators of interest in the desired or expected direction (Table 19).

Our estimates indicate that households who gained a new connection following the completion of the UPUW works experienced time savings, increased per capita water consumption, and decreased water collection from sources outside the home. All of these effects are in line with the theory of change. Specifically, with regard to time savings, we estimate that treatment households in these peri-urban areas experienced time savings of 12 minutes per day in water collection outside the home, relative to matched

[120] The point from which household members directly take water for consumption; for many households this is stored water.
[121] Cairncross et al. 2003.
[122] Osborne 2019.

comparisons – treatment households report 7 minutes per day collecting water daily, compared to 19 minutes among comparisons.

The reconstructed baseline value among the matched sample is about half an hour per day, suggesting that both groups experienced time savings. This points to substantial spillover among unconnected households in terms of time savings and in turn suggests that just as in Semonkong the impact reported here is likely a lower bound as it does not account for the full reduction of collection time, in real terms, among treatment households nor that among comparison households.

When asked directly about their perception of any change, 71% of newly connected households said they now spend "a little less" or "much less time" collecting water. In contrast, 56% of unconnected households say they spend about the same amount of time, though another 24% of unconnected households say they now spend a little or much less time collecting water.

> **"…it is our first time to see our water with such high pressure if it is Metolong we are grateful because some people who used not to have water now have water all year round. Where I live is uphill but I have water all the time. We used to have challenges in the past but now we have plenty of water."**
> – Newly connected households in Roma on improved service reliability

The project logic assumed that time savings would be reallocated to productive activity. Households who said they spent less time than previously collecting water were asked to specify all the ways in which they allocated that extra time. Overall, the most common responses included household chores (59%), rest or leisure (27%), paid work (10%), and unpaid work (10%).[123] Thus, the evidence in Roma and Morija, like in Semonkong, does not point to substantial reallocation of realized time savings to productive activities.

Both newly connected and unconnected FGD participants in Roma and Morija also report time savings from access to individual taps. In Morija, newly connected respondents said that they previously had to wait up to 30 minutes at public taps in the queue, and now one respondent was pleased to report that she is able to now collect water in only five minutes. Respondents in both villages note they are able to multi-task *while* collecting water, doing activities like cooking, resulting in further time savings. One Morija participant said that she was able to increase production scale for her small business with her time savings. Given the overall quantitative results, this anecdote may represent an exception to the norm, with respect to use of time for productive activities. Unconnected households reported time savings but to a lesser extent, consistent with the quantitative findings, as many said they still rely on older sources and those that use neighbor's taps are dependent on the time restrictions their neighbors set for water collection.

[123] Survey question was select all that apply, so percentages may exceed 100.

Table 19. Estimated impacts of improved access in Roma & Morija

Households in Roma & Morija connected as a result of the MCC programs experienced…		
	TIME SAVINGS	**12 minute per day in time savings, for collecting water outside the home** Connected households: 7 min./day, Unconnected households: 19 min./day.
	WATER COLLECTION	**62 liter per day reduction in volume of water collected outside the home** Connected households: 14 liters/day, Unconnected households: 76 liters/day.
	WATER CONSUMPTION	**73 lcpd increase in water consumption** Connected households: 93 lpcd, Unconnected households: 20 lpcd.
	DIARRHEAL ILLNESS	**No statistically significant reduction in diarrheal illness prevalence among children under 5[a]** Connected households: 10.6%, Unconnected households: 14.7%.
	WATER EXPENDITURES	**No statistically significant difference in water expenditures per month** Connected households: 98 Maloti/mo., Unconnected households: 88 Maloti/mo.
…relative to comparable households in Roma & Morija who remain unconnected.[b]		

Notes: [a] Sample size for illness 191 children. [b] Impacts reported are relative to a sample of matched comparison households in Roma and Morija. Impact estimates in table above produced with Gaussian kernel matching method; ATT is reported. All estimates provided above for outcomes other than diarrheal illness and water expenditures are statistically significant at the 1% level (p-value <0.01). Quantities above for all outcomes other than diarrheal illness are in reference to values estimated for summer season. Winter season values are similar and presented in Annex B.

In line with the result on time savings, we find a significant impact on the amount of water collected from sources outside the home. Treatment households collect an average of 14 liters of water per day outside the home versus 76 liters per day among comparisons, an impact of -62 liters per day for treatment households. The reconstructed baseline value for the matched sample is approximately 70-75 liters per day, suggesting a slight increase for comparison households, alongside a larger reduction for treatment households.

Treatment households consume 73 lpcd more than comparison households. Newly connected households report an average of 93 lpcd – essentially reaching the 100 lpcd recommended for optimal consumption described earlier – compared to 20 among unconnected households. The reconstructed baseline value for lpcd in the matched sample is about 20.5 lpcd, indicating a practically meaningful increase only for treatment households. When asked directly about their perception of changes in consumption, 67% of newly connected households said that they now use “much more” or “a little more”, whereas 54% of unconnected households said that they now consume “about the same” as previously, about a quarter said “a little more” compared to before. Among newly connected households, 97% said that they have sufficient water for all domestic activities, compared to the 36% who said that they used to have sufficient water. In contrast, 58% of unconnected households said that they have sufficient water for all domestic activities – essentially unchanged relative to before the interventions (57%).

"Even though the water bill is high we no longer struggle getting water like before."
– Newly connected households in Roma

There are two results from this IE which are not in line with the theory of change. First, no significant impacts were detected in these areas with regard to water expenditures. Connected households reported more (98 Maloti per month) than comparison households (88 Maloti per month), but the difference was not statistically significant. The reconstructed baseline value for the matched sample is approximately 50 Maloti per month, indicating that that expenditures for both groups have increased over time. In these peri-urban areas, it is likely that previous sources for both groups were also paid sources, such that any source changes from baseline are substitution of some paid sources for others, with the observed expenditure increase for both groups.[124] When asked directly about their perception of any changes, 60% of newly connected households say that they now pay "a little more" or "much more", along with 27% of unconnected households.

Second, treatment households reported a lower prevalence of diarrheal illness among children under five (10.6%) than comparison households (15.4%), but the difference was insignificant. Importantly, however, our sample for this outcome was underpowered relative to initial expectations, since only 30% (304) of households in these areas overall contained any children under five, and fewer given the reduced sample due to the matching procedure. Given the small sample size of households with any children under five, it was not possible to meaningfully compare defensive or medical expenditures or caregiving time for households with sick children as the theory of change hypothesized.

About 49% of newly connected households perceive that diarrheal illness has decreased over time, and another 48% believe it has stayed the same, while 41% of unconnected households perceive it has decreased over time, and 58% believe it has stayed the same. In Morija, connected FGD participants expressed some concerns about the cleanliness and reliability of the tap water, but they note that the quality is better than previous sources and has contributed to improved health and sanitation.

As in Semonkong, although connected and unconnected households have similar safe water storage habits, they have substantially different hygiene resources, with connected households possessing much healthier hygiene resources than their unconnected counterparts. Connected households – regardless of whether they reported illness or not – were much more likely (21%) to have a fixed facility in the dwelling or on their plot for handwashing compared to unconnected households (8%). They were also more likely to have water available for handwashing (82%, compared to 33% of unconnected households) when observed. Newly connected households with children under five that did report illness were substantially more likely to lack a handwashing facility at the household (43%), compared to newly connected households with children under five who did not report illness (14%). However, no such difference was observed among comparison households who did and did not report illness; also, caution is in order when comparing those reporting illness and not given the small sample sizes.

On the other hand, other evidence does not point to differences in favor of circumstances that would support better health outcomes among connected households. No meaningful differences were observed between newly connected and unconnected in terms of their perception of the quality of their main

[124] Nearly half of Package 1 unconnected households' main source of recall drinking water was a neighbor's tap or public standpipe, with other substantial sources including wells, springs, and boreholes.

drinking water source. Newly connected and unconnected households alike rarely treat their drinking water – 60% of newly connected households and 63% of unconnected households report "never" treating their main source of drinking water, similar levels to those reported for prior to the intervention, while about one fifth of both groups reported "rarely" or "once in a while" treating their drinking water. If anything, data show a slight increase in the percentage that never treat among connected households, from 57% previously – an increase that could potentially signal greater trust of their new piped water source compared with their previous sources, though just as with the results in Semonkong it is prudent not to overstate this given the relatively small magnitude of the difference. Among those who ever treat their main drinking water, the vast majority boil water (99% of connected and 98% of unconnected households), while some unconnected households also report using a simple filter (13%).

Likewise, water storage in the household was nearly ubiquitous for both types of households, though it is worthwhile noting less so in the newly connected households – 93% of unconnected households report storing water, while 15% of newly connected households do not. Approximately a quarter of both types of households (27% newly connected and 24% unconnected) use their main drinking water storage container only for drinking. Though largely uncommon overall, connected households were more likely (11%) to mix treated and untreated water in storage containers compared to unconnected households (5%). Other behaviors including how long water is stored before drinking (usually about a day or less), how often containers are cleaned (daily or weekly), and compliance with safe storage practices (ubiquitous partial compliance, with mostly wide-mouthed but covered containers) are similar between the two groups of households.

> **"…the water we fetched from the well was not clean. We collected water where the animals also drank water, and I felt that I needed to connect water to receive clean water that is also near to me." "…on top of what everyone said, water is a great need in this area. The wells have run dry. We used to collect water from the river, when it was dry we used to share the water with animals it was a problem. There was no cleanliness. The issue was a health hazard to our lives. It became a need for me to connect."**
> – Newly connected households in Roma on challenges prior to connection

Just as in Semonkong, *E. coli* results were substantially better for newly connected households' point of consumption, with 95% compliance compared to only 75% compliance in unconnected households. Although over half of unconnected households use neighbors' taps as a primary source of drinking water, only 8 of 41 unconnected households whose water from the point of consumption tested positive for *E. coli* used such a source. Instead, most households with a positive result had a main source of drinking water that was either a public borehole, well, or a public standpipe. Poor water quality from these sources as well as worse hygiene practices could explain this divergence in results, given similar treatment and storage behaviors between the two groups.

Newly connected households' taps were also tested for *E. coli* and FCR, which adheres to particles in the water to aid in removing pathogens potentially harmful to health. Most (76%) household taps tested in the newly connected group had a low level of FCR (0.1-0.2 mg/L), 13% had non-detectable levels (<0.1 mg/L), and 11% had the WHO recommended level (0.2-0.5 mg/L). Despite generally low levels of chlorine, tap water was largely compliant with *E. coli* standards, with 97% of tap tests conducted containing no *E. coli* colonies.

5.3.2.4 Customer Surveys

The objective of the customer survey was to measure the current level of service quality, outcomes of interest, and perceptions about changes in service delivery among WASCO's customer base, with special attention on the UPUW Package 3-5 sites, where no IE could be carried out. Based on agreement with MCC during the design stage, the customer survey was conducted in such a way as to be representative of the customer base in Package 1 sites, and Package 3-5 sites.

Findings for the customer survey are presented below. Package 1 and Package 3-5 results are discussed together, and findings for both groups are disaggregated by existing and new customers. As in the IE, "new" was defined by the UPUW commissioning date in each site. As described earlier in the Methodology, sampling weights have been applied to achieve representativeness of WASCO's customer base. In the context of interpreting the findings for the customer survey, it is important to bear in mind the different levels of success in the various sites with regard to implementation fidelity, and current functionality (summary in Table 20 below; see Process Study findings – section 5.2 – for full results). Therefore, the overall P3-5 results at times mask variation between sites that may reflect the various service delivery challenges in each site. Site-specific results are discussed in this section where such differences are important to highlight; site-specific data is in Annex B.

Table 20. Summary of UPUW implementation fidelity & known service delivery issues

Site and Package	Implementation Fidelity Score	Summary of known service delivery issues
Maseru, Morija, Roma, Mazenod, Teyateyaneng (P 1)	8.17	Reliability (pipe bursts, cuts)
Mapoteng (P 5)	7.33	N/A
Qacha's Nek (P 3)	6.83	N/A
Butha-Buthe (P 3)	6.83	N/A (MCC infrastructure not used)
Quthing (P 3)	5.00	Seasonal reliability (rainy season)
Mokhotlong (P 4)	4.50	Reliability, Quantity (intakes vulnerable to flooding)
Leribe (P 4)	4.50	Quantity, seasonal reliability (drought)
Mafeteng (P 3)	3.17	Reliability (shutdown for desludging)
Mohale's Hoek (P 4)	2.67	Reliability (shutdown for desludging), Quantity, Quality

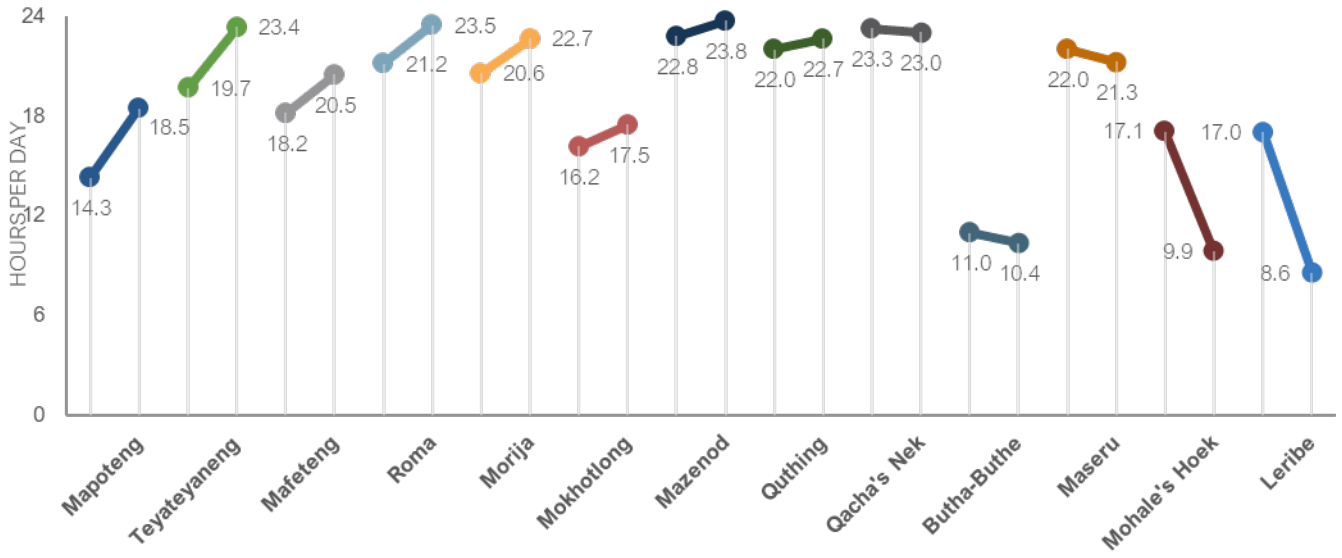
Note: Semonkong not included in table above as it was not part of the customer survey. Results for Semonkong are in section 5.2.

Overall, we find that WASCO is reliably delivering a quality water supply to its customers except in water networks with severe, known service delivery issues such as Mohale's Hoek, Leribe, Butha-Buthe, and Mokhotlong. Where customers are connecting for the first time, switching to an on-premises tap likely carries with it benefits in terms of time savings in water collection and increased consumption, though the customer survey relies on before and after recall without a relevant comparison group for estimating impacts. In some Package 3-5 sites, consumption appears to have increased even for existing customers, suggesting improvements in service delivery since before the UPUW works were commissioned. In sites where UPUW Activity implementation was poor, as named above, reliability is considerably lower than the country-wide average and the data suggest that this intermittency may be negatively associated with water quality. Nevertheless, across all sites, a plurality of WASCO customers perceives that diarrheal illness has become less common over time. Detailed results are below.

5.3.2.4.1 SERVICE DELIVERY

Table 21 summarizes various quantitative findings regarding the reliability, quality, and other dimensions of WASCO service in the Package 1 and Package 3-5 sites. A quarter of Package 1 respondents and about 14% of Package 3-5 respondents note improved reliability now relative to before the commissioning of the UPUW works, and indeed WASCO provides water service upwards of 22 hours per day in most sites (Figure 24). One newly connected participant in Teyateyaneng noted that she does not any longer try to collect rainwater on rainy days, relying only on her tap, and another participant noted that she has gone so far as to throw away the containers that she previously used to collect rainwater. The Package 3-5 average hours per day of water service is dragged down by ongoing reliability issues in Butha-Buthe, Leribe, and Mohale's Hoek, where ongoing service delivery issues as noted in the process evaluation restrict water service to 8.5-10.4 hours per day, on average. Shortages were so extended in Mohale's Hoek that one participant said, "There is no water coming out from these taps, they are simply ornaments decorating our compounds." Where shortages occurred frequently, respondents lamented that these frequently occurred without notification from WASCO – and even when they are notified, the information is not accurate. This has posed serious reliability concerns for the towns, whose residents must return to long lines at older sources.

Figure 24. Average daily supply hours, by town (household recall of previous and current)



Note: For each town, left-most dot charts hours per day of service recalled before completion of UPUW Activity and right-most dot charts current estimated hours per day of service. Towns are ordered from largest improvement (Mapoteng) to largest reduction (Leribe).

Regarding water quality, we find that upwards of 94% of water tested directly from WASCO household taps is compliant with WASCO and WHO drinking water quality standards (i.e. no detectable presence of E. coli). This is even despite sub-optimal FCRs in most of the tap tests conducted,[125] suggesting that WASCO customers may benefit from good raw water quality. Expectedly, water quality is generally worse from the point of consumption than from the tap, although still quite good. With the caveat of a sample size of only 42-50 water quality tests conducted per site, there is slightly lower compliance with WHO

[125] There is wide between-site variation in this measure—a minimum of 2.5% of tap tests in Mazenod and maximum of 53% in Mafeteng recorded a FCR in the WHO-recommended range of 0.2-0.5 mg/l.

standards in the sites with reported intermittency, the lowest being 80.8% compliance in Butha-Buthe. Nevertheless, 10 and 17% of existing customers in Package 1 and Package 3-5 sites identified water quality as a notable improvement in their water supply since before the UPUW Activity. New customers reported that, although they were occasionally displeased with the color or smell of water from WASCO taps, they generally felt it was higher quality than their previous sources, such as unprotected wells. Package 1 respondents have a slightly lower perception of WASCO water quality than Package 3-5 respondents (Table 21), and correspondingly the Package 1 households are much more likely to treat their water before they consume it (Table 25).

> **"Metolong connected has good water pressure, whereas the other parts remain with little pressure. Where there is Metolong connection there is so much pressure."**
> – Newly connected in Mazenod

5.3.2.4.2 POTENTIAL UPUW ACTIVITY OUTCOMES

Table 22 and Table 23 describe measured and perceived changes in outcomes of interest aligned with the UPUW Activity theory of change for Package 1 and Package 3-5 WASCO customers. In discussing these outcomes, it is important to bear in mind which, if any, of these could be plausibly attributed to the MCC investment. For time savings and illness outcomes mostly associated with a new connection, attribution to the UPUW Activity depends on the extent to which new customers' ability to connect was affected by the program. This causal link is stronger in sites where provisions for connections were furnished or reticulation was extended, such as the majority of Package 1 sites and Leribe. Meanwhile, for outcomes associated with central infrastructure upgrades, like improved quality, reliability, or consumption, attribution may be more likely across the various UPUW sites given the ubiquitous work on WTP elements such as intakes, reservoirs, and existing pipelines and reticulation. Of course, in sites that have required remediation of UPUW-funded infrastructure at WASCO's expense, the case for attribution to MCC is even less clear.

New customers in both groups of sites report spending 20 to 30 minutes less per day collecting water now than before they connected. Additionally, 40 to 50% of surveyed respondents feel that they consume at least a little more water now than they did before the UPUW Activity. In a practical sense, households described being able to wash dishes, bathe, do laundry, and other household chores more frequently, due to both easier access to water and water collection time savings, which they feel has created cleaner households and healthier household members. While the UPUW Activity theory of change hypothesized that time savings would be devoted to paid work, we find instead that most respondents who reported time savings spent this time on household chores or leisure, instead.

When asked if the amount of water consumed now is sufficient to fulfill their needs, 96% of Package 1 respondents and 80% of Package 3-5 respondents answered affirmatively, with the lower proportion in Packages 3-5 accounted for with dissenting opinions from customers in sites with known service delivery problems. This represents a predictable increase relative to the perceived sufficiency of supply prior to the intervention for new customers, but there was also a notable increase for existing Package 3-5 customers. This suggests that the UPUW Activity may not only have benefitted customers connecting for the first time, but also improved service for pre-existing customers—the improved sufficiency of water

supply relative to household needs was especially notable among existing customers in Quthing, Qacha's Nek, and Mapoteng.

Although we do not have a direct measurement of diarrheal illness before the UPUW Activity, 28% of Package 3-5 respondents and 34% of Package 1 respondents felt that diarrheal illness occurred less now than before the intervention. New customers participating in focus groups attributed this change to consuming tap water rather than previous sources.

On the other hand, a plurality of respondents feel that they pay more for water now than prior to the intervention. This is to be expected given increasing WASCO tariffs over the course of the last decade and increased consumption for new and existing customers alike, but it is nevertheless a major source of tension between WASCO customers and the utility. There were a variety of issues with WASCO bills described in focus groups, including bills not coming on time, cost fluctuations on a month-to-month basis, standing charges, and questionable meter readings. Households note that they are forced to pay high standing charges even on months when water is not available. They also report that WASCO members rarely come to read their meters and thus they do not know how their bills are being determined. Some households said they must make difficult decisions between their water bills and other household necessities. They offered a variety of recommendations to WASCO, including improving communication on cuts and maintenance, decreasing costs, and offering subsides for those who cannot afford a connection.

Table 21. Service delivery, by package and customer type

Service Delivery	Package 1 Sites Existing	Package 1 Sites New	Package 1 Sites Total	Packages 3-5 Sites Existing	Packages 3-5 Sites New	Packages 3-5 Sites Total
Average daily service hours	22.1	21.04	21.64	16.08	15.49	15.72
Average daily service hours – recall *	21.93	n/a	21.93	17.41	.	17.41
Quality – *E. coli*, tap (% compliant)	96.8%	96.2%	96.6%	94.2%	94.5%	94.4%
Quality – *E. coli*, point of consumption (% compliant)	95.8%	89.9%	93.4%	95.1%	91.5%	92.9%
Quality – FCR, tap						
Non-detectable (<0.1 mg/l)	38.4%	32.3%	36.0%	18.7%	20.6%	19.9%
Low (0.1-<0.2 mg/l)	51.6%	53.6%	52.4%	53.0%	53.3%	53.2%
WHO recommended (0.2-0.5 mg/l)	9.5%	14.1%	11.3%	28.3%	26.1%	27.0%
High (>0.5 mg/l)	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%
Perceived improvements in service since interventions						
None						
Reliability	25%	n/a	25%	14%	n/a	14%
Water quality	10%	n/a	10%	17%	n/a	17%
Pressure	4%	n/a	4%	8%	n/a	8%
Tariff/price	0%	n/a	0%	1%	n/a	1%
Smell	6%	n/a	6%	2%	n/a	2%
Color	10%	n/a	10%	5%	n/a	5%
Taste	4%	n/a	4%	2%	n/a	2%
Perceived problems in service since interventions						
None						
Reliability	9%	n/a	9%	19%	n/a	19%
Water quality	2%	n/a	2%	9%	n/a	9%
Pressure	4%	n/a	4%	8%	n/a	8%
Tariff/price	4%	n/a	4%	10%	n/a	10%
Smell	1%	n/a	1%	6%	n/a	6%
Color	6%	n/a	6%	17%	n/a	17%
Taste	1%	n/a	1%	3%	n/a	3%
Perceived safety of main drinking water source						
Yes, always	19.5%	18.5%	19.1%	24.1%	22.8%	23.3%
Yes, most of the time	54.4%	47.3%	51.3%	36.8%	37.3%	37.1%
Only sometimes	15.9%	14.5%	15.3%	22.4%	19.6%	20.7%
Never safe to drink	9.1%	18.0%	13.0%	15.5%	18.2%	17.2%
Do not know	1.1%	1.6%	1.3%	1.2%	2.2%	1.8%
Perceived safety of WASCO water** (scale of 0-10)	7.28	6.93	7.09	7.64	8.05	7.87
Perceived safety of own drinking water*** (scale of 0-10)	7.64	8.05	7.87	7.37	6.74	6.96

All estimates above, where seasonality is relevant, are provided for the summer season. Winter season values are similar; complete results can be found in Annex B.
*Reconstructed baseline; ** Directly from tap; ***After any storage, treatment, or handling.

Table 22. Customer survey, intermediate outcomes, by package and customer type

	Package 1 Sites Existing	Package 1 Sites New	Package 1 Sites Total	Packages 3-5 Sites Existing	Packages 3-5 Sites New	Packages 3-5 Sites Total
Intermediate Outcomes						
Time collecting water (min./day)	0.52	1.45	0.92	16.77	15.88	16.22
Consumption (lpcd)	85.85	72.81	80.16	95.52	80.03	85.91
Volume collected outside the home (liters per day)	1.5	5.11	3.06	19.95	18.24	18.89
Diarrheal illness prevalence, children under five	6.6%	7.8%	7.2%	17.8%	9.3%	12.2%
% of households with any children under five	*22.6%*	*33.0%*	*27.1%*	*25.2%*	*29.1%*	*27.6%*
Water expenditures (M/mo.) – all sources	81.21	91.96	85.95	141.74	112.57	123.72
Water expenditures (M/mo.) – water collected outside home	3.8	6.94	5.17			
Reconstructed Baseline Values*						
Time collecting water (min./day) – recall	1.6	22.09	10.53	23.52	48.74	39.17
Consumption (lpcd) – recall	-- *	*58.79*	--	-- *	*62.88*	--
Volume collected outside the home (liters per day) – recall	4.51	58.79	27.72	31.08	62.88	50.36
Water expenditures (M/mo.) – water collected outside home*	2.85	46.76	21.59	52.29	39.9	44.6
Alternative measures of outcomes **						
Estimated current: time collecting water (min./day)	14.2	22.3	17.7	33.6	37.5	36.0
Estimated baseline: time collecting water (min./day)	15.31	69.59	38.26	58.91	106.32	88.23
Estimated current value: water expenditures (M/mo.)	114.82	127.66	120.87	105.1	99.79	101.79
Estimated baseline value: water expenditures (M/mo.)	78.62	51.55	65.45	81.63	37.11	53.98

All estimates above, where seasonality is relevant, are provided for the summer season. Winter season values are similar; complete results can be found in Annex B.
* Our survey instrument only asks about recent WASCO bills, so we cannot calculate the recall piped water consumption for existing customers. For water collection and expenditure on sources outside the home, we have current and recall data. Alternative measures of time spent on collection and expenditure are inclusive, though the different way of asking yields different levels of response.
** These "alternative" measures were asked in a general sense, whereas measures in intermediate outcomes section were calculated based on relevant variables for each source of water the household uses/used. Asking general questions about expenditures and time spent on collection increases response rates but can decrease the accuracy of responses. Differences between the measures either suggest overestimation when respondents think generally about outcomes of interest or omission of certain sources/habits when they discuss them in a granular sense. While point estimates vary depending on the measurement method, both measures reinforce relative similarities and differences between the new and existing customer groups.

Table 23. Customer survey, perceived changes in outcomes, by package and customer type

	Package 1 Sites Existing	Package 1 Sites New	Package 1 Sites Total	Packages 3-5 Sites Existing	Packages 3-5 Sites New	Packages 3-5 Sites Total
Perceived Changes in Intermediate Outcomes						
Time spent collecting water (min./day)						
Do not know	2.3%	2.4%	2.3%	6.2%	10.2%	8.7%
Much more now	2.6%	1.6%	2.1%	6.5%	4.1%	5.0%
A little more now	4.0%	4.5%	4.2%	6.2%	3.4%	4.5%
About the same	82.1%	38.2%	62.9%	50.2%	19.3%	31.1%
A little less now	7.3%	39.1%	21.2%	19.2%	32.2%	27.3%
Much less now	1.7%	14.2%	7.2%	11.7%	30.7%	23.5%
Consumption (lpcd)						
Do not know	2.0%	2.4%	2.2%	5.3%	8.5%	7.3%
Much more now	6.3%	20.8%	12.6%	19.4%	28.2%	24.8%
A little more now	21.3%	27.4%	23.9%	20.3%	26.7%	24.3%
About the same	59.4%	35.8%	49.1%	31.7%	21.4%	25.3%
A little less now	9.7%	11.7%	10.6%	15.4%	11.4%	12.9%
Much less now	1.4%	1.8%	1.6%	8.0%	3.8%	5.4%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	96.6%	95.2%	96.0%	81.8%	78.7%	79.9%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	93.7%	63.0%	80.3%	64.9%	41.6%	50.5%
Diarrheal illness prevalence, children under five*						
Do not know	16.4%	17.1%	16.8%	47.2%	33.8%	38.4%
More	1.5%	3.4%	2.5%	7.8%	3.5%	5.0%
Less	26.9%	40.6%	34.4%	24.4%	30.2%	28.2%
About the same	55.3%	38.9%	46.3%	20.5%	32.5%	28.4%
Water expenditures (M/mo.)						
Do not know	23.8%	13.2%	19.2%	10.6%	15.6%	13.7%
Much more now	10.0%	27.3%	17.5%	22.0%	34.0%	29.4%
A little more now	20.8%	19.1%	20.1%	19.7%	21.9%	21.1%
About the same	38.6%	25.5%	32.9%	30.4%	14.7%	20.7%
A little less now	5.6%	12.1%	8.4%	10.9%	8.6%	9.5%
Much less now	1.3%	2.8%	1.9%	6.5%	5.2%	5.7%

*Note: Asked as an opinion/perception of households with at least one child under five relative to before commissioning of UPUW works, not a direct measurement

Table 24. Customer survey, allocation of time, by package and customer type

	Package 1 Sites Existing	Package 1 Sites New	Package 1 Sites Total	Packages 3-5 Sites Existing	Packages 3-5 Sites New	Packages 3-5 Sites Total
If perceives spending less time collecting now… Household uses extra time for…						
Paid work / earn money	13.5%	6.1%	7.2%	13.9%	7.9%	9.3%
Unpaid work	10.5%	10.2%	10.2%	6.8%	9.5%	8.9%
Study	8.5%	4.3%	4.9%	4.9%	4.6%	4.6%
Household chores	44.5%	59.7%	57.4%	58.1%	68.2%	65.8%
Household business	2.0%	2.7%	2.6%	6.9%	4.9%	5.3%
Rest/relaxation, leisure	46.4%	38.8%	39.9%	25.2%	21.5%	22.4%
If perceives spending more time collecting now… Household does less…						
Paid work / earn money	3.5%	2.7%	3.1%	10.6%	2.7%	6.1%
Unpaid work	6.0%	3.7%	4.7%	10.6%	0.0%	4.5%
Study	0.4%	2.2%	1.4%	0.0%	1.7%	1.0%
Household chores	41.9%	57.5%	50.3%	50.0%	45.4%	47.3%
Household business	0.2%	0.5%	0.3%	7.6%	0.0%	3.2%
Rest/relaxation, leisure	18.0%	18.4%	18.2%	0.0%	20.6%	11.9%

Note: Time use questions were select multiple, and in some cases, households did not know or would not say how their time was used. Thus, totals may be above or below 100%.

Table 25. Customer survey, treatment and hygiene, by package and customer type

	Package 1 Sites Existing	Package 1 Sites New	Package 1 Sites Total	Packages 3-5 Sites Existing	Packages 3-5 Sites New	Packages 3-5 Sites Total
Treatment of main drinking water source (current)						
Do not know	0.2%	0.1%	0.1%	0.3%	0.2%	0.2%
Yes, always	17.4%	16.3%	16.9%	8.7%	13.1%	11.4%
Yes, sometimes	14.0%	14.1%	14.0%	17.4%	10.1%	12.8%
Rarely/once in a while	12.1%	16.7%	14.1%	21.5%	20.1%	20.6%
No, never	56.4%	52.8%	54.8%	52.1%	56.6%	54.9%
Treatment of main drinking water source (recall)						
Do not know	1.5%	3.6%	2.4%	4.8%	9.5%	7.7%
Yes, always	13.9%	14.0%	14.0%	5.5%	11.3%	9.1%
Yes, sometimes	14.1%	9.8%	12.2%	13.4%	7.9%	10.0%
Rarely/once in a while	10.2%	16.4%	12.9%	19.1%	10.7%	13.9%
No, never	60.3%	56.2%	58.6%	57.3%	60.6%	59.4%
Stores water in household for any purpose (% Yes)	80.7%	81.8%	81.2%	90.7%	91.8%	91.4%
Main drinking water container used only for drinking (% Yes)	22.0%	35.8%	29.1%	35.6%	36.2%	36.0%
Safe storage practices (WHO/JMP) **						
Full	0.5%	0.0%	0.2%	0.6%	0.2%	0.4%
Partial	97.6%	98.6%	98.1%	96.6%	97.4%	97.1%
Non-compliant	2.0%	1.4%	1.7%	2.8%	2.4%	2.5%
Handwashing station in household						
Fixed facility observed in dwelling or plot	34.0%	32.3%	32.9%	48.8%	44.6%	47.0%
Mobile object observed	52.8%	49.4%	50.7%	41.4%	41.8%	41.6%
No handwashing place in dwelling or plot	10.5%	13.0%	12.0%	4.4%	11.1%	7.4%
Not observed	2.7%	4.9%	4.0%	5.3%	2.5%	4.0%
Water is available where hands are washed (% Yes) *	87.4%	77.3%	83.0%	72.4%	71.4%	71.8%

*If observed

5.3.2.5 Spillover: Use of piped water from neighbors

Findings from the IEs detailed earlier indicate that there may be considerable spillover occurring to unconnected households who live in proximity to connected households. This suggests that unconnected households have also benefited from expansions in access to piped water, further implying that the estimated impacts above are likely a lower-bound of overall impact since they do not take into account the benefits on the unconnected households, and because the impact on newly connected households is likely attenuated because of that spillover. Additional survey data and qualitative data sheds further light on this occurrence.

The percentage of unconnected households that report using a neighbor's tap for any purpose in the household is 41% in Semonkong and 54% in Roma and Morija.[126] About 41% of households in Semonkong and 53% of unconnected households in Roma and Morija report using a neighbor's tap for all basic domestic purposes including drinking, cooking, bathing, washing hands, household cleaning, and laundry.[127] Approximately the same percentage report it is their main source for those activities. Fewer (32% in Roma and Morija, 12% in Semonkong) reported using their neighbor's tap for gardening, likely due to its heavy water requirements and, based on qualitative findings below, sometimes due to explicit restrictions from their connected neighbors.

Conversely, the percentage of newly connected households who reported allowing their neighbors to collect water from their tap was 13% in Roma and Morija and 20% in Semonkong. In Maseru, 9% of households in both Metolong- and non-Metolong-supplied areas reported allowing neighbors to collect water from their tap. Overall from the customer survey, about 15% of households say they allow neighbors to collect water from their tap, with the exception of existing customers in P1 (9%).

There is a clear discrepancy between the reports of connected versus unconnected households. This appears at least partly due to multiple unconnected households collecting from single connected households – most connected households who allow neighbors to connect report about 2 neighbors who collect water from them; they further report that not all neighbors who collect water from them pay. There may be other dynamics at play locally; for example, there may be a small number of connected households who are willing to be more generous to a greater number of unconnected neighbors.

When connected households were asked how much they are paid by neighbors per month, responses were large in relation to their average water expenditures. Connected households in Semonkong, for example, average 69 Maloti per month in water expenditures, relative to an average of 59 Maloti reportedly received from neighbors; in Roma and Morija, average reported payments of 48 Maloti per month represent about half of treatment households' average expenditures (98 Maloti/month); and in Maseru urban, average reported payments received are 82 and 77 for Metolong and non-Metolong areas, relative to average water expenditures of 65 and 83.[128] Since a small number of households report giving water and getting paid, this phenomenon does not greatly alter the IE results detailed previously.[129] However, these data suggest that households who allow their neighbors to collect from their tap may be recovering a substantial portion of their own water bill from their neighbors. For their part, the

[126] Unconnected households were only surveyed in these two sites based on the design of the IE.
[127] 37% of households in Semonkong report using a neighbor's tap for laundry.
[128] Though different than the issue of spillover, another way that connected households may recover part of their bill is through rent from tenants (between 14-20% of connected households in the IE groups report having tenants). Nearly all households with tenants reported that tenants use water from their account and pay as part of the rent; thus, their payments vs. share of consumption is not practically feasible to disentangle.
[129] In Roma and Morija, the ATT estimate is reduced significantly, but as with the main model, the estimate is not significant.

unconnected households who collect water from their neighbors' taps report expenditures that exceed what the connected households report. Among unconnected households who report using their neighbor's tap as a source of water, those in Semonkong report paying their neighbor(s) around 62 Maloti per month and those in Roma and Morija report paying their neighbor(s) around 262 Maloti per month at their neighbor's tap. The survey did not ask the unconnected households whether they gather from multiple connected neighbors' houses.

Table 26. Connected households allowing neighbors to collect from their tap

	Roma & Morija T (new)	Semonkong T (new)	Maseru, Metolong supplied	Maseru, non-Metolong	P1, existing only	P1, new only	P3-5, existing only	P3-5, new only
Allows neighbors to collect from tap	12.6%	20.4%	8.9%	8.7%	8.7%	15.0%	15.9%	15.4%
# Neighbors	1.35	2.08	2.56	2.41	2.39	1.98	2.19	1.84
# Neighbors who pay	1.12	1.81	2.31	2.22	2.13	1.66	1.70	1.44
Amount paid by neighbors (M/mo.)	47.54	58.60	82.19	77.06	77.35	60.30	72.01	74.08

Note: For groups above, broader customer Package 1 (P1) group is inclusive of IE sample. Thus, P1 "existing" connections includes the Maseru Metolong and non-Metolong groups, and P1 "new" connections includes the Roma and Morija treatment group.

All of the connected households who reported allowing neighbors to collect from their tap were given a follow-up question, which asked them to estimate the share of water from their tap that they used for their own consumption, versus the share that neighbors collected. To answer this question, respondents were asked to separate a pile of ten stones into two piles – one representing their own share, and another the neighbors' (Figure 25.). Among the different groups of connected households surveyed for the evaluation, reports of own consumption (share out of 10) ranged from a minimum of 4.6 among Metolong-supplied households in Maseru urban, to a maximum of 7.1 among newly connected households in Roma and Morija. It is notable that in Maseru urban (as well as customer survey Package 1 existing customers, which are largely made up of Maseru urban customers), connected households report a smaller share of their own tap water for their own consumption versus that collected by neighbors.

Figure 25. Connected households' estimation of share of own vs. neighbors' consumption

FGDs indicate that unconnected neighbors used water from connected neighbors taps in all sites. The majority of unconnected households paid for the water on either a monthly basis or a per-container basis, with the exception of one FGD in the Leribe district, where participants said they gave the water to unconnected households for free.[130] The monthly fees were set by the connected households and ranged from M20-M65/month or M1-M5/bucket. One participant in a connected household FGD said that selling water "is one of the best ways of earning extra money." These fees are a source of tension for both the connected and unconnected households. One respondent said that her neighbor insists on splitting the monthly 300 Maloti WASCO bill with her, even though she does not access or use as much as the owner.

For their part, connected households expressed frustration that the unconnected households did not have the pay the costly initial connection fee or sometimes were unable to pay the negotiated fees. Connected households often say they are not charging for water per se, but rather collecting a nominal amount that simply goes to paying the bill, and that they are helping their unconnected neighbors.

Unconnected households feel as though they pay too much, and many of them suspect that their neighbors are taking advantage of them to help subsidize their monthly bills. Unconnected households said that they were rarely shown the connected neighbor's WASCO bill and that, when they did see it, they felt overcharged with no source of recourse. Additionally, they cited the payments as a significant financial burden, with some going as far as to say they were unable to afford food due to water expenses.

> **"At times when you go collect water you find WASCO officer busy disconnecting the tap saying the tap owner is owing some money. Despite the fact that I do not owe the tap owner I will suffer the same fate with her."**
> – Unconnected household in Roma using neighbor's tap

[130] The other Leribe focus group did mention selling water to cover WASCO bills.

Some connected households set formal limits on the quantity of water their neighbors could use, others set informal limits – such as the water could not be used for gardening or laundry - and others set no limits on water collection. However, many unconnected households noted that they were conscientious about their water usage from their neighbor's taps. Unconnected households also frequently find that they are unable to access the water when they want it, such as if the connected household head is asleep, or if it is after dark, or if the connected household has left without notice. According to FGD participants, this leads to tension and mistrust. Participants also noted that WASCO cuts service without warning, impacting both groups.

Unconnected households often chose to use their connected neighbor's taps because other sources, such as wells and rivers, were often running dry, far away, and had longer lines and poor water quality. They found the tap water to be cleaner and more convenient, resulting in time savings. The most frequent reasons mentioned by unconnected households regarding their own lack of connection to the network themselves were high connection costs, which they cited as M3,500-M90,000, along with their own distance from the network. Many unconnected FGD participants noted that they were unemployed and were unable to save money for a connection.

5.3.2.6 Unanticipated Effects: Use of Metolong water along the DCS

The Metolong DCS, which conveys the bulk Metolong Supply to reservoirs in Maseru, Mazenod, Roma, Morija, and Teyateyaneng, necessarily bypasses rural villages in central Lesotho that were historically served by the Ministry of Water's DRWS. The MP, as an urban water supply project, did not contemplate providing water to these villages under its purview. However, shortly after the Metolong Dam's commissioning and coinciding with a period of acute drought, easily accessible portions of the DCS along roadsides were vandalized by people seeking to supplement the drought-induced shortage of other water supply sources with free water from the Metolong Dam. As vandalization of the DCS became more commonplace and vandalized sites became more frequently exploited as a regular source of water supply, the Ministry of Water decided to install formal taps at the sites of vandalization under the logic that the flow of water could at least be controlled, rather than leaking freely. The taps where this vandalization occurred remain a key source of water for rural communities along the DCS and occasional urban passersby to this day.

SI conducted FGDs with men and women from two villages along the DCS, Ha Motloheloa and Ha Makhalanyane, to better understand their use of water from the Metolong DCS and perceived benefits or challenges of this supply relative to their previous arrangements. While these communities appear to have benefitted from access to the Metolong DCS in the form of increased water consumption, their use of the Metolong supply has also potentially created other challenges while exacerbating social inequalities between those with and without the means to easily access that water. Apart from potential effects on villagers, WASCO cannot recover costs for this water use, effectively increasing WASCO's NRW figures. Meanwhile, where institutional responsibility for water service provision to these communities used to rest clearly with DRWS, the availability of water from the DCS and failed attempts to extend this water closer to villages through tertiary pipelines have left a vacuum in terms of institutional responsibility, where neither DRWS or WASCO appears accountable for service provision. This institutional vacuum has left these communities increasingly dependent on this source of water and without recourse when occasional supply issues arise, all while imposing significant financial cost on WASCO and, by extension, urban water consumers.

Villagers participating in these FGDs report that they have increased water consumption in their households as a result of access to the taps along the DCS. Previously, villagers were restricted in the amount of water they could draw (e.g. formal or informal system of certain taps open on certain days) or the days of the week they could draw water from sources like wells, public taps, and boreholes. Now, villagers can, in theory, draw an unlimited, reliable quantity of water from the taps along the DCS, as long as they are willing and able to travel to the tap, wait in line, and transport it. Villagers said they are now able to water their gardens and conduct other domestic tasks reliant on water that were not possible before the Metolong source became available.

However, many villagers participating in FGDs report more time spent collecting water compared to their previous situation, since the taps along the DCS are quite far from the majority of homes that rely on them, with some exceptions from individuals who presumably live closer to the DCS. For those who live far but are able to travel to the taps on foot, the journey can be time-consuming, arduous, and sometimes dangerous. Collecting water by foot now reportedly takes 3 to 4 hours or more per round trip, depending on the length of the queue or time of day, with long queues reported on weekends when people are not at work. In Ha Motloheloa, respondents noted that most people need to cross a main road to get to the taps. Respondents from one FGD cited instances when children and elderly individuals have been hit by cars while crossing the road to access the taps.[131] In Ha Makhalanyane, respondents complained about the physical difficulty of transporting wheelbarrows to the taps to collect a sufficient amount of water.

This situation has reportedly highlighted an inequality between those who live close to the DCS or have cars for transporting water, and those who live far away or face other barriers in accessing water from the DCS taps. The latter group either need to spend more time traveling to collect water at the taps, with the attendant challenges described above, or otherwise incur real costs to obtain that water by paying someone else to collect for them. Accessing the main taps is an especially difficult challenge for elderly villagers and persons with disabilities. These individuals frequently have to pay others to collect their water for them. Such participants report that their pensions are not sufficient to cover the increased expenditures on water collection activities, which has resulted in some elderly villagers limiting their water consumption or economizing water for tasks like laundry. These challenges pose sufficiently large barriers to some participants that they instead have opted to rely on closer, more expensive, or unsafe sources of water – such as unprotected wells and river water – rather than the DCS taps.

Further, there are some reports that people beyond the villagers for whom the taps were intended are taking advantage of this water for other purposes. In Ha Makhalanyane, there are reports of residents of Maseru and other cities driving to the DCS taps with large storage containers to take advantage of the free water for economic purposes such as brick-making. People from the village with smaller storage vessels have to wait for the large containers to be filled before they can fill theirs.

Respondents report that the Ministry of Water attempted to respond to this issue through the construction of tertiary lines from the DCS leading to public taps in nearby villages, which dispense water based on a paid token system, with funding from the Government of Lesotho. These public taps were supposed to improve access to the villages while also recovering some of the lost revenue from the DCS taps. When these public taps were installed, authorities told the villagers that they would be an intermediate step toward in-yard water connections for individual households. However, since the public tap installations, there has been no follow-up on the individual connections, as DRWS, village chiefs, and community

[131] The frequency of such instances cannot be determined through the two focus groups conducted.

councils all believe other groups are in charge of the project, and the public taps have not been maintained. In both villages, the public taps are plagued with a variety of problems, including low water pressure, poor water quality, broken equipment, and frequent unplanned cuts to the water supply. In Ha Makhalanyane, only one of the eight public taps were working as of May 2019. These consistent problems have left villagers in both locations frustrated with their current water access situation.

Figure 26. Water use along DCS

(a) Tap along previously vandalized section of Metolong DCS

(b) A truck collecting free buckets of water from this tap

Many of the sources that villagers used prior to the availability of water from the DCS have been decommissioned or are no longer maintained, as DRWS has informed villagers that it is now WASCO's responsibility to ensure their service provision. Meanwhile, villagers from both locations report that WASCO and the Ministry of Water have been unresponsive to communications regarding the broken public taps. Thus, the portfolio of alternatives to consuming water from the DCS have shrunk over time, leaving villagers increasingly independent on the DCS taps.

Even for the public taps that still function, respondents report that the token system makes water more expensive than their previously available sources. In Ha Makhalanyane, participants noted they previously paid 5 Maloti per month for water from a village tank, but they now pay anywhere from R60 to R100 per month at the public taps.[132] Some villagers report that they are unable to afford the tokens in the first place. When the public taps are broken, villagers are not given refunds for the tokens they have purchased and are unable to use.

Villagers express mixed opinions on the quality of the Metolong water, whether from the DCS taps or from the newer public taps. Respondents note the water pressure and water quality from the public taps is not as good as the pressure and quality of the water from the DCS taps, and that the quality of the water from the DCS taps is not as good as the quality of the water from previous groundwater sources.[133] Participants note that the water from the taps appears brown in color after rain. In Ha Motheloa, one participated noted that, "every time we drink [Metolong water], we complain of stomachache." Villagers who consume water from taps connected to Metolong do not report utilizing any water treatment methods, such as boiling, to improve the cleanliness and quality of the water. In Ha Makhalanyane, residents report that they previously treated their borehole-supplied village water storage tank with lime.

[132] Lesotho Maloti and South African Rand (R) are used interchangeably in Lesotho.
[133] Before the Metolong DCS was built, in Ha Makhalanyane, groundwater was previously drawn into a village tank using an electric borehole.

In both villages, respondents noted their current dependence on the Metolong water and expressed concern for their livelihoods if the Metolong water were to be cut off, because other available sources are not sufficient to meet their needs. Though all FGDs expressed a desire to have water piped into their yards and to have better management of the water system, most also say they would not be willing to pay for the farther main Metolong taps if the water was not free but those who are able to afford an in-yard connection would be willing to pay for that connection. Ha Motheloa residents said they would not be able to afford the water and Ha Makhalanyane residents said they would return to relying on well water; in Ha Motloheloa, however, villagers also noted that their well, while still maintained, does not actually yield a sufficient quantity of water to supply the village due to population growth and drought.

In conclusion, the introduction of Metolong water as a primary source for these communities and ones like them along the DCS has apparently created an institutional vacuum where neither WASCO nor DRWS fully accepts responsibility and accountability for the provision of quality water for domestic consumption. The water from the DCS almost certainly has allowed for increased consumption relative to previous sources used before the Compact, but at the cost of increased collection time and reduced availability of alternative water supplies previously maintained by DRWS. Meanwhile, consumption along the DCS by these villages and urban passersby alike directly contributes to the acute NRW challenges that plague WASCO. The way forward with these villages as potential paying urban water consumers is unclear. Initial attempts to create token-based public standpipes have failed and, despite professed WtP for in-yard connections by some households, it is unclear if willingness and ability to pay among all of the households is sufficient to justify a large-scale investment in in-yard taps.

While the status quo is sustainable in the sense that the Metolong Dam can supply sufficient water for the targeted urban consumers and unintended rural consumers along the DCS alike, it imposes significant financial strain on WASCO and, by extension, urban water consumers while also rendering rural consumers in this area increasingly dependent on the Metolong DCS supply. This imposes a burden on households who live far away or have physical constraints that make the long trip to the DCS difficult or impossible and leaves them without recourse when problems arise with their water supply.

5.3.3 Intermediate Outcomes – Industry & Private Sector

In this section, we address the part of EQ 7b related to current water use by industrial manufacturing firms and other enterprises, and changes in water use from the urban water network since the Lesotho Compact started. This portion of the evaluation was conducted using PE methodologies, including site visits to a select group of industrial firms, KIIs with firm staff and other knowledgeable sector stakeholders such as LNDC, and secondary data analysis using WASCO's consumption and billing database as well as data on employment obtained from LNDC. As such, this component of the evaluation does not quantify causal impacts, but rather describes water use and perceived changes over time among industrial firms and other enterprises, along with the reported effects of any such changes, including whether any have induced additional business investment or expansion.

5.3.3.1 Textile and Garment Industry

We conducted case studies of five industrial textile firms based in the Thetsane and Tikoe industrial areas of Maseru to understand how they use water in their productive processes, how this has changed in the years since the Metolong Dam came online, and what they view as past and ongoing constraints to continued economic growth in the textile industry. In this section, we first highlight key differences in

productive processes between different kinds of firms in this sector in Lesotho, which demonstrates how they are each affected by shortcomings in water supply. Then we describe the results of our interviews with industrial firms, including a description of how these firms have perceived changes in water supply since the Metolong Dam came online, and how this may have affected operations and decisions about future investment or expansion.

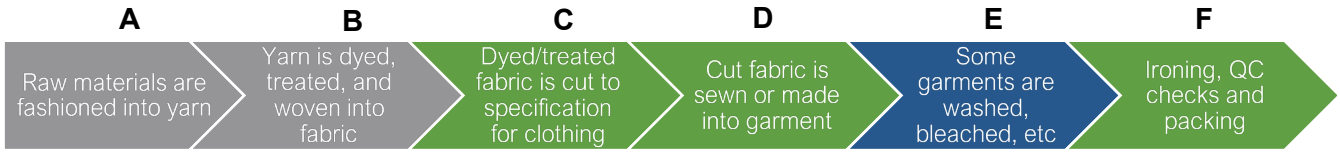
Through these case studies, and corroborated by secondary employment and water consumption data obtained from LNDC and WASCO, we have learned that increasing the bulk supply of water available to Maseru may have satisfied a necessary condition for the entry of new firms and the continued operation and growth of existing firms; however, according to the firms, any recent increase in growth that may have occurred was less directly connected to water supply and more strongly associated with political stability and ongoing support of the AGOA mechanism together with macroeconomic trends favoring increased demand from major markets such as the United States, South Africa, India, and China. Also, new entrants into these industries are not the ones hypothesized by the MCC project. Water supply was only one of several barriers to entry, with a lack of adequate wastewater treatment reportedly posing a more significant barrier to firms engaged in wet processes of production. This compounds other factors including the overall cost of investment for potential new entrants. Further, with the extension of AGOA (counter to ERR assumptions) continuing to make it cheaper to import fabric duty-free, the need or incentive for a new fabric mill was nearly eliminated. Further, firms engaged in wet processes perceive that the increased cost of water in recent years roughly offsets the increased revenue from less frequent plant shutdowns or production decreases that the improved water supply provides.

Finally, and perhaps critically, the industrial firms in Maseru are almost entirely supplied from the pre-existing Maseru Water Supply facilities. The Metolong Dam does not supply industrial estates directly.

5.3.3.1.1 GARMENT INDUSTRY IN LESOTHO & WATER USE IN PRODUCTIVE PROCESSES

From beginning to end, the journey in a given textile operation from importing raw materials, like cotton, to exporting final textiles and garments, like denim jeans, can be summarized broadly as depicted below in Figure 27.. Processes C, D, and F can be considered “standard” or “cut-make-trim” (CMT) processes. Just about every textile firm in Lesotho, regardless of scale, is engaged in these processes. With dyeing, washing, and other wet processes excluded, water is only required for ironing garments and for employee consumption and sanitation purposes. Process E, between making garments and packing them, only applies for garments such as denim jeans where a certain wash (e.g. stone wash), bleach, or additional dye is required to finalize the garment. All of these are wet processes that require significant water and, furthermore, require treatment of wastewater that is not suitable for municipal wastewater systems with the sediment and chemical contamination that is a byproduct of these processes.

Figure 27. Textile (A-B) and Garment (C-F) Manufacturing Process



Due to the scale required to make this intensive process profitable, there are few firms engaged in them in Lesotho. Finally, Processes A and B are required for making textiles and fabrics in-house, rather than importing them from elsewhere. There is only one group of firms in Lesotho that possesses the scale

required to execute all of these functions from beginning to end in-house—the Nien Hsing Group. The next largest textile firm using wet processes in Lesotho after the Nien Hsing Group, CGM Industrial, imports their fabric from outside Lesotho before proceeding at Step C, including intensive washing and wastewater treatment (step E). Outside of these two examples of "wet" textile operations, the vast majority of the remaining firms in Lesotho are simple CMT firms.

CMT firms only use water in the production process for ironing (Figure 28.a). Ironing primarily occurs on the final garment before it is packed, but ironing lines are also run to each of the assembly stations for any fabric that has become wrinkled throughout the production process. In contrast, wet firms use water as a critical input to their production process. Such firms focus nearly exclusively on denim clothing and add value to the CMT process by purchasing their denim fabric from suppliers or making it themselves, washing, desizing (removing warp yarns which resist dyeing), and dyeing or bleaching the denim garments to produce styles requested by buyers (Figure 28.b and c). Within these processes, most water is needed for washing. CGM Industrial estimates that about 80% of the water it consumes is used in its washing room. Additional photos of these production processes taken as part of industrial firm interviews are provided in Annex B.

Figure 28. Water Use in CMT and Wet Processes

(a) CMT: ironing station for blouses before packing at Lucky Manufacturing

(b) textile wet process: sized thread being run through dye pre-weaving

(c) garment wet process: machines for stone washing jeans at Nien Hsing

The Nien Hsing Group adds additional value through vertical integration of the fabric creation process into their business model through one group member who operates the only fabric mill in Lesotho, Formosa Textiles. Formosa produces denim fabric from raw cotton for use by other Nien Hsing Group members such as Nien Hsing International and C&Y Garments. The denim fabric mill includes its own wet processes, as the cotton must be made into yarn, dyed, and sized to strengthen for weaving, woven into fabric, and then occasionally subjected to additional dyeing in the finishing stage. The dye and sizing chemicals are applied by running the yarn strands through a wet solution (see photos in Annex B). By making their own denim, Nien Hsing can capture a higher profit from the final sale of the denim garments.

Table 27. Textile firms interviewed for the evaluation

Firm	Estate	# Permanent Employees As of Sep. 2017	Cut-Make-Trim Processes Water used for ironing, employee consumption	Wet Processes Water used for dyeing, washing, etc.
Nien Hsing Group	Thetsane	C&Y Garments: 2,088 Formosa Textiles: 1,206 Nien Hsing Int'l.: 2,755 Global Garments: 2,549 Glory International: 0[a]		
CGM Industrial	Thetsane	1,371		
Lucky Manufacturing	Tikoe	400		
Maseru E Textiles	Tikoe	948		
Tai Yuan Garments	Thetsane	2,011		

Notes: [a] Opened 2019. This is a CMT knitwear factory in Tikoe and does not use water except for employee consumption and sanitation. Factory profile indicates approximately 250 employees at present (https://www.nhjeans.com/glory-international-maseru-lesotho/).

The CMT firms we interviewed report using around 800 cubic meters of water per month on average for employee consumption, sanitation, and ironing. Despite its minimal role in the production process, reliable water supply is still important to these firms because the factory must shut down if there is insufficient water for employee consumption and sanitation. These shutdowns cost the firms both in terms of foregone production and in wages that must be paid out to employees. Thus, these firms typically have water reservoirs on site to smooth any disruptions in the WASCO supply and allow for continued operation. The CMT firms we interviewed explained that they can typically continue operating for a day or two using their stored water before they must shut down the factory or cope through other means, like purchasing water from a truck or purchasing water bottles. Otherwise, though, water service provision does not significantly affect their production.

Wet process firms like CGM Industrial and members of the Nien Hsing group also must shut down if there is insufficient water for employee consumption and sanitation. They are also more vulnerable to service cuts due to the volume of water they consume on a daily basis in the production process. Where a CMT firm may maintain a storage reservoir with a capacity of 45 to 50 cubic meters enabling one to two days of continued service without water, according to WASCO's consumption database, most wet firms consumed more than 50,000 cubic meters per month from 2015 to 2018, with larger consumers like Formosa Textiles consuming between 60,000 and 80,000 cubic meters per month alone. CGM Industrial, the lightest water consumer among the wet firms with monthly consumption between 2,000 and 5,000 cubic meters, can only operate for about 8 hours without a water supply before sending employees home.

Wet firms are also affected by deficiencies in water pressure. Managers and engineers in the Nien Hsing group track water pressure and water quality as a regular part of their job functions. If water pressure is inadequate, they may decide to dial down the pace of production to ensure that water pressure in the production process is adequate. To promote the health of their workers, they also independently test drinking water quality every six months and install filtration devices to protect employees against any issues with drinking water quality. Water use represents such a significant cost for wet firms that they invest significantly in water efficiency and recycling technology to mitigate the risk of service cuts,

minimize the cost of water as a productive input, and also reportedly to improve the environmental friendliness of their operations. CGM Industrial estimates that the washing plant is able to recycle and re-use about 60% of the water in its production process.

Outside the cost of water as a productive input and investing in water recycling technology, wet firms must also invest in large-scale wastewater treatment facilities. This is because there are legal water quality standards for water entering the municipal wastewater system in Lesotho that are not met by the raw wastewater produced by these factories, due to the chemicals and sediments from their washing. Even if they are recycling this water instead of disposing of it in the municipal wastewater system, which they have done increasingly since about 2008, there are still minimal standards it must meet in terms of suspended solids and chemical composition before it is used again in production.

5.3.3.1.2 PERCEIVED CHANGES IN WATER SUPPLY DUE TO METOLONG PROGRAM

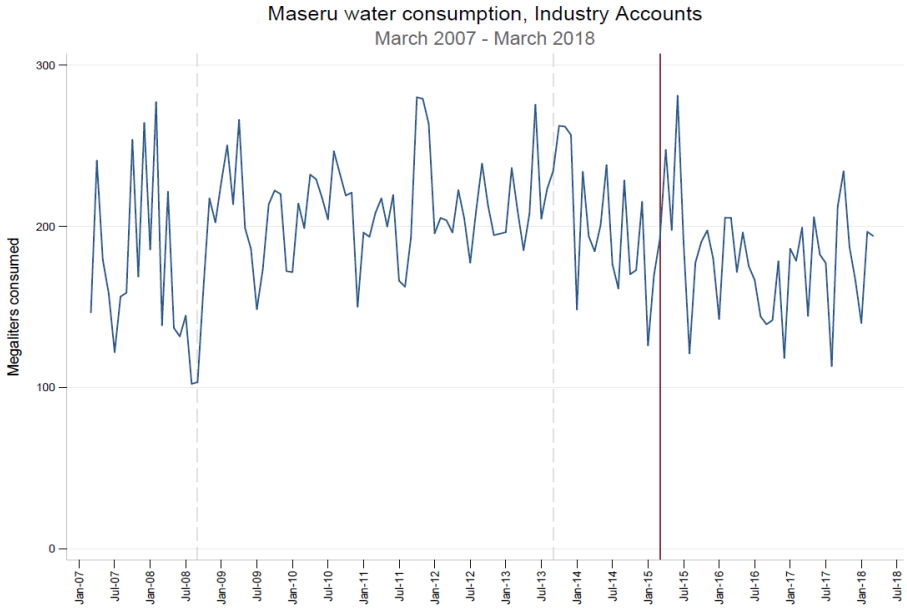
All of the firms interviewed indicate that WASCO service cuts have occurred less frequently and for shorter durations since the Metolong Dam began delivering water to Maseru in March 2015. Note that case study informants were asked specifically about supply before/after the Metolong Dam came online in 2015. However, respondents were not generally well informed as to the source of their firms water between the two major supplies to Maseru, and it is possible given the long recall period that they are falsely attributing improvements in supply to the Metolong Dam for which the Maseru supply is responsible. Nonetheless, we report on what firms conveyed to SI during interviews.

One firm estimated that they might have experienced cuts around 4-6 times per month before the dam came online compared to around 2-3 times per month in recent years. It is exceedingly rare that the cuts last long enough (between 6-8 hours and 1-2 days, depending on the firm) in recent years for the firms to shut down production completely. The Nien Hsing group indicated that, before the Metolong Dam came online, there were two separate cases where employees had to be sent home for a full week due to water shortages. No shortages this acute have occurred since. Additionally, the firms all report improvements in water pressure. These improvements have increased the wet firms' ability to produce at full capacity on a regular basis compared to before the Metolong Dam came online.

Although firms feel WASCO has improved its communication surrounding outages, citing radio broadcasts for outages resulting from planned maintenance and responsiveness to phone calls inquiring as to the situation with unplanned outages, they still desire better communication to improve their ability to cope with outages. In the event of an unplanned outage, it is critically important for wet firms to know if they should dial down production to conserve water for an outage in excess of a few hours or if they can confidently rely on their stored supply for a shorter outage. CGM Industrial stated that while they find WASCO is somewhat more accessible now than they have been in the past for questions about shortages, their perception is that it is not always clear who at WASCO ultimately has the answers wet firms need to make decisions surrounding production in the event of a water shortage.

Nevertheless, despite reported improvements in reliability and water pressure, based on WASCO secondary data it does not appear that industrial firms in Maseru meaningfully changed their water consumption over and since the Compact period. Although there is considerable variation over time, likely due to fluctuations in orders and productivity, the general range of consumption for industry in Maseru as a whole--between 150 and 250 MLs per month, most months—has not changed (see Figure 29.).

Figure 29. Maseru Industrial Water Consumption, 2007-2018



Note: the consumption pictured is the sum of all WASCO accounts with the "Industry" or "Wet Industry" account type in Maseru. In fact, large industrial firms often possess as many as a half dozen accounts of different types, including domestic (for locally housed staff), business, industry, and wet industry. While excluding all but the last two types may underestimate the water these firms use somewhat, it likely captures the vast majority of water used for production. The other account types might only contribute 0-2 Ml of additional consumption per month, so their exclusion is unlikely to meaningfully change the trend.

With regard to water quality, firms generally believe that drinking water quality is the same now as before the Metolong Dam came online, based on key informants' recollection of their own independent water quality testing as described above. Although water quality does not affect production, per se, the Nien Hsing Group still incurs marginal costs when drinking water quality is poor because they invest in water filtration systems for their employees and change the filters more frequently when quality falters. They have also historically invested in water from outside sources if the drinking water at the factory smelled, was discolored, or did not pass their independent testing. Multiple firms cited the appearance of bloodworms in the water supply in February 2018 as informing an ongoing distrust of Metolong water.[134]

All of the firms interviewed expressed their discontent about increased tariffs for water consumption over the last several years. Even if the Metolong Dam does not supply these firms, according to interviews with WASCO staff the increased costs of operating the dam are part of the considerations informing increased tariffs in recent years, which affects all WASCO customers given Lesotho's country-wide water tariffs. For wet firms especially, this increase represents a sizable increase in their cost of doing business. Although they were unable to calculate the balance of the tradeoff precisely, their perspective is that the increased cost of water as a productive input roughly offsets the increased revenue from less frequent plant shutdowns or production decreases that the improved water supply provides. For the Nien Hsing group, the largest consumer of water in all of Lesotho, this increased cost is substantial enough to merit capital investment in higher efficiency washing machines throughout the plant and better wastewater recycling technology. The cost savings is not the sole justification for this capital investment, as they

[134] Phakela 2018.

expressed their view that it is a corporate social responsibility to reduce their water consumption in the name of conservation, but the business case is also present.

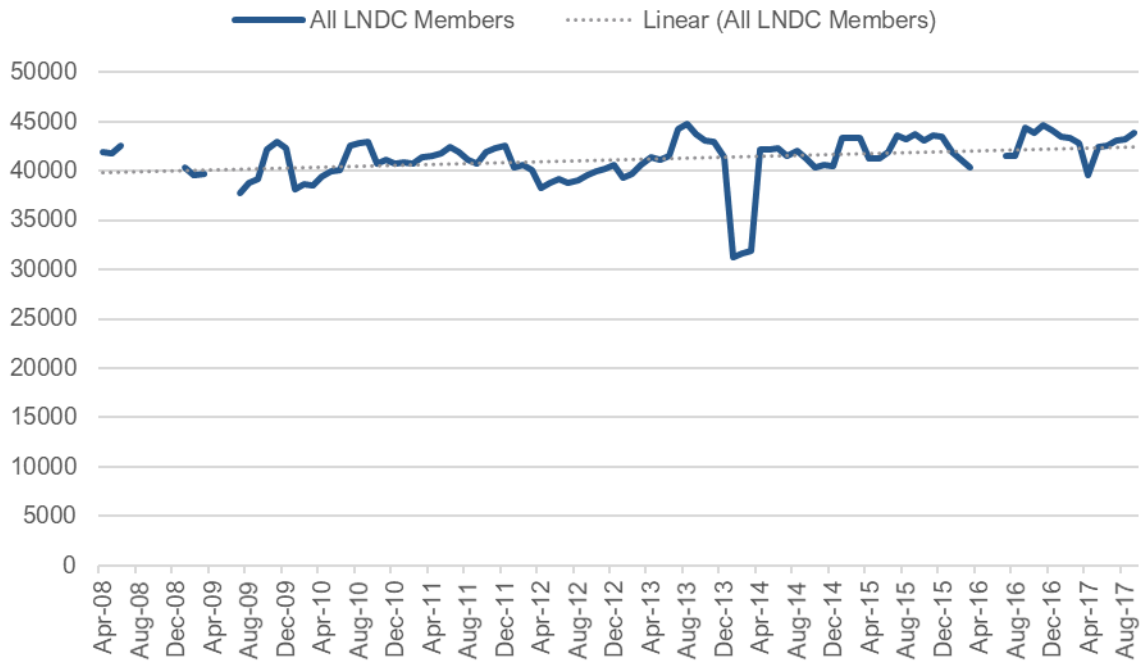
5.3.3.1.3 EFFECTS OF IMPROVED WATER SUPPLY ON TEXTILE & GARMENT INDUSTRY

Returning to the project logic and economic model with respect to textile industry firms, the first link in the theorized causal chain held: the reliability and pressure of the water supply improved after the bulk water supply into Maseru increased, even if this improvement was at best caused indirectly by the MP, as firms are apparently being supplied at present by the Maseru Water Supply rather than Metolong. Thereafter, the model posited that these improvements would lead to expansion and growth of industrial firms leading to more employment opportunities and greater production. We that to the extent that any preservation of or changes in employment and production occurred (see LNDC data to this effect below in Figure 30.), these were more likely due to favorable macroeconomic conditions and the extension of the AGOA treaty through at least 2025 than the change in water service. Nonetheless, the improvement in water service likely removes a potential constraint to future growth that would have existed without the increased bulk supply.

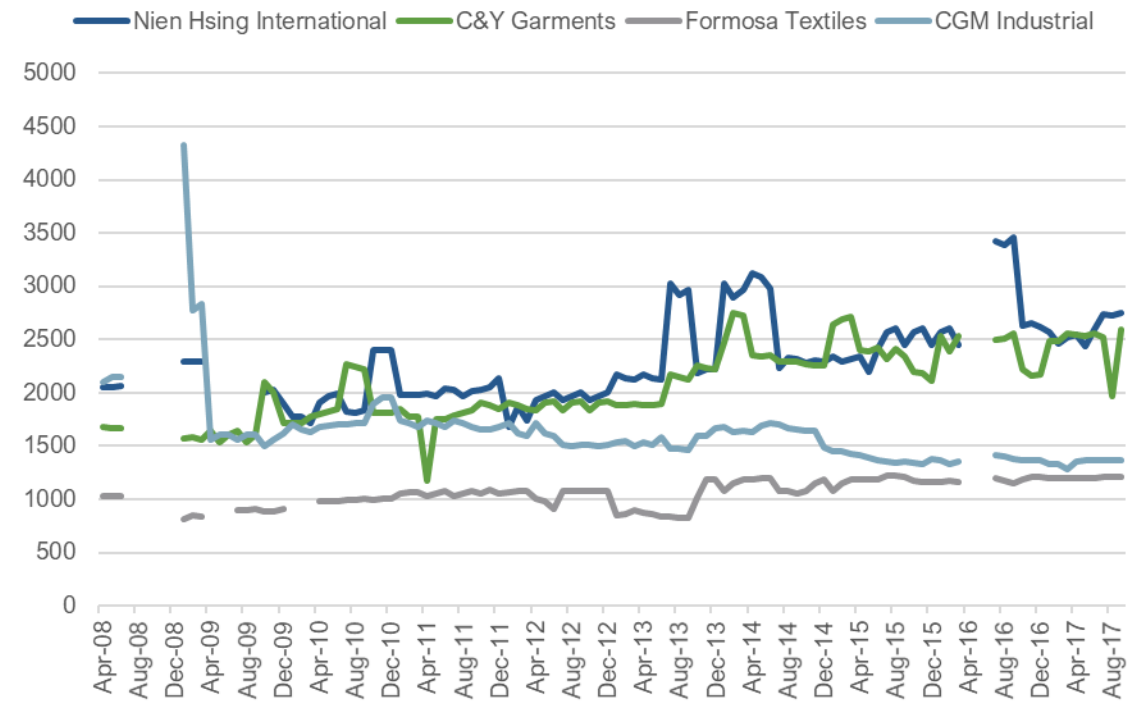
The original ERR calculation assumed preserved and new income and employment in the industry, enabled by the construction of a local milling facility and new “wet” industry firms in the Tikoe industrial estate. These more distal links in the theorized causal chain of events did not hold – Formosa Textiles still maintains the only fabric mill in Lesotho and there have been no new entrants into the “wet” textile industry aside from the pre-existing players – CGM Industrial and the Nien Hsing group. These players are still operating much as they did before the Metolong Dam came online, using the same wet procedures as before and consuming roughly the same amount of water. Although new textile firms have opened at the Tikoe Industrial Estate since the Compact ended, these have exclusively been CMT firms.

Figure 30. Permanent Employees, Lesotho Industrial Firms

(a) all LNDC firms



(b) case study firms



Managers at wet firms believe that investment in a fabric mill and entry of new wet firms into the market did not manifest because they represent large-scale investments which are likely more heavily influenced by larger political and economic factors than the availability of water. Well-informed industry participants believe that macroeconomic factors influencing demand for textiles, political stability in Lesotho, and the outlook for other important costs of production such as wages are more heavily weighted than the availability of water in making this kind of investment. In other words, while increasing the bulk water supply into Maseru may have fulfilled a necessary condition for this kind of investment, there are other conditions that render this condition insufficient. Furthermore, the original ERR envisioned that this investment would be spurred by the termination of the third-country fabric provision in the AGOA treaty, which grants to CMT firms duty-free export of garments made with fabric provided from outside Lesotho, but this provision stands through at least 2025.[135]

Still, stakeholders contend that the pre-existing bulk water supply serving Maseru would not have been sufficient for their continued operation in Lesotho without the addition of the Metolong bulk supply. It is not possible to estimate what the current state of employment and production in this industry would be in Lesotho without the Metolong Dam given its concurrence with the other economic and political factors listed above, but it is reasonable to conclude that the dam may contribute to future preserved employment by preventing acute supply shortages for a long time to come. Furthermore, although stakeholders cannot cite any productive investment that has been made to take advantage of the improved supply, they state confidently that they do not need to factor the adequacy of water supply into their strategic planning for the future. So, where an additional constraint to the textile industry may have arisen in the absence of the Metolong Dam, it has been successfully addressed. Indeed, a separate "Tikoe Thetsane Industrial Water Supply Project"[136] funded by the Government of Lesotho with the express purpose of supplying 20 ML per day to the Tikoe and Thetsane Industrial areas, commissioned in 2012, was mothballed shortly after the Metolong Dam's commissioning. Even though the Metolong Dam does not supply these areas directly, the timing of this decision suggests that the combined Maseru and Metolong supplies are sufficient for domestic and industrial needs without further assistance.

5.3.3.2 Small and Medium Enterprises

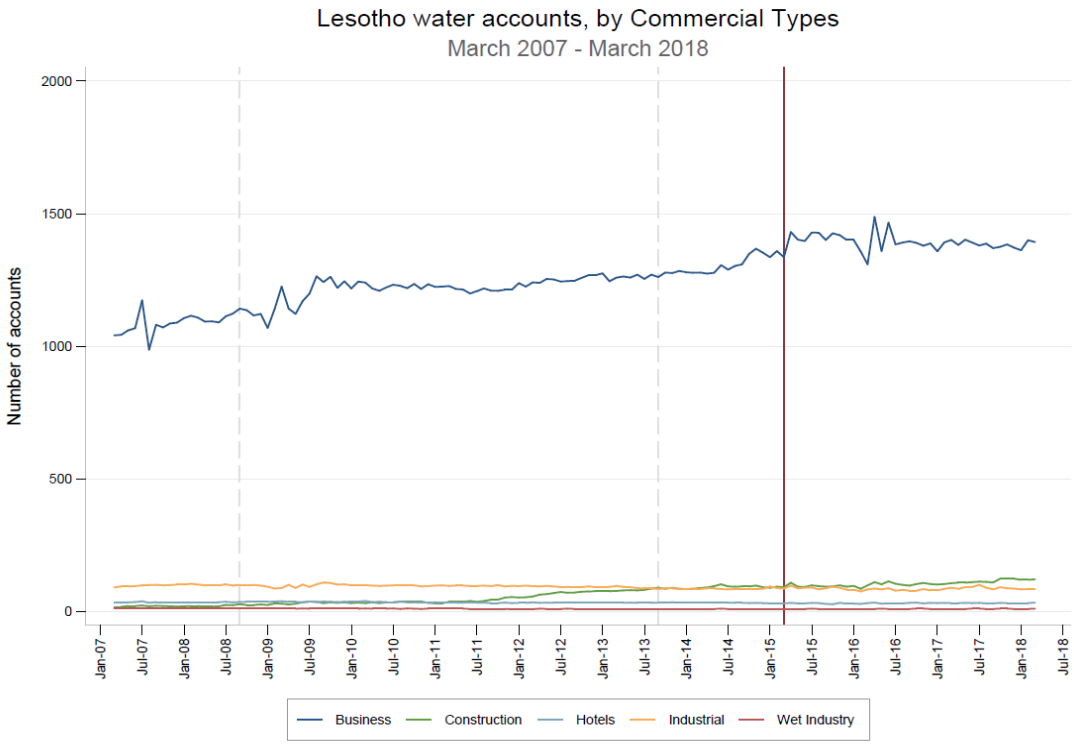
The UPUW Activity ERR assumed that SMEs in urban areas of Lesotho where the UPUW activity operated would respond to an improved water supply by experiencing decreased manufacturing costs, taking advantage of increased manufacturing opportunities, and/or investing in new productive capabilities. As we have seen from the process evaluation findings, this theory of change broke down at the first stage in areas like Mohale's Hoek, Butha-Buthe, and other sites where the WASCO water supply is similar to or worse than it was prior to the Compact. However, even in areas where the supply seems to have improved such as in Maseru, peri-urban Maseru, and Semonkong, well-informed government and non-government stakeholders in the SME sector did not perceive significant effects on businesses.

Informed stakeholders contend that any changes in the SME sector over this time period have more to do with broader contemporaneous economic trends than with any changes in water supply. Secondary data from WASCO reveals an increase from around 1,200 accounts of the "business" customer type at Compact signing in Lesotho to nearly 1,400 as of March 2018 (see Figure 31.), with no distinct change in this trend before and after the time when MCC-funded works were commissioned. Still, similar to the

[135] Lu 2018.
[136] WASCO n.d.(b).

findings about industry described in the previous section, some respondents from Maseru and the surrounding areas served by the Metolong Dam reinforced the sentiment that the supply of water before Metolong came online would not likely have been sufficient to meet increasing demand over time.

Figure 31. Commercial WASCO Accounts Country-Wide, 2007-2018



According to informed stakeholders within the Basotho Enterprise Development Corporation and the Ministry of Small Business Development, Cooperatives, and Marketing, most of the SMEs in Lesotho are involved in trading, small-scale manufacturing, handicrafts, restaurants, tourism, and agricultural enterprises. For the most part, with the exception of restaurants, guest houses, and specific manufacturing trades like brick-making, these SMEs do not require water service as a productive input. Stakeholders universally felt that constraints to SME prosperity in Lesotho are the same now as they were in the pre-Compact period, and that the most significant of these are unrelated to water service provision. Persistent barriers commonly cited among respondents interviewed include a lack of business and entrepreneurial skills and access to finance, capital, and raw inputs as major constraints.

One constraint commonly cited by respondents that does involve water service is the lack of affordable spaces with adequate utility connection in which SMEs can operate. Even if the UPUW Activity improved water service in some of the cities where SMEs operate, stakeholders felt that the benefits of improved service accrued almost exclusively to domestic WASCO customers. Without creating dedicated spaces such as “market centers” where SMEs can take advantage of improved water service on the premises where they operate, the potential for SMEs to benefit was viewed as minimal. Stakeholders did cite informal and small-scale car washes as water-utilizing SMEs that have rapidly expanded in urban areas of Lesotho since 2008. However, they also cite a sharp increase in car ownership during this time period which they attribute to that proliferation more than the improvements in water supply.

5.3.4 Synthesis of Findings – Program Achievements Relative to Objectives

MCC-funded water sector programming in Lesotho sought to improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management. The urban components of the Water Sector Project covered by this evaluation were meant to fulfill the first portion of this program objective. The process evaluation findings in section 5.2 yield mixed results in terms of achieving this objective. Where implementation fidelity was strong—in the MP and in Packages 1, 2, and 5 of the UPUW Activity—improvements in water supply were achieved. The nature of these improvements ranged from increasing the bulk water supply to Maseru and surrounding peri-urban towns supplied by the Metolong Dam, to improving the reliability and accessibility of the water supply where new reservoirs and reticulation were constructed in UPUW Activity sites. On the other hand, in some UPUW sites, especially Package 3 and 4 sites where new intakes or clariflocculators were constructed, missteps in design and oversight of the construction of the works, as documented in this report, failed to improve the water supply and in some cases caused or exacerbated challenges by installing malfunctioning infrastructure that required subsequent repair.

The theory of change and economic analysis elaborated in section 2.3 connected the program objectives to the larger Compact goal of reduced poverty through economic growth. Our summative evaluation findings, as elaborated in section 5.3, assessed the impact of access and supply improvements. On the one hand, these findings showed that increasing access to quality water for domestic use can yield meaningful benefits particularly in terms of time savings in water collection and water consumption for urban households in Lesotho. However, households reported that time savings were not primarily reallocated to productive activities as hypothesized in the theory of change and impacts on diarrheal illness were not detected – baseline levels of diarrheal illness were relatively low, and the evaluation was underpowered to detect statistically significant differences of the magnitudes measured in this evaluation.

The summative evaluation also found no impact of supply improvements when comparing households in townships supplied by the new Metolong supply, compared with townships that had not yet been connected. Across the board in these areas, household recall of service levels prior to the new Metolong supply was already about 22 hours of service per day, suggesting that most households may not yet have experienced a level of declining service so as to experience substantive changes resulting directly from the Metolong supply. Our interpretation of these results, given the success of the implementation of the MP and that it did indeed increase bulk water supply to Maseru and surrounding areas, is that the main benefit of the intervention to date is allowing Maseru to avert negative outcomes that would have occurred when the pre-existing bulk supply ultimately failed to meet demand.

In terms of industrial use, critically important as a benefit stream in the MP's ERR calculation, we found that improvements in bulk water supply to Maseru would at best eliminate one of several constraints to growth in the textile industry. Adding to this, our evaluation also found that the pre-existing Maseru WTP has, in recent years, provided a dedicated supply to industrial areas, both "freeing up" supply from Metolong for other uses, while also showing that any recent benefit to industrial areas has been the result of non-Metolong water sources. Overall, industrial growth and water use in the time period of interest was relatively stagnant, primarily due to the persistence of other and reportedly more binding constraints to industrial growth and expansion in Lesotho.

Taken together, this evaluation finds that Compact investments made meaningful contributions in terms of improving water supply for domestic and industrial use in urban Lesotho, but that these improvements

are at times tenuously linked to the theory of change and discrete benefit streams hypothesized in ex ante economic analysis. For example, given the specific nature of the intervention and existing service levels, household-level benefits largely benefited new rather than existing customers, and some assumed links between intermediate outcomes did not materialize (i.e. time savings and productive activity). Moreover, varying implementation fidelity led to uneven achievement of results across all program sites. Other non-water related constraints to growth in the textile industry must be removed before it can capitalize on the improved supply. However, the increased bulk supply resulting from the Compact works will significantly prolong the timeframe over which domestic and other users of water in urban Lesotho have access to reliable, high quality water supply.

5.3.5 Limitations

Timing. Given the geographic scope, complexity, and time since completion of the MP and UPUW Activity, it was essential to sequence evaluation activities in a way that produced a summative evaluation that was responsive to program realities and that made responsible use of evaluation resources. However, a drawback of the choice to sequence the evaluation in this way is that our description of the current function and management of the infrastructure funded by these projects and our primary data on WASCO service for households is offset by almost two years. Furthermore, it could be that some of the specific management arrangements described in response to EQs targeted by the process evaluations may have changed between September 2017 and now.

IE Design A Sample Sizes. The evaluation team was not able to obtain as many households from Roma and Morija as well as Semonkong to achieve the required sample sizes as calculated in the Summative Evaluation Design Report. While significant effects were detected for many outcomes, the loss of power affected our ability to detect changes in diarrheal illness. However, the reason the sample sizes were lower than anticipated is that there were not sufficient eligible units to recruit into the study; therefore, we have identified the full population of interest, meaning that we can be confident that any difference in service represents the actual difference between population means for those specific groups.

Selection bias. Quasi-experimental designs are more susceptible to selection bias relative to experimental designs, as the starting point is a group of households we know have been exposed to a program, and comparison households must be identified through statistical procedures that make use of observable traits. Through propensity score matching, we are only able to account for observable traits and remain vulnerable to the influence of any unobservable traits that are correlated with a household's self-selection into treatment or outcomes of interest. Along these lines, propensity score matching adjusts for systematic differences in observed characteristics. Given the substantial differences between unmatched groups of connected and unconnected households along relevant observable characteristics, the matching is critical for internal validity of the comparison between the two. However, exclusion of many unconnected households from the analysis as a result of that matching procedures means – as is always the case with propensity score matching – that we cannot claim the results are generalizable beyond that subset of comparable households in the treatment and comparison groups.

Lack of baseline. A significant limitation of this IE is the lack of baseline data for treatment and comparison households, necessitating a reconstruction of baseline through survey recall measures. This approach always carries risks of response and recall bias, which is especially a concern here given the time elapsed since the pre-intervention period. Nonetheless, SI examined the distributions of all recall variables, and while it is not possible to determine whether there is systematic over- or under-estimation on the part of

respondents, the distributions of recall responses are logical and were determined to be of sufficient quality for use in this evaluation, including in the selection models to calculate propensity scores.

Customer Survey Sample Size. It would have been prohibitively expensive and superfluous for the purposes of this evaluation to generate town-representative estimates for the customer survey, so Package sites 3-5 were grouped together as a single unit; this grouping was further supported by MCC as the UPUW projects aimed to achieve specific outcomes collectively. Nonetheless, each service center had its own unique set of project outputs funded by the activity and serves a community with unique geographic and demographic characteristics, and, moreover, the implementation success in each site and resulting challenges differed. We have highlighted site-specific results where salient differences emerged, but overall the sample sizes from each town in the customer survey are relatively small.[137]

Administrative data quality. WASCO generously provided data from its customer information database, and consumption and billing databases, which contributed to the evaluation in numerous ways including for sampling purposes as well analyzing broad trends in connections and consumption over time for household and industry-level beneficiaries. Nonetheless, we faced some limitations working with this data, including a lack of GPS points for households outside of Maseru and Mazenod, as well as some issues within the dataset requiring data cleaning before it could be used for analysis. The current WASCO customer database was inaugurated in 2007, just before the Compact opened. Some customers existing before 2007 are often missing critical fields, such as their town of residence and account type. While there are not many such customers still consuming water actively,[138] these missing fields render us unable to include them in our sampling frames or secondary data analysis. Further, we faced limitations in obtaining utility M&E data. While data was provided for a period of about ten fiscal years for production, consumption, revenues, and NRW, not all years contained all indicators, service centers were broken out differently in some years, and there were several illogical values that SI was not able to reconcile with WASCO, such as negative NRW values. We have presented WASCO data where relevant, while excluding any obvious illogical values or inconsistencies and acknowledging the limitations this may indicate regarding the data as a whole.

Similarly, LNDC generously furnished the employment data for all of its members that was used to inform their quarterly Industry Status Reports. However, this data is compiled manually and the data quality allegedly varies from year to year with the person responsible for the exercise. While recent years include useful disaggregations of firm type and employment type, early years provide overall figures that are, at times, illogical and in some years missing altogether. Furthermore, while employment trends among LNDC members are a useful proxy for industrial employment as a whole in Lesotho and certainly contain the largest and most influential industrial players, some industrial firms, especially small ones, may be missing from the data.

Attribution. Regarding our IE design and counterfactual construction, the first threat to validity and attribution is the complexity introduced by the funding of the MP and UPUW Activity and the inherent nature of urban water programming. As described previously, not all inputs that contributed to changes in water service for affected communities were funded by MCC as part of the Compact. One example

[137] Around 300 non-IE households per Package 1 town and 130 households for Package 3-5 town.
[138] Around 2,100 of these accounts were actively consuming water at the time the Compact opened, but only 625 still appear in the consumption data as of March 2018.

was the Metolong Dam, which was designed with Compact funding but constructed through supplemental external funding.

Secondly, service in WASCO service centers at the time of data collection is the result of UPUW Activity outputs *combined* with WASCO-funded remediation of defects and other externally funded support, such as training of key Metolong Dam staff funded by the World Bank. Aside from funding, urban water networks are complex systems with service deviating within and across systems due to external factors such as geography, elevation, weather, and distance from the distribution main. Our evaluation thus calculates ATT, recognizing that treatment varies within and across networks. Even then, impacts of increased access to water, such as those estimated for our Design A IE, can only truly be attributed to MCC when the intervention has caused new connections directly, which is the critical causal mechanism for these impacts to manifest. This causation is clear in Semonkong, where no network existed prior to the UPUW Activity, but less clear in other sites where the UPUW Activity at most furnished provisions for new connections and/or extended reticulation to previously unserved areas.

Keeping these complexities in mind, our evaluation is better understood as a validation of MCC's theory of change (i.e. "if water access and service are improved, these changes in outcomes of interest will occur") more so than a full attribution of program effects to MCC (i.e. "the MP and UPUW Activity as funded by MCC alone caused a change of this magnitude in outcomes of interest"). Of course, to the extent that treatment effects are observed, the MP and UPUW Activity and MCC's funding role in these interventions likely serve as necessary conditions for these treatment effects to manifest given the nature of the interventions carried out.

In addition, our methods are specifically constructed to detect impacts on two groups of beneficiaries for whom a counterfactual comparison group can be feasibly constructed: those caused by improved service for existing customers in Maseru and those caused by improved access for new customers in Morija, Roma, and Semonkong. The MP and UPUW Activity may have had effects on other groups, such as improved access for new customers in Maseru, improved service for existing customers in Design A sites, either of these groups in any of the other sites, or non-domestic consumers of water from any of these networks. Our PE attempts to describe how these beneficiary groups consume water and how this may have changed over time, but by definition cannot attribute any changes to the interventions. Thus, again, our evaluation is meant to validate MCC's theory of change and estimate any treatment effects for the specific groups included in the IE designs, but the results of the IE designs do not represent a total accounting of the impacts of the MP and UPUW intervention.

5.4 Economic Rate of Return and Compact Targets

Under this evaluation, we have estimated causal and potential program effects for the MP and UPUW Activity that are directly relevant to the benefit streams estimated in MCC's economic analysis for these programs. We also included lines of inquiry in our qualitative instruments meant to validate or challenge the assumptions underlying this economic analysis. Although these outputs are not sufficient to estimate an updated economic analysis, they contribute valuable insights and lessons learned regarding the credibility of estimated benefits and costs and the validity of underlying assumptions. We discuss the link between the evaluation findings and the ERR and Compact Targets for each of the MP and UPUW Activity below.

Insights from the evaluation suggest that the estimated ERR for the MP would in reality be lower because no milling facility was constructed in Lesotho, as anticipated, and the number of firms and employees participating in water-intensive textile processes has held constant instead of growing. Although the Metolong Dam has significantly increased the bulk water supply to Maseru as anticipated and the improved supply to Maseru has enabled preserved employment in the textile industry, the potential program effect on preserved employment is indirect at best, as these firms are not supplied by the Metolong Dam. While the Metolong Dam and associated works are a valuable asset to Lesotho that will ensure adequate water supply to Maseru and surrounding areas for many years to come, these works currently do not project to benefit the textile industry directly.

Insights from the evaluation suggest that the estimated ERR for the UPUW Activity would also be lower. The UPUW Activity, to the extent that it enabled access to piped water to households who would not have had access without it, certainly can claim a sizable reduction in time spent collecting water for such households. However, we do not find evidence of such a reduction among households who were already connected to the networks in Maseru. We also do not find evidence of a reduction in child diarrheal illness, although this finding could be sensitive to low statistical power, given the indications in water quality testing and questions regarding hygiene that suggest connected households may be less vulnerable to such illness than unconnected households. Finally, we do not find evidence of investment enabled by improved water supply. Further, the costs of operating and maintaining UPUW infrastructure are likely considerably higher than anticipated, since much of this infrastructure outside of pipelines and reservoirs has required remediation or replacement.

5.4.1 Metolong Program

The economic rationale for the MP included the assumption that: “the absence of secure water supply to industry prevents Lesotho from attracting foreign direct investment to set-up new industries, and particularly so-called “wet” industries, such as knitted-fabric mills, the presence of which would remove Lesotho’s dependence on the AGOA third country fabric provision for knit fabric exports to the United States. Some 28,000 employees could lose their jobs had the third country fabric provision expired in September 2007.” MCC estimated that the MP would result in an ERR of 24.1% over twenty years, taking into account the costs of constructing, operating, and maintaining the Metolong works; and benefits in the form of preserved and new employment in the textile industry, quantified through wage income.

The cost to MCC of the MP was lower than anticipated. WASCO’s accounting system does not allow for the separation of costs to operate the Metolong Dam and associated works alone relative to expectations, but the sizable reduction in capital costs relative to expectations suggest that, on balance, the MP likely had a lower economic cost than originally anticipated.

However, it is not clear that any economic benefits aligned with MCC’s original economic analysis can be attributed to MP to date, even if some could arise in the future. Although the MP supplies sufficient water in bulk to Maseru and surrounding areas for water-intensive textile and garment manufacturing firms to open, operate, and expand, there has been very little change in the size or number of “wet” textile firms since the commissioning of the Metolong Dam. A key assumption underlying the causal mechanism for this change was the construction of a knit garment milling facility following the expiration of AGOA, but AGOA has been extended until at least 2025 and no such milling facility, nor any other significant investment in “wet” manufacturing infrastructure, such as wastewater treatment facilities, has been made that would enable new or expanded firms. Although firm managers do express doubt that Maseru’s water

supply would have sufficed to enable their continued operation into the future, and that they don't consider water supply a constraint to future growth, it is unclear to what extent the Metolong Dam is responsible for this, given that these areas are supplied by the pre-existing Maseru Water Supply. While there is evidence that adequate water supply may be a constraint to the growth of the textile industry in Lesotho, this constraint appears to exist in Maputsoe rather than in Maseru.[139]

There are some potential economic benefits of the MP that are not hypothesized in the most recent ERR. First, extending the Metolong Supply to peri-urban areas enabled the closure of at least one WTP in Teyateyaneng, with corresponding cost savings for WASCO. While the ERR hypothesized entirely industrial economic benefits from the MP, the MP-supplied water in fact mostly targets domestic customers. Water from the Metolong Dam also has enabled increased consumption for rural consumers along the DCS at no cost, although some of them may spend more time collecting water now than they did from previous sources. Nonetheless, these benefits are unlikely to sufficiently offset the substantial, unrealized industrial benefits envisioned in the original ERR. Thus, the actual ERR for the MP is likely well below original expectations, though the MP has, in reality, likely contributed to the aversion of water shortages in Maseru and surrounds for decades to come.

5.4.1.1 Potential Lessons for Future Models

The assumptions underlying the MP ERR were misaligned with the way that responsible parties ultimately intended to use the water. According to WASCO Annual Reports, the now-defunct Tikoe Thetsane Industrial Water Supply Project was in process as early as 2008, near the beginning of the Compact. With a dedicated water supply to the two major industrial estates in Maseru, the GoL sent a clear signal that the MP water would be targeted for domestic use. The MP economic analysis should have been recalculated with likely domestic users in mind, or otherwise the MP supply should have been targeted somewhere where industrial firms might be able to use it directly. There are hypothetical ways in which the MP can still benefit industrial users even if it does not supply them directly—perhaps it relieved the burden on the pre-existing Maseru Water Supply with the knowledge that the Metolong Supply would come to meet domestic demand—but any such assumption should have been included in the ERR and validated in advance. Furthermore, even if the MP was directed to industrial customers in practice, our case studies reveal that water supply was not a singular, binding constraint to private investment in wet industries in Lesotho. Future cost-benefit analyses should enumerate what other major constraints are likely to be so that these can be monitored over the course of the Compact and considered in the analysis of whether or not anticipated benefits manifested. In this case, these constraints include a lack of complementary investment in wastewater facilities.

Additional consideration might also be given to estimating the economic value of avoiding an acute water supply shortage—WASCO's consumption and NRW data suggests that the pre-existing Maseru supply might have been sufficient to satisfy non-industrial demand with the assistance of the since-mothballed Tikoe Thetsane supply to the present day, and even potentially some years into the future. However, with an additional 40 Ml per day capacity relative to the pre-existing sources even if these sources were to cease operation, at whatever time these sources would have become insufficient to meet demand and for many years after, the Metolong Supply will suffice with no further intervention. The downstream transmission could even be further extended to serve other urban areas whose supply is not as secure.

[139] Gain 2018.

The Metolong Dam is certainly a valuable asset for Lesotho, even if its hypothesized economic benefits are unlikely to manifest and no clear benefits can be assigned seven years after Compact closure.

5.4.2 UPUW Activity

The economic analysis of the UPUW Activity was mostly oriented to the benefits of improved urban water service on domestic WASCO customers in the form of time saved in water collection, prevented diarrheal illness among children under five, and obviated costs of transport and care from this illness prevention. The analysis also assumed that improved service would motivate private investment in an incremental ratio to the infrastructure investment, and thus increased productivity of businesses. When comparing these benefit streams with the capital cost to MCC of the furnished infrastructure and the assumed cost of operating and maintaining this infrastructure, MCC's post-Compact ERR estimated that the UPUW Activity would result in an ERR of 15.5% over twenty years.

We do find significant decreases of a large magnitude on time spent collecting water for new connections in Roma, Morija, and Semonkong. Compared to recall estimations of time spent collecting water around an hour, newly connected households in these areas spend almost no time collecting water since connection. There may even be a spillover effect reducing time collecting water for unconnected households, who also spend significantly less time collecting water than before the intervention in Semonkong, especially, potentially due to the ability to collect water from their neighbors instead of alternative sources. These effects could plausibly have held in other UPUW sites where project implementation went according to plan and WASCO service centers are able to supply water to meet demand. The economic analysis assumed that households connected to WASCO before the UPUW Activity may have also spent time collecting water due to deteriorating service leading up to the improvements furnished by the activity. However, we find in most sites that this assumption does not hold—such customers do not experience time savings because they were not spending much time collecting water outside the home before the interventions, as it stood.

Given the low prevalence of diarrheal illness to begin with, our study is not significantly powered to detect a real effect regarding diarrheal illness, if one exists. In both Design A IEs, we find that treatment households report lower diarrheal illness prevalence than comparisons, but because of small sample sizes were not able to meaningfully estimate changes in medical costs or caregiving related to diarrheal illness. The economic analysis assumed that time saved from water collection or care for sick children would be allocated at least in part to productive activity. Where time was reportedly saved in water collection, we find little evidence of such time use. Thus, even though the water collection time savings benefit stream manifested, it is unlikely to have produced the economic benefits hypothesized.

Finally, the economic analysis assumed that private investment was 50% likely to manifest in response to infrastructure investment improving the water supply. Speaking with knowledgeable stakeholders regarding urban SMEs in Lesotho and observing trends in new commercial WASCO accounts, it does not appear likely that this investment occurred. This is not exactly a violation of the assumptions underlying the ERR, which acknowledged such investment was not certain, but it does call for a downward revision of economic benefits.

Regarding cost, there is a minor discrepancy between the post-Compact ERR and subsequent audit documents for the UPUW Activity, which report slightly higher capital investment from MCC. Nevertheless, the hypothesized cost of the UPUW Activity is likely to be considerably higher than

expected, given that WASCO was made responsible for remediations to unsatisfactory infrastructure in many of the sites at its own expense. Crucially, this fact also calls for a downward revision in hypothesized benefits—the benefits our evaluation has found apply in sites where the UPUW Activity was implemented according to plan. In other sites, such as Mohale's Hoek, Mafeteng, Leribe, and Mokhotlong, these benefits are reduced or eliminated by shortcomings with the funded infrastructure.

5.4.2.1 Potential Lessons for Future Models

Many of the key parameters and assumptions informing the UPUW ERR were drawn directly or adapted from a rural water programming context. Although the narrative of the ERR acknowledged some of the ways that the urban water context might affect economic benefits, future economic analyses would benefit from more targeted measurements of pre-existing conditions and feasible program effects on outcomes of interest to calculate benefit streams. MCC's recent Water Sector Cost-Benefit Guidance[140] acknowledges that time savings and health outcomes are more likely to manifest in the context of extended infrastructure (i.e. new connections) than upgraded infrastructure (i.e. improved service), but economic analyses should further take into consideration that benefits may also vary depending on whether new connections are to an entirely new network, as in Semonkong, or to an existing network.

There may be additional consideration due in these dynamic urban contexts where unconnected customers may be receiving considerable spillover benefits via water collection from connected households. Likewise, the difference in implementation contexts may dictate important differences in expected spillover (where some may already occur pre-intervention) - for example, new customers in Roma and Morija, where networks were simply extended, spent 22 minutes per day on water collection prior to the UPUW Activity, while those in Semonkong with no such network spent over an hour per day.

Other realities of urban water service that call for differentiating the parameters used in economic analyses include multiple concurrent source use, household storage practices, and sanitation and environmental conditions within the household. The context in each country and in sites within countries will be different, and it would improve the quality of future economic analyses to plan more intentionally to measure baseline parameters for and monitor benefit streams before and during the Compact, instead of relying as heavily on post-hoc evaluation efforts. Technologies such as remote sensing may aid in such efforts, as might additional technical assistance or support to utilities for improved M&E efforts during the Compact, with the added benefit of bolstering utilities' internal M&E efforts in the long-term.[141]

As impacts aligned with time savings and reduced diarrheal illness are more likely to manifest for newly connected households, future economic analyses and M&E frameworks should make efforts to track new connections attributable to the projects, if feasible, differentiating these from any that may have happened even absent the intervention. Furthermore, given the statistical rarity of water-borne illness causing death or requiring medical treatment in urban contexts and the added complication of recruiting sufficient number of children under five within households sampled for a survey also focusing on other outcomes, future models might consider benefit streams on the reduced prevalence of diarrheal illness rather than mortality. Given low rates of hospitalization for water-borne illness in urban contexts, prevalence may be easier to measure in the short-term, even if it only serves as a proxy for mortality in the longer-term.

[140] Osborne 2019.
[141] There were no existing estimates at WASCO either overall or on a site by site basis for the value of reliability (average daily service hours), nor were there plans to monitor this quantity during the contract either by MCC or WASCO.

Table 28. ERR Benefit Streams & Costs, Metolong Program

	ERR	Key ERR Inputs	Actual
Benefit Stream	Value added (wage income) of manufacturing jobs preserved and added through the construction of the Metolong Dam and conveyance structures.	76k m^2 new factory space at Tikoe by 2037 → 19k new factory jobs 2019: 58,462 m^2, → 14,615 new factory jobs	▼ Likely lower than anticipated.
Costs	Costs of construction, operation/water provision, and maintenance	$86.8 million capital cost to MCC (actual $69.3 million), $530,000-$970,000/year operation/maintenance cost to WASCO (actual unknown)	▼ Likely lower than anticipated, though not enough to offset significantly lower benefits

Table 28 (cont). ERR Assumptions, Metolong Program

	ERR	Actual
Key Assumption	Termination of AGOA will necessitate a local milling facility, to preserve existing employment in the knitted fabric sector.	☒ AGOA was extended through 2025, removing the strict need for a local milling facility. In addition, external investors are not attracted to the significant costs of investing in wastewater treatment.
Key Assumption	Development of local milling facility and expansion of the textile industry at Tikoe cannot occur without water supply afforded by the scheme.	? Valid in that a new and better water supply was necessary for any potential local milling facility. However, the Tikoe Thetsane Industrial Water Supply Project may have provided this improved supply on its own, absent Metolong. ☒ However, water supply is only one of other major constraints. A local milling facility would also require an enabling economic environment encouraging foreign direct investment.
Key Assumption	Investment in expanding production in the textile and garment industries occurs in response to the incremental supply of water.	? Valid to the extent that water is required for employee consumption. However, expansion in Tikoe and the existing Thetsane complexes have largely been limited to firms not engaged in wet processes. Additionally, the Tikoe Thetsane Industrial Water Supply Project may have provided this improved supply on its own, absent Metolong.

Notes: ERR estimated plausible range for factory space of 66,000 - 86,000 square meters. Plausible range for actual costs as a percentage of estimated costs was 80 - 120%. Plausible range for added benefits as a percentage of estimated benefits was 80 - 120%.

Table 29. Compact Close ERR Benefit Streams & Costs, UPUW Activity

	ERR	Key ERR Inputs	Actual
Benefit Stream	(i) time saved in water collection	50% reduction, against baseline estimate of 112.5 minutes per day, leading to increased productive activity for employed people.	▲ Likely higher for new connections. At most, time spent reduced from over an hour a day to near zero. There may be spillover effects on unconnected households through neighbors. ▼ Likely lower for existing connections. These spent little time collecting water before the interventions.
Benefit Stream	(ii) time saved in obtaining medical treatment for and (iii) reduced mortality for children under 5 due to water-related illnesses water-related illnesses	(ii) 50% reduction, against country-wide baseline estimate of 9,107 days, leading to increased productive activity for employed people; and (iii) 30% reduction, against 7% baseline.	▼ Likely lower than anticipated. Diarrheal illness less prevalent in connected households. Result insignificant though IE model under-powered for this outcome.
Benefit Stream	(iv) increases in investment due greater water availability	50% likelihood of private sector investment equal to 33% of infrastructure investment when water supply is improved	▼ Likely lower than anticipated. Supply not improved in some sites. Limited qualitative and secondary evidence of investment
Costs	Cost of infrastructure investment, institutional strengthening, "other" Compact costs, and O&M	$33.4 million cost to MCC (actual $34.6 million), $250k-$430k/year O&M cost to WASCO (actual unknown)	▲ Likely higher than anticipated, due to significant cost of remediation of defects by WASCO.

Table 29 (cont). ERR Assumptions, UPUW Activity

	ERR	Actual
Key Assumption	For existing customers, time would be spent on water collection as service deteriorated over time leading up to UPUW	☒Just prior to commissioning, pre-existing customers recall spending very little time on water collection. This benefit mostly accrues to new customers.
Key Assumption	Time saved in water collection and illness care would be used for productive activity	☒To the extent time was saved (mostly for new connections in water collection), there is limited evidence that this time was used for additional productive activity.
Key Assumption	Private sector would respond to improved water supply from infrastructure investment with private investment	☒Infrastructure investment did not always improve water supply. Although commercial WASCO accounts have increased over time, with the exception of construction accounts, trend in WASCO commercial accounts relatively unchanged over the course of past decade.

Notes: ERR estimated plausible range for reduction in time savings of 45% - 55%, and reduction in diarrheal illness of 25 - 35%.

5.5 Lessons Learned

- EQ 8: What lessons can MCC or the Government of Lesotho apply to future programs related to program design, implementation, and sustaining results?

The urban water programming of the MCC Lesotho Compact had a wide range of results both in project implementation and final outcomes. As the Compact was completed seven years ago, MCC informants report that some of the lessons that can be derived from this Compact have already informed programs funded since—for example, by including programming targeting institutional reforms and other non-engineering elements in project design to complement or precede infrastructure in investment.

From the process evaluation, differences in the implementation fidelity and current functionality of MP-funded and UPUW Activity-funded infrastructure drive home important lessons regarding project preparation, project management, and contracting for large-scale infrastructure programs. Given MCC's fixed five-year Compact timeframe and preference for fixed fee contracts, it is important with widespread infrastructure projects to use the due diligence and project preparation phase to ensure that project details are fixed, prioritized, and aligned with a clear and well-evidenced logic and end-goal. The MP, with robust due diligence documentation and a clear goal of designing, constructing, and conveying a bulk water supply that would meet demand in Maseru and surrounding areas until at least 2020, was able to follow the blueprint established in the due diligence phase effectively over the Compact period. The UPUW Activity, where these details were less fixed and shifted in a broken-down negotiation between funders, implementers, and final beneficiaries, struggled to ensure adequate project delivery.

If details including project scope and design can be fixed at the project preparation phase stage, MCC's preference for fixed fee contracts may be workable. However, if a DBE or DCSE Engineer must design and scope work iteratively over the course of the Compact, as was the case in the UPUW Activity, selecting a fixed fee contract over a more typical cost-reimbursable model may open the project up to risk. This is especially true if the contract does not ensure an adequate liability period following commissioning of the work. As a best practice, contracts should include at least two years following the defects remediation period for design and supervision engineer liability. The MA could enforce this because it retained its statutory authority beyond the Compact period, but in the case of the UPUW Activity, the DCSE effectively walked away before defects were adequately remedied, leaving no responsible party for this remediation.

Finally, the difference in performance between the MPMU and the various iterations of the UPUW PIU underscore the necessity of adequate project management by a qualified entity in ensuring project success. Where a Project Manager is to be employed, other than the owner of the works or the DCSE, this should be made clear in the DCSE contract and spelled out the hierarchy of instruction. The ultimate operator of water infrastructure should have a larger role in informing design and approving works. Ideally, it would be tasked with overall project management, although human capacity constraints may prevent this in some circumstances, depending on the capabilities of the operator and complexity of works.

From the summative evaluation, our findings provide further support to the literature informing MCC's most recent guidance for cost-benefit analysis of water sector programming,[142] especially regarding the types of program benefits that can be expected by upgrading central infrastructure versus expanding

[142] Osborne 2019.

access. Indeed, judging by the benchmarks set in the World Bank's recent summary of Performance of Water Utilities In Africa,[143] WASCO's provision of over 76.6 lpcd of water to households across most of its service centers places it among the top quartile of African water utilities, thanks in large part to the improved supply enabled by the MP and UPUW Activity. Nevertheless, the MCC Lesotho urban water sector programming targeted benefit streams for which this improved supply only resolved one of many necessary conditions. With improvements sought to industrial employment as the most salient example, MCC likely would have needed to make complementary investment in the enabling environment for foreign direct investment for new and expanded entrants in wet industry to appear.

6 NEXT STEPS

Following MCC and local stakeholder review of the draft report, SI presented the findings to MCC at their headquarters in Washington, DC. Feedback from MCC's Evaluation Management Committee was collected during this presentation. Following that presentation, the team traveled with a representative from MCC to Maseru to present findings to local stakeholders including the Lesotho Millennium Development Agency (LMDA), WASCO, and the Ministry of Development Planning. The final report includes revisions made in response to feedback from MCC and local stakeholders (see Annex C). The final report together with the evaluation brief and de-identified public dataset will be publicly available by mid-2020.

7 STATEMENT OF INDEPENDENCE

All members of the evaluation team and key personnel of subcontract staff responsible for the primary data collection, analysis, and reporting that informs this report are entirely independent of the MP and UPUW Activity, meaning that they were not involved in the planning, implementation, or internal M&E of these projects. No member of the evaluation team or key personnel of subcontract staff have any direct or indirect professional or financial interest in any of the stakeholders whose involvement in the MP and UPUW Activity is commented upon in this report, such as MCC, LMDA, implementing contractors, WASCO, etc. Although two individuals that participated in data collection efforts had previous employment with MCA-L or WASCO, neither individual was involved in direct data collection, analysis, or reporting. This report has been produced with independence and with the sole objective of providing unbiased, relevant, and well-evidenced responses to its guiding EQs.

[143] Van den Berg and Danilenko 2017.

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ANNEX A: IMPLEMENTATION FIDELITY SCORECARDS

The scorecards below were produced for the implementation fidelity assessment (see section 5.2.1).

Table 30. Metolong Program Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: WTW, HLPs	**2**	**4**	**2**	**2**	**10**	
Overall: Dam & LLPs	**2**	**4**	**2**	**2**	**10**	
WTW & HLPs						
Chemical storage	2	4	2	2	10.00	
Lime storage & transfer	1	3	2	2	8.20	Lime handling and dosing problems.
Chemical dosing	2	4	2	2	10.00	
Incoming Aerator	2	4	2	2	10.00	
Floc Channels and Settlers	2	4	2	2	10.00	
Filters	2	4	2	2	10.00	
Chlorination	2	4	2	2	10.00	
Clear water storage	2	4	2	2	10.00	
High Lift Pumps & Motors	2	4	2	2	10.00	Pump motors have now all been replaced.
HLPs Electrical	2	4	2	2	10.00	
Telemetry / SCADA	2	3	2	2	9.50	Operational but level sensor at Command Reservoir not working.
Command Reservoir	2	4	2	2	10.00	
Dam & LLPs						
Metolong Dam	2	4	2	2	10.00	
LLPs Pumps and Motors	2	4	2	2	10.00	
LLPs Electrical Supply	2	4	2	2	10.00	

Note: Dam itself and high lift pumps (HLPs) were not MCC funded. LLPs are Lower Lift Pump Stations.

Table 31. Package 1 – Maseru & Surrounds, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Package 1	**1**	**3**	**2**	**2**	**8.2**	
Primary Installations						
Terminal Reservoirs High South Complex	2	4	1	2	8.70	Incoming pipe leaks & reservoir leaks dealt with.
Reticulation Maseru	2	2	1	2	7.70	Especially Maseru: Problems with overpressure due to failing altitude valve, some residual asbestos-cement pipes, non-connection of new and old reticulation systems.
Reticulation Mazenod	2	3	1	2	8.20	
Extension Roma	2	2	1	2	7.70	
Extension Morija	2	3	1	2	8.20	

Table 32. Package 2 – Semonkong, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Package 2	**2**	**3**	**1**	**2**	**8.2**	
Primary Installations						
Raw water intake weir and offtake pipe to sump	2	4	2	1	8.7	
Raw water sump and pump installation	2	4	2	1	8.7	
Raw water pumps and Motor Control Centre	2	4	2	1	8.7	
Raw water rising main 200mm 780m	2	4	2	2	10	
WTW Electrical Input & distribution	2	4	2	2	10	
WTW Telemetry	1	2	1	1	5	
WTW flocculation and sedimentation tanks	2	3	2	1	8.2	
WTW Filtration and backwash	1	2	2	1	6.3	
Pumps1 & MCC – WTW to Reservoir 1	2	4	2	2	10	
Pumps 2 & MCC- WTW to Reservoir 2	2	4	2	2	10	
Pumps 3 & MCC – Res 1 to HT3 -	2	4	2	2	10	
Pumps 4 & MCC – Res 2 to HT4 -	2	4	2	2	10	
Dependent Installations						
Raw water reservoir	2	4	2	2	10	
WTW chemical dosing	2	3	2	2	9.5	
WTW Chlorination	2	4	2	2	10.0	
WTW Sludge disposal	2	4	2	2	10.0	
WTW Clear water reservoir	2	4	2	2	10.0	
Rising main 1 WTW to Res1 - 200mm	2	4	2	2	10.0	
Rising main 2 WTW to Res 2 - 110m	2	4	2	2	10.0	
Reservoir 1	2	3	2	1	8.2	
Reservoir 2	2	4	2	2	10.0	
Rising main 3 Res1 to HT3 - 63mm	2	4	2	2	10.0	
Rising main 4 Res 2 to HT4 - 63mm	2	4	2	2	10.0	
Header Tank 3	2	4	2	2	10.0	
Header Tank 4	2	4	2	2	10	
Office building	2	4	2	2	10	
Staff houses	2	4	2	2	10	
Diesel Genset	2	4	2	2	10	
Diesel fuel storage	0	0	2	2	5.3	
Reticulation and house connections	2	2	2	2	9	
Safety Equipment	2	3	2	2	9.5	

Table 33. Package 3 – Mohale's Hoek, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Mohale's Hoek	**0**	**0**	**1**	**1**	**2.7**	
Primary Installations						
300mm dia. perforated intake pipe	0	0	1	2	4	Design is inappropriate and does not consider the usual riverbed load characteristics
Construction of new intake structure	0	1	1	1	3.2	Design is inappropriate rot allowing silt to settle and be removed by pump. A two-chamber structure is essential. Sump has been flooded and filled with silt and detritus.
2No submersible raw water pumps	2	3	1	1	6.8	Pumps are suitable for installation in a suitable sump
2 No submersible de-sludging pumps	0	0	1	1	2.7	Pumps installed are inappropriate for this duty. No agitation provided,
Raw water rising main	0	0	1	1	2.7	Raw water delivery main has been occluded by deposited silt and will have to be replaced.
Clariflocculator 385m³	1	2	1	1	5	Needs frequent desludging which requires shut down of whole plant for three days
High Lift Pump station at WTW: install new 3No. WKLn 50/3 pumps	1	2	1	1	5	One single WKn 50/4 would be a good selection. The WKLn 50/5 is oversized. The WKLn50/3 is inappropriate.
Dependent Installations						
Intake pumps MCC	2	4	1	1	7.3	
High lift pumps MCC	2	4	1	1	7.3	
Rehab laboratory equipment and supply new	2	4	1	1	7.3	
Rehab settling tanks	2	4	1	1	7.3	
Upgrade dosing systems	2	4	1	1	7.3	
Upgrade chlorine dosing systems	2	4	1	1	7.3	
Rehab air compressor room	2	4	1	1	7.3	
Rehab rising main 8204m 160mm	2	4	1	1	7.3	
Reticulation and plot connections	2	4	1	1	7.3	
Safety Equipment	2	4	1	1	7.3	

Table 34. Package 3 – Quthing, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Quthing	**1**	**2**	**1**	**1**	**5**	
Primary Installations						
River Intake	0	0	0	0	0	
Raw water (low-lift) pumps	2	4	2	1	8.7	
Replace high lift pumps at WTW	2	4	2	1	8.7	
Motor control centers for High Lift and Raw Water Pumps	2	4	2	1	8.7	
Dependent Installations						
New clear water reservoir at WTW	2	4	2	1	8.7	
Upgrade supply main 160mm dia.	2	4	2	1	8.7	
Chlorination Equipment replaced	1	3	2	1	6.8	
Safety Equipment	1	3	2	1	6.8	

Table 35. Package 3 – Qacha's Nek, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Qacha's Nek	**2**	**3**	**1**	**1**	**6.8**	
Primary Installations						
High Lift Pumps WKLn 65/4 60cu.m/h @180m	2	4	1	1	7.3	
Motor control center for High Lift Pumps	2	4	1	1	7.3	
Dependent Installations						
Upgrade chemical dosing	1	0	1	1	4	Equipment installed under the MCC Compact has not functioned properly and has been replaced by WASCO (not under the Compact)
Upgrade chlorination system	2	3	1	1	6.8	Initial problems rectified
Rehabilitate WTW 26.4 cu.m/h including filters	2	4	1	1	7.3	
New reservoir	2	4	1	1	7.3	
New supply main 90mm dia, 1970m	2	4	1	1	7.3	
Break pressure tanks (2)	2	4	1	1	7.3	
Gravity distribution mains	2	4	1	1	7.3	
Reticulation and plot connections	2	4	1	1	7.3	

Table 36. Package 3 – Mafeteng, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Mafeteng	**0**	**1**	**1**	**1**	**3.2**	
Primary Installations						
Rasabela Clariflocculator	0	1	1	1	3.2	Is not suitable for high turbidity / high sediment loads - not possible to evacuate sludge without shutting down, draining to about 60% full via provided outlets, and then pumping out with sludge pump and cleaning manually.
Booster Pump installation to Reservoir 1 at Likhoele with stand-by generator	0	1	1	1	3.2	1 duty + 1 standby pump installed but not delivering as required. Suction line needs to be de-aired before starting manually and pump trips after a short period. Generator not checked for amp capacity for pump start-up
WASCO office PS - replace 2 pump sets	1	2	1	1	5	Pumps sets operate well but cannot be started with generator supply
WASCO Office stand-by generator	0	1	1	1	3.2	Generator amp capacity is not sufficient for pump start-up
Dependent Installations						
Chemical flocculant / pH dosing	2	4	1	1	7.3	
Rasabela WTW repair settlers	2	4	1	1	7.3	
Rasabela renovate rapid sand filters	1	2	1	1	5	
Filters - 2 new slow sand filters	1	2	1	1	5	
Backwash Air blowers	1	2	1	1	5	
Chlorine dosing and storage	2	4	1	1	7.3	
Clear water reservoir rehabilitation	2	4	2	1	8.7	
MCC for Booster Pump installation to Reservoir 1	2	4	1	1	7.3	
WASCO office MCC	2	4	1	1	7.3	
Likhoele new 650m³ circular tank	2	4	2	1	8.7	
Rasebala (?) new 1 200m³ circular tank	2	4	2	1	8.7	
Thabaneng new 650m³ circular tank	2	4	2	1	8.7	
Thabang 810cu.m inc 160kl elevated (No 3)	2	4	2	1	8.7	
Thabaneng new 160m³ rectangular tank	2	4	2	1	8.7	
Rasebala new 1200m³ rectangular pressed steel tank	2	4	2	1	8.7	
WASCO Office rehabilitate 1400m³ rectangular pressed steel tank	2	4	2	1	8.7	
Gravity line from Reservoir 2 to Reservoir 3	2	4	2	1	8.7	
Gravity Main 1 from Reservoir 2 to Reservoir 1 booster station	1	3	2	1	6.8	
Rising Main 2 from the WASCO office reservoir to Reservoir 2.	2	4	2	1	8.7	

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
UPVC pipeline extensions and rising mains	2	4	2	1	8.7	
Safety Equipment	2	3	2	1	8.2	

Table 37. Package 4 – Butha-Buthe, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Butha-Buthe	**2**	**3**	**1**	**1**	**6.8**	
Primary Installations						
Delivery Pump Set 1 comprising 2 high lift pumps	0	1	0	1	1.8	Apparently are delivering much higher flow into the old line through a cross connection and overload the motors/overload trips. Performance on new 90mm line may be over design flow and also trip pumps.
Electrical installation Motor Control Centre (MCC) for high lift pumps	1	2	1	1	5	Motor pump control centers may be acceptable, but the pump and pipeline situation must be assessed and understood before the MCC can be tested and accepted (to SI's awareness, still yet to be done).
Dependent Installations						
New 90mm dia rising main to Makopo reservoir	1	2	2	1	6.3	Pipeline may have air entrapment problems which can only be assessed/diagnosed after extended operation of the pumps.

Table 38. Package 4 – Leribe, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Leribe	**1**	**1**	**1**	**1**	**4.5**	
Primary Installations						
New river intake	0	1	1	1	3.2	Intake is vulnerable to low flow, sand mining. Intake screens cannot be accessed except under low flow conditions. Trash racks are not self-cleaning and cannot be easily cleaned
New river intake pump installation and raw water rising main	2	3	1	1	6.8	Single pump only - no stand-by provided. No desludging facilities. Submersible pump can be replaced if duplicate is on hand. Local isolation provided. Rising main function is good.
Intake from Sand Infiltration	0	0	1	1	2.7	Actual design / drawings not seen. Perforated pipe collectors clogged and backwash system not effective / functional
Sand Infiltration blower installation	0	2	1	1	3.7	SI considered collector grid not suitable for backwash (especially if constructed as per Mokhotlong intake drawing) - blower not assessed.
Dependent Installations						
Delivery Pump Set 2 - 3 high lift pumps to Tsifa-li-Mali reservoir	2	2	1	1	6.3	One pump set motor burnt out and repaired. Non-return valve(s) not working properly so isolating valves have to be closed/opened manually and

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
						automatic run function is barred. Flow meter not functioning.
Electrical installation MCC1 - abstraction pumps	2	4	1	1	7.3	
Electrical installation MCC2 - high lift pumps	1	2	1	1	5.0	Function is not automatic and problems experienced with level switches. Motor 2 burn out may be attributable to inadequate protection.
Rising Main to Tsif-li-Mali 250mm diameter uPVC with break pressure tank	2	4	1	2	8.7	
Gravity Main 2 Tsifa-li mali to Tlai 200mm diameter	2	4	1	2	8.7	
Gravity Main 3 Tlai to Amerika / Sebothoane 160mm diameter.	2	4	1	2	8.7	
Tsifa-li-mali 2400m3 steel tanks	2	4	1	1	7.3	
Refurbish main reservoir	2	4	1	2	8.7	
Break pressure tank	2	4	1	2	8.7	
Safety Equipment	2	2	1	0	5	Chlorination room in poor state, security of chlorine gas very poor, open manholes, long grass, difficult access

Table 39. Package 4 – Mokhotlong, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Mokhotlong	**1**	**1**	**1**	**1**	**4.5**	
Primary Installations						
River intake	0	0	1	1	2.7	River intake has clogged to virtually no inflow after the first flood of any magnitude after construction.
Spring Intake	0	1	1	1	3.2	Spring intake has clogged to virtually no inflow after the first flood of any magnitude after construction. Surface flow diverted into opened up collector pipe as interim provision.
Dependent Installations						
WTW Pumps KSB WKLn 50/9 at 35cu.m/h @ 80m head	2	4	1	1	7.3	
Motor Control Centre for WTW pumps	2	4	1	1	7.3	
Standby Generator set	0	1	1	1	3.2	If generator amp rating is too low, a larger replacement unit has to be installed and / or a new motor "soft start"
New rising main WTW to new reservoir 160mm 1435m	2	4	2	1	8.7	
New reservoir	2	3	2	1	8.2	Site of reservoir is clean and reservoir shows no leaks. Access is difficult but is seldom required. No remote signal on full / empty
Break pressure tank	2	4	2	1	8.7	

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Refurbish WTW chlorine dosing equipment	2	2	1	1	6.3	

Table 40. Package 5 – Mapoteng, Implementation Fidelity Scorecard

	Design [0, 2]	Installation [0, 4]	O&M [0, 2]	Funding [0, 2]	Aggregate [0, 10]	Notes
Overall: Mapoteng	**2**	**4**	**1**	**1**	**7.3**	
Primary Installations						
Spring intake	1	3	1	1	5.5	Intake needs better self-cleaning screening
Gravity main	2	4	1	1	7.3	
Community offtakes	2	4	1	1	7.3	
Reservoir, a BPT & storage for future expansion	2	4	1	1	7.3	

ANNEX B: METHODS & ADDITIONAL DATA

PROJECT IMPLEMENTATION CONTEXT

Table 41. Specific UPUW Components, by package and site

Package	Locations	Components
1	Maseru, Mazenod, Roma, Morija, Teyateyaneng	Pipeline Rehabilitation and Extension, Reservoir Rehabilitation
2	Semonkong	New Water Supply System
3	Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek	Reservoir Rehabilitation, Treatment Plant Rehabilitation, Network Extension, New Reservoirs
4	Mokhotlong, Butha-Buthe, Leribe	Pipeline Rehabilitation and Extension
5	Mapoteng	Pipeline Extension

Table 42. UPUW Activity (Packages 2-5), Site Populations

Urban center	Population (2006)	Population (2016)
Butha-Buthe	14,268	35,108
Leribe	*24,300*	38,558
Mafeteng	32,148	39,754
Mohale's Hoek	28,310	40,040
Mokhotlong	8,808	12,940
Qacha's Nek	8,167	15,917
Quthing	13,776	27,314
Semonkong	7,781 *	7,856
Mapoteng (district popn.)	23,926	Not available

*Was not considered an urban area in 2006. Popn 2006 from: http://www.bos.gov.ls/Census_Pre_Results_2006.htm

PROCESS EVALUATION

Table 43. Key Informants for Process Evaluation

Stakeholder / Entity	Key Informants
WASCO	29
Metolong Authority	4
(Formerly) MCA-L	4
MPMU	1
(Formerly) Jeffares and Green	1
MWH Global	1
MCC	1
(Formerly) PDNA	1

Table 44. Scoring Criteria for Implementation Fidelity Assessment

Dimension	Scoring Criteria
Design (i)	2 = Designs suit the function requirements/specifications & local context; function requirements cover right quantity at right quality over right period of time at optimum cost. 1 = Areas of poor design but the function requirements can be met with minor modifications or changes in operating procedures. 0 = One or more parts of the design prevent the function requirements from being fully realized. (e.g., a plant that provided 60% of the required delivery would be scored "0" if the problem is with the design, rather than the operation)
Installation (ii)	4 = As envisaged. 3 = Can be remedied with minimal time and cost. 2 = Can be remedied with moderate time and cost. 1 = Remedy involves major time and cost. 0 = Installation has failed altogether.
Management, Operations & Maintenance (iii)	2 = Operations procedures and maintenance requirements are to standard (e.g. manuals available, log sheets printed and filed, operators trained to deal with situations out of the ordinary), O&M scheduled, schedule is posted in clear view, plant is clean and tidy. 1 = Either O or M not to standard. 0 = Both O&M are not to standard.
Funding (iv)	2 = Evidence of funding adequacy – sufficient staff, tools, building maintenance and sufficient storage for chemicals, spares etc. and equipment is in good condition. 1 = Evidence of funding constraints – short staffed (operator overloaded but managing, most important tasks being completed), buildings not maintained and storage etc. inadequate. Equipment not in good condition. 0 = Evidence of severe funding constraints – very short staffed (operator overloaded and workload unmanageable, some important tasks not being completed), equipment broken, buildings in disrepair.
Aggregate	Aggregate score = $1.\overline{3}$ (i) + 0.5 (ii) + $1.\overline{3}$ (iii) + $1.\overline{3}$ (iv) = Range 0-10

METHODS: SITE SELECTION FOR DESIGN A

To successfully find matches for the IE, we would need to have a reasonable degree of confidence in having a sufficient number of comparison 'candidates' in the study area. During the design stage, SI estimated the likely availability comparison 'candidates' in each of these areas using administrative data from the WASCO customer database (EDAMS) together with Lesotho census data, and geospatial data of WASCO networks in these sites. Within the 150m buffer around the network in each site SI identified which census EAs intersected with this buffer then extracted the number of households in each of these EAs and projected 2019 populations using Lesotho's 1.31% annual population growth rate from the latest census. Using EDAMS data from March 2018, the latest version available to us, we also projected the number of current connections in each site by using the average monthly rate of new connections post-Compact, and applying this through April 2019, when we expect data collection to begin. Columns F, G, and H vary the assumption of what percentage of the total households in the intersecting EAs resides within the network boundary. Later during the evaluation, the buffer was expanded to 300 meters before sampling due to our learning that WASCO does connect households outside of 150 meters for a fee.

Table 45. Estimated coverage within network boundary

Location	A	B	C	D	E	F	G	H	I	J	K
	# elig. EAs	HHs (2016)	HHs (2019)	Cxn. (3/18)	Cxn. (4/19)	%HH in buffer: 40%	%HH in buffer: 60%	%HH in buffer: 75%	if E	if F	if G
Morija	16	1,324	1,377	460	530	551	826	1,033	96%	64%	51%
Roma	76	6,281	6,531	1,323	1,474	2,612	3,919	4,898	56%	38%	30%
Mazenod	37	3,354	3,488	1,797	2,054	790	1,184	2,616	147%	98%	79%
Teyateyaneng	99	8,300	8,630	3,951	4,466	3,452	5,178	6,473	129%	86%	69%
Semonkong	20	1,898	1,974	419	536	1,395	2,093	1,481	68%	45%	36%

A=Number of EAs that intersect with 150m network buffer
B=Number of households within the eligible EAs
C=Applied 1.31% annual growth rate to estimate current population in 2019 (Multiplies B * 0.0131^3)
D=Number of Active, Domestic customers in each service center
E=Number of active, domestic customers projected through 4/2019 (Inflates D by monthly rate of new conn. post-Compact)
F, G, H = Varying estimated percentage of household (HH) within network buffer zone in eligible EAs (Multiplies assumed % by C)
I, J, K = Estimated coverage within the network's buffer, based on varying parameters in E, F, G (Divides F, G, H by E)

METHODS: ORIGINAL SAMPLE SIZE CALCULATIONS & ACTUAL SAMPLE SIZES

The sample size calculations from our Summative Evaluation Design Report are presented below. Full details on the assumptions underlying these calculations are available in that report. However, on the basis of these calculations, we originally estimated a required sample size of 2,520 households for Design A in Package 1 towns, 500 households for Design A in Semonkong, 740 households for Design B in Maseru, and 1,400 households for the customer survey across all UPUW towns.

Table 46. Sample size calculation inputs

Design & outcome[a]	μ1	Est. target	μ2	σ_p	m.e.	Req. sample size	+25% for matching	T	C
Design A: estimated impacts based on ERR									
Time Savings	47	-50%	24	67	-	270	338	169	169
Diarrheal Illness	.129	-30%	.09		-	2012	2516	1258	1258
Design B: estimated impacts scaled by half									
Time Savings	23	-25%	17	26	-	592	740	370	370
Diarrheal Illness	.106	-15%	.09	-	-	10840	13550	6775	6775
Customer Survey[b]									
Time collecting water	24	-	-	26	5	352	-	-	-
Diarrheal Illness	.09	-	-	-	.015	1398	-	-	-

[a] Mean and Standard Deviation (SD) values for time savings are from IEMS 2012 dataset. Mean collection time for non-piped households 47 with SD 71, and for piped 23 with SD 26 and pooled SD of 67. Pooled SD is used for Design B calculation. Diarrheal illness values are from Lesotho Demographic and Health Survey dataset: 10.6% for households with improved source, 12.9% for households with unimproved source.

[b] Equation for estimating a population proportion: N = (p*q)/(me/z)^2, where q=1-p, z=1.96 corresponding with desired 95% significance level, and me=desired margin of error. Equation for estimating population mean: N= (z*s^2)/me^2, where z=1.96 for desired 95% confidence level, s^2 is equal to the population standard deviation (estimated using IEMS midline data), and me=margin of error.

Table 47. Minimum detectable effect sizes (MDES) for Designs A and B

Design & outcome[a]	n	μ1	MDES (δ)	μ2	μ1	MDES (δ)	μ2
Design A-new connections					**Semonkong only**		
Time savings	2012	47	(-)8.37	38.6	47	(-)16.82	30.18
Diarrheal illness	2012	.129	-0.039	.09	.129	(-).0953	.0337
Water consumption	2012	55	(-)6.87	62	55	13.81	69
Water expenditures	2012	30	(-)3.75	26	0	7.53	7.53
Design B-existing connections							
Time savings	592	23	(-)6	17	-	-	-
Diarrheal illness	592	.106	(-)0.0813	0.0247	-	-	-
Water consumption	592	97	22.37	119	-	-	-
Water expenditures	592	82	(-)18.91	63	-	-	-

[a] Time savings from IEMS 2012 dataset; water consumption and expenditures from NORC baseline report. Consumption for all households with a tap 97 lpcd; water bill 82 Maloti per month. Rural & peri-urban are combined in the NORC report, given as 14.3 lpcd consumption, inclusive of all drinking water sources; expenditures reported categorically but average is approximately 30. SDs for consumption and expenditures set equal to mean

Over the course of household listing and data collection, we were required to make the following changes to our sample. For Design A, upon discovering fewer households than we expected that met eligibility criteria, we relaxed the eligibility criteria as follows:

1.) We included households who did not know when they moved to their areas as eligible for the study, given that enumerators mostly reported households did not know because they moved in so long ago that they could not remember.

2.) We counted households who moved to their current location from another location in the same town as eligible, as long as they have lived somewhere in the same town since before the UPUW works were installed.

Even after eligibility criteria were expanded, we found fewer households than desired in Morija and Roma. We thus increased the sample size in Semonkong to include all eligible households rather than limiting to 500. Given the shortage of households available for Design A in Roma, Morija, and Semonkong, we expanded the customer survey sample to include population-representative estimates for two groups:

3.) Package 1 towns, who benefitted from both the MP and UPUW Activity (Maseru, Roma, Morija, Teyateyaneng, and Mazenod).

4.) Package 3-5 towns, who benefitted from the UPUW Activity alone (Qacha's Nek, Quthing, Mohale's Hoek, Mafeteng, Mokhotlong, Leribe, Butha-Buthe, and Mapoteng)

Given the shortage of households available for the customer survey in Morija relative to expectations, additional households were sampled from Teyateyaneng and Mazenod to meet the required sample size for the Package 1 customer survey group. Following the changes above, there were additional losses from our sample in Design A and Design B groups due to refusals and pruning from propensity score matching. Table 48 lists the final number of surveys conducted in each site by design group.

Table 48. Final Sample Size for Household and Customer Surveys, by Design and Town

	Customer Survey		Design A		Design B		
	New	Existing	Treatment	Comparison	Treatment	Comparison	Total
Maseru	146	---	---	---	390	375	**911**
Mazenod	197	119	---	---	---	---	**316**
Morija	---	121	162	163	---	---	**446**
Roma	---	148	555	416	---	---	**1119**
Teyateyaneng	185	117	---	---	---	---	**302**
Package 1 Total	*528*	*505*	*717*	*579*	*390*	*375*	***3094***
Semonkong	---	---	318	299	---	---	**617**
Package 2 Total	---	---	*318*	*299*	---	---	***617***
Buthe-Buthe	81	49	---	---	---	---	**130**
Leribe	89	39	---	---	---	---	**128**
Mokhotlong	92	33	---	---	---	---	**125**
Package 3 Total	*262*	*121*	---	---	---	---	***383***
Mafeteng	69	61	---	---	---	---	**130**
Mohale's Hoek	79	49	---	---	---	---	**128**
Qacha's Nek	85	47	---	---	---	---	**132**
Quthing	76	53	---	---	---	---	**129**
Package 4 Total	*309*	*210*	---	---	---	---	***519***
Mapoteng	86	43	---	---	---	---	**129**
Package 5 Total	*86*	*43*	---	---	---	---	***129***
Grand Total	**1185**	**879**	**1035**	**878**	**390**	**375**	**4742**

METHODS: QUALITATIVE SAMPLING & DATA COLLECTION

Table 49. Qualitative Sampling Summary

Group	Sampling Approach	Sample Frame	Sample Size
UPUW Household FGDs	Purposive	WASCO customer database (connected), Village Chief list (unconnected)	48 FGDs (24 treatment, 24 comparison), 6-8 respondents per FGD, all female
UPUW Village Chief KIIs	Purposive: senior-most chief(s) available for village	N/A	32 chiefs
Industry Case Studies	Purposive: largest firms in each area, diverse goods made	LNDC employment database	5 firms
SME KIIs	Purposive: most relevant government and non-government organizations	N/A	4 organizations
Rural DCS Household FGDs	Random	Village Chief list	4 FGDs (2 male, 2 female), 6-8 respondents per FGD
Rural DCS Village Chief KIIs	Purposive: senior-most chief available for village	N/A	2 chiefs

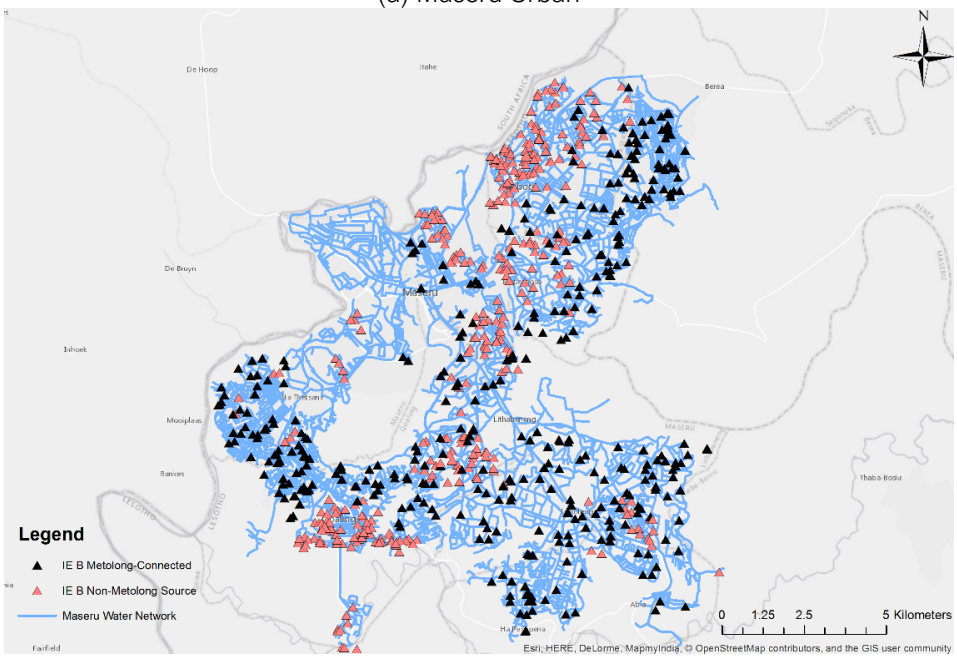
Table 50. Topics addressed in household FGDs

Participant type	Connected households (Design A Treatment; Design B, all)	Unconnected households (Design A Comparison)
Selection into treatment; Experience of interventions; Potential spillover effects	- Reasons for requesting a connection - Previous water source situation - Perceived changes in water service - Notable 'shocks' (e.g. major interruptions) - Expectation of benefits versus reality - Perceived water quality; changes over time - Water consumption; seasonality - Alternative source use (current and past); reliability, quality, convenience, and price - Perceived benefits over time	- Demand for connection, WtP - Current water source use; seasonality - Factors influencing source choice; reliability, quality, convenience, and price - Seasonality of water use practices - Barriers to connection - Indirect benefits/spillovers - Perceived changes over time in any of the above
Other WASH practices	- Household water storage - Household water treatment - Sanitation & hygiene in household - Seasonality of these practices - Cost of coping behaviors - Perceived changes over time	- Household water storage - Household water treatment - Sanitation & hygiene in household - Seasonality of these practices - Cost of coping behaviors - Perceived changes over time
Bias & confounding factors	- Internal migration over the last decade - Housing market and rental prices - Awareness of MCC interventions - Other interventions / WASH programs	- Internal migration over the last decade - Housing market and rental prices - Awareness of MCC interventions - Other interventions / WASH programs
Outcomes	- Time & cost savings, diarrheal illness - Re-allocation of time or money - Distribution of benefits - Unanticipated effects	- Time & cost savings, diarrheal illness - Re-allocation of time or money - Distribution of benefits - Unanticipated effects

METHODS: MAPS OF HOUSEHOLDS SURVEYED

Figure 32. Map of surveyed households for IE

(a) Maseru Urban



(b) Semonkong

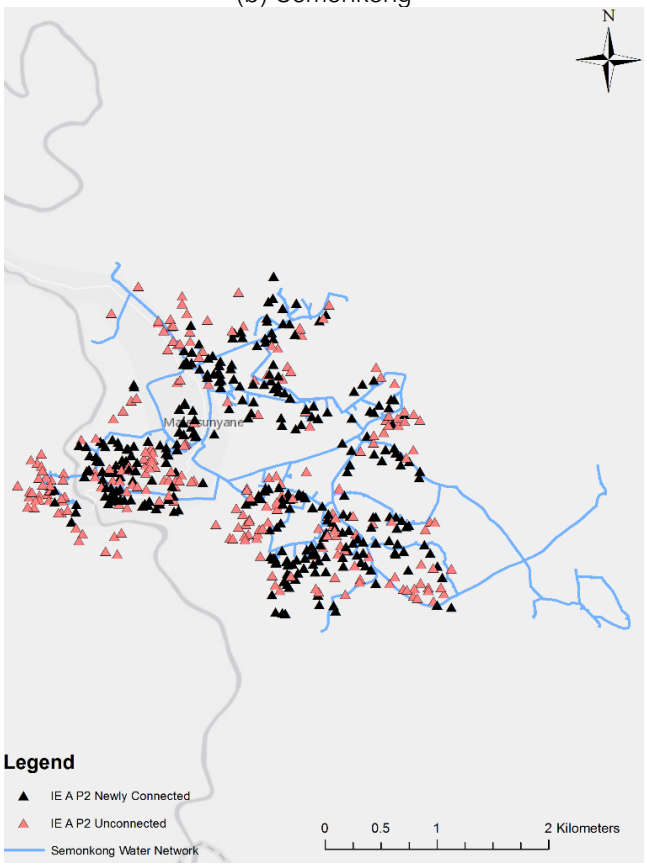
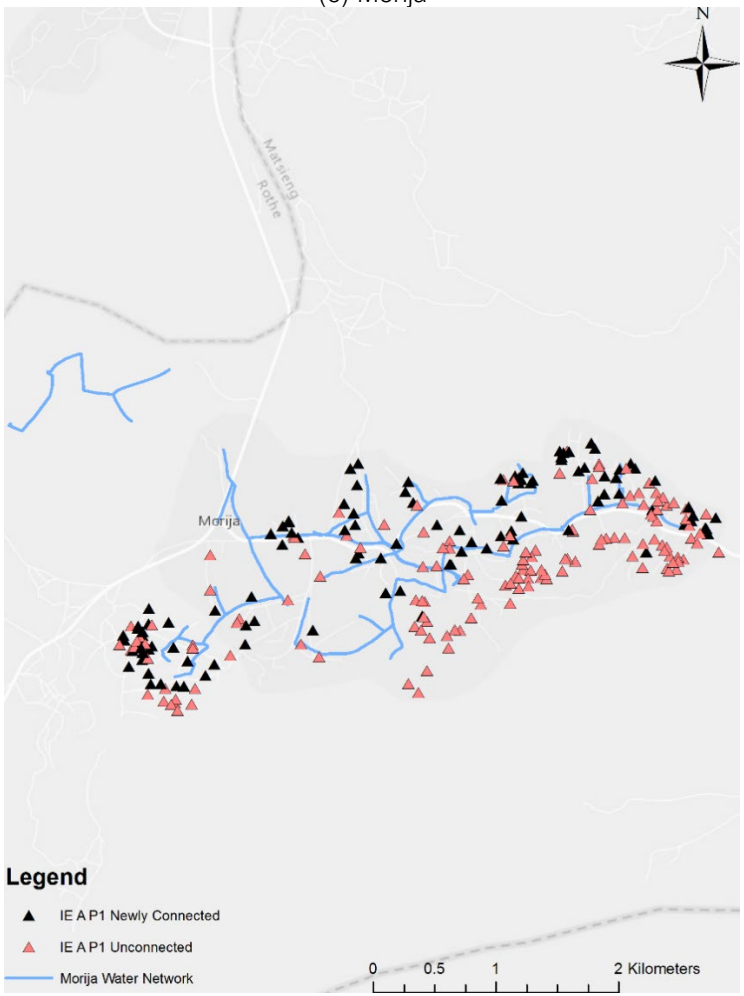


Figure 32. Map of surveyed households for IE (continued)

(c) Morija



(d) Roma

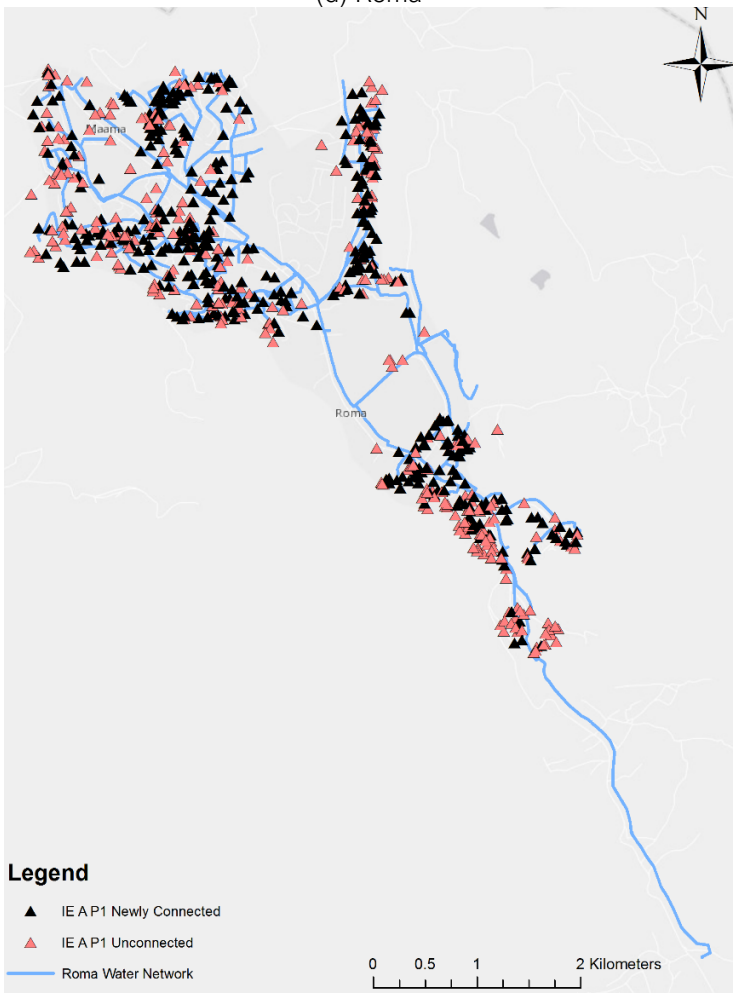


Figure 33. Map of surveyed households for Customer Survey

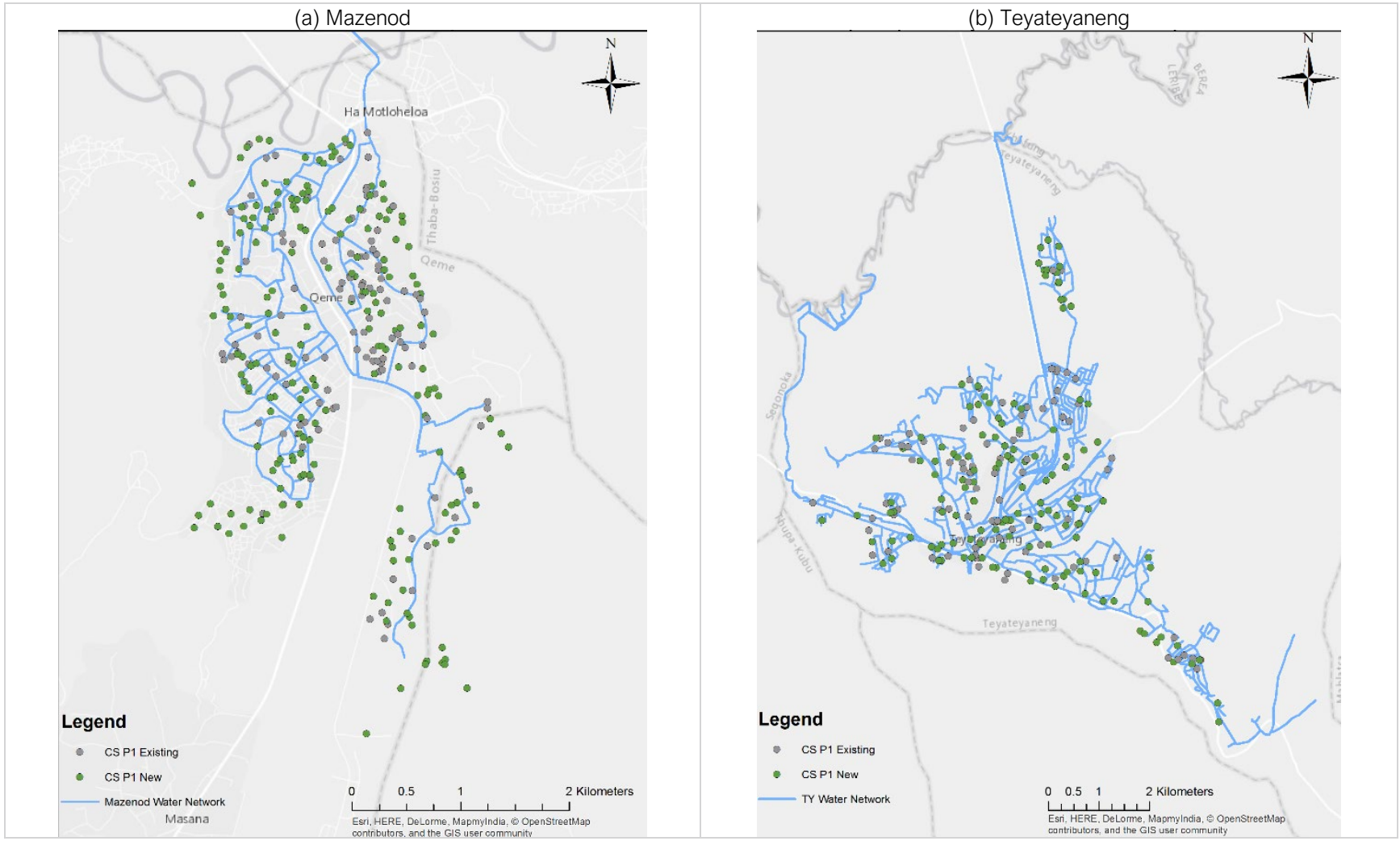
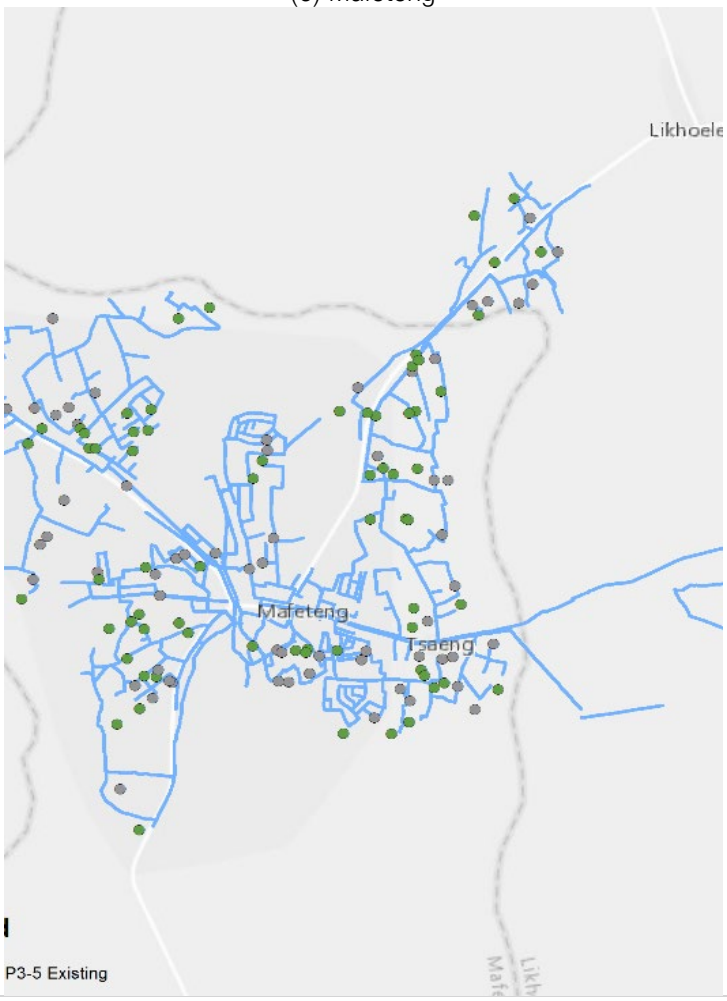


Figure 33. Map of surveyed households for Customer Survey (continued)

(c) Mafeteng



(d) Mohale's Hoek

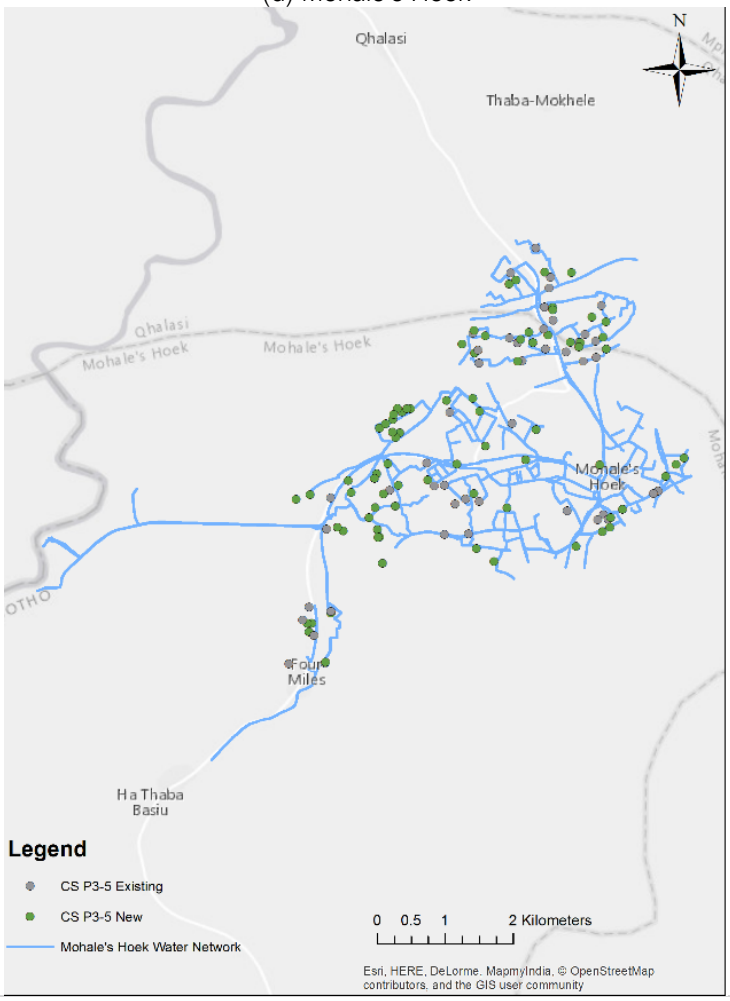
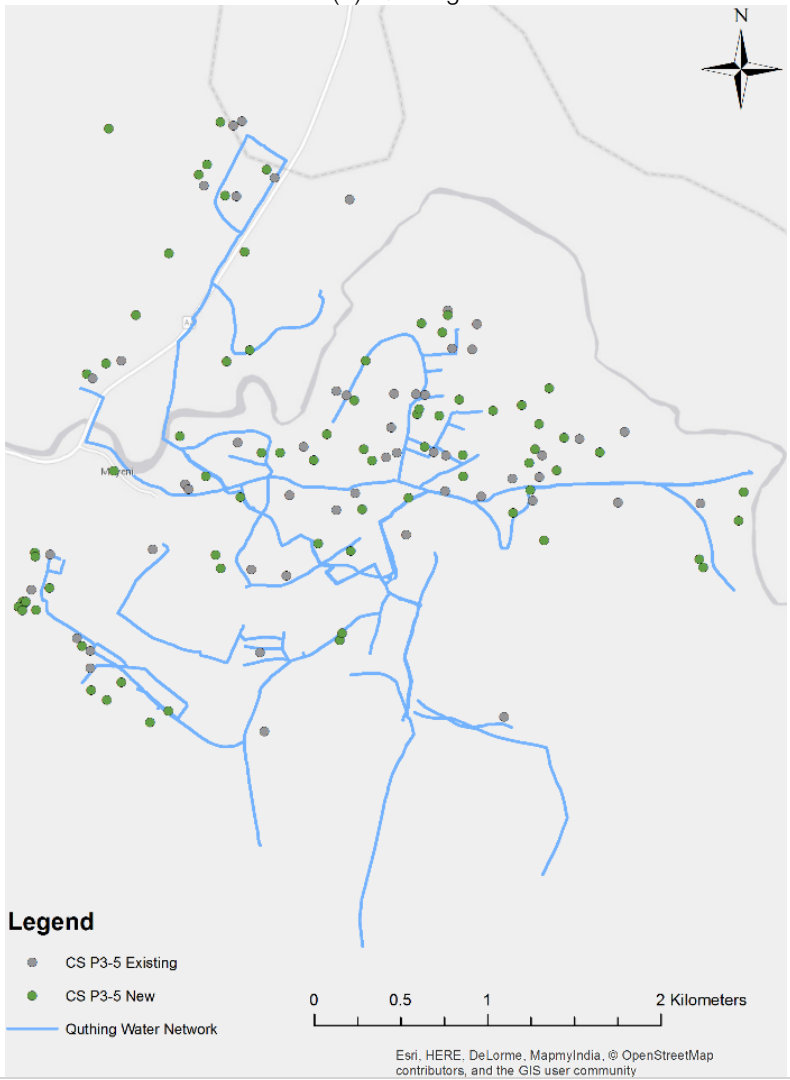


Figure 33. Map of surveyed households for Customer Survey (continued)

(e) Quthing



(f) Qacha's Nek

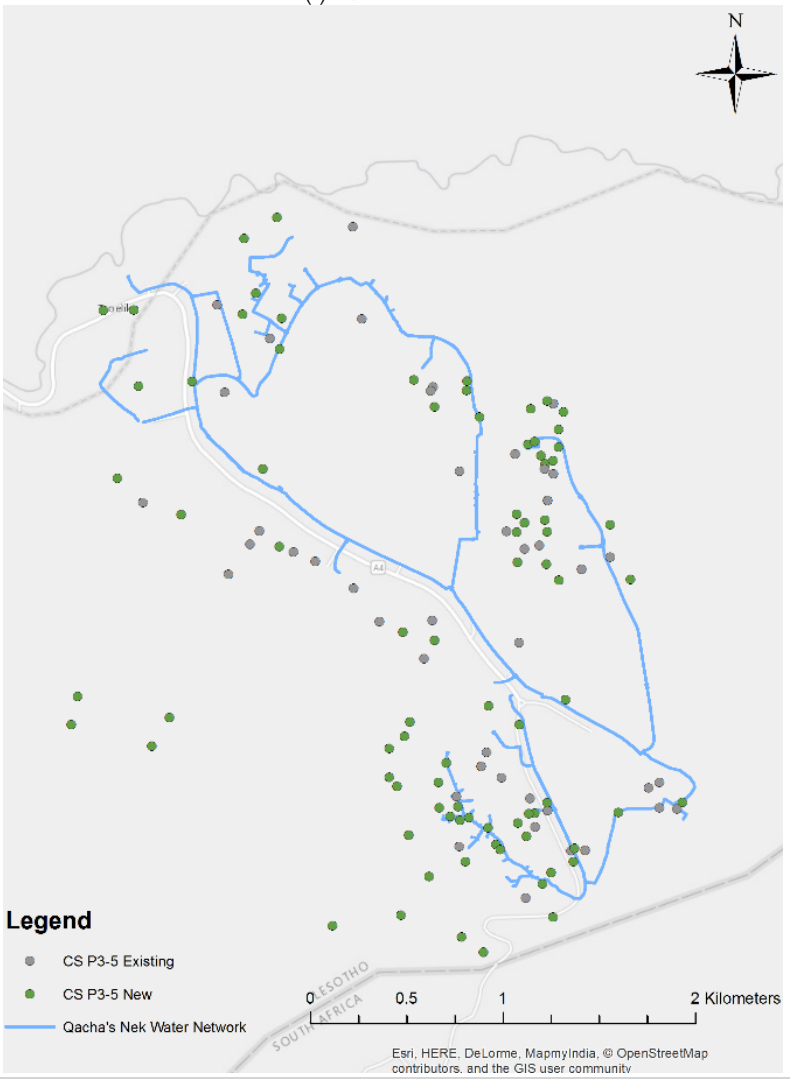
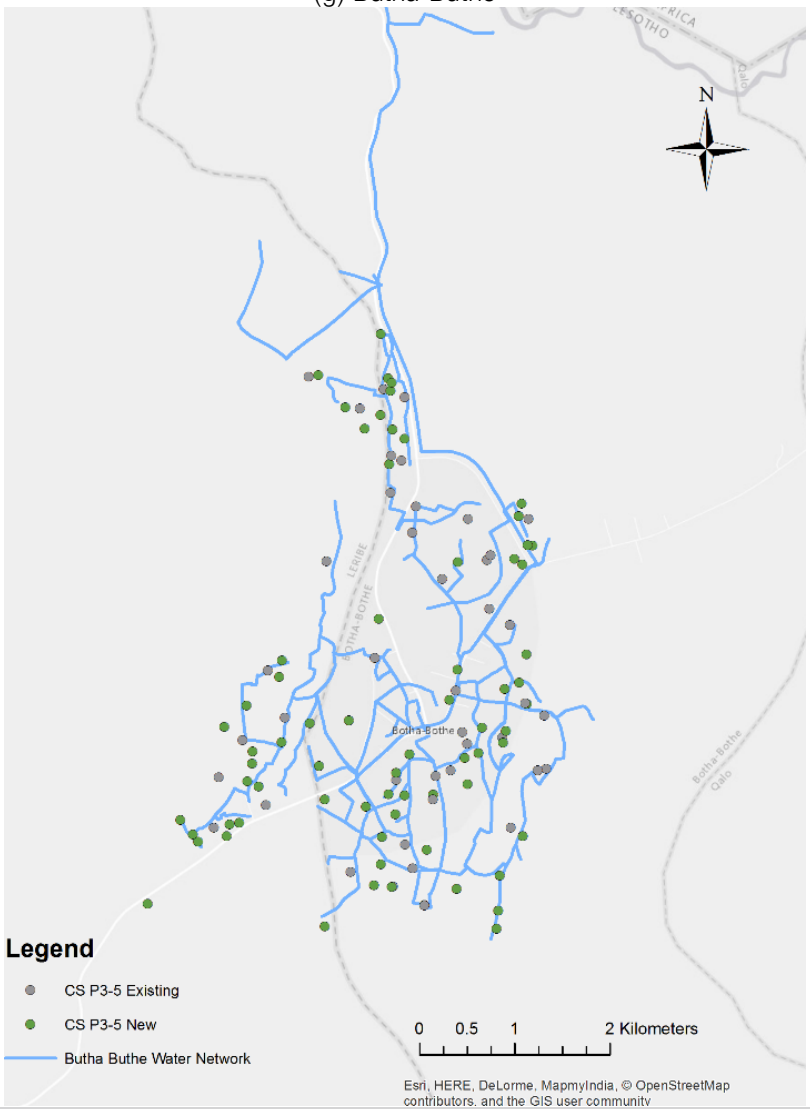


Figure 33. Map of surveyed households for Customer Survey (continued)

(g) Butha-Buthe



(h) Leribe

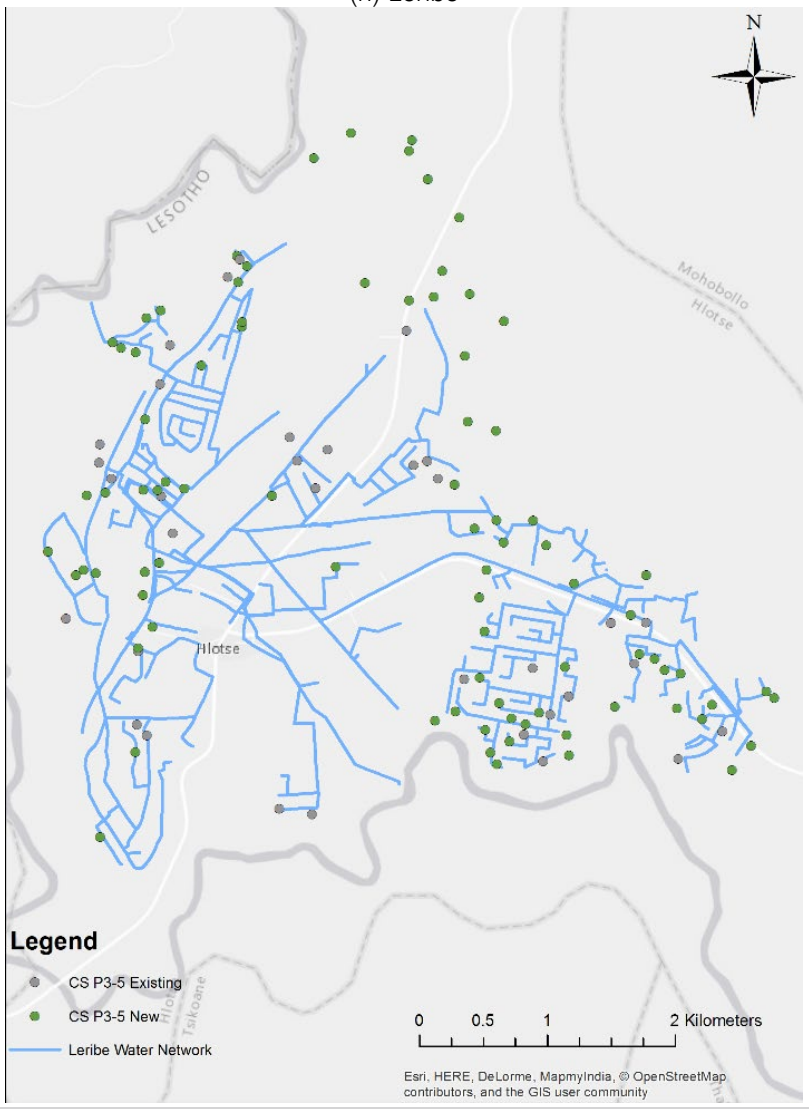
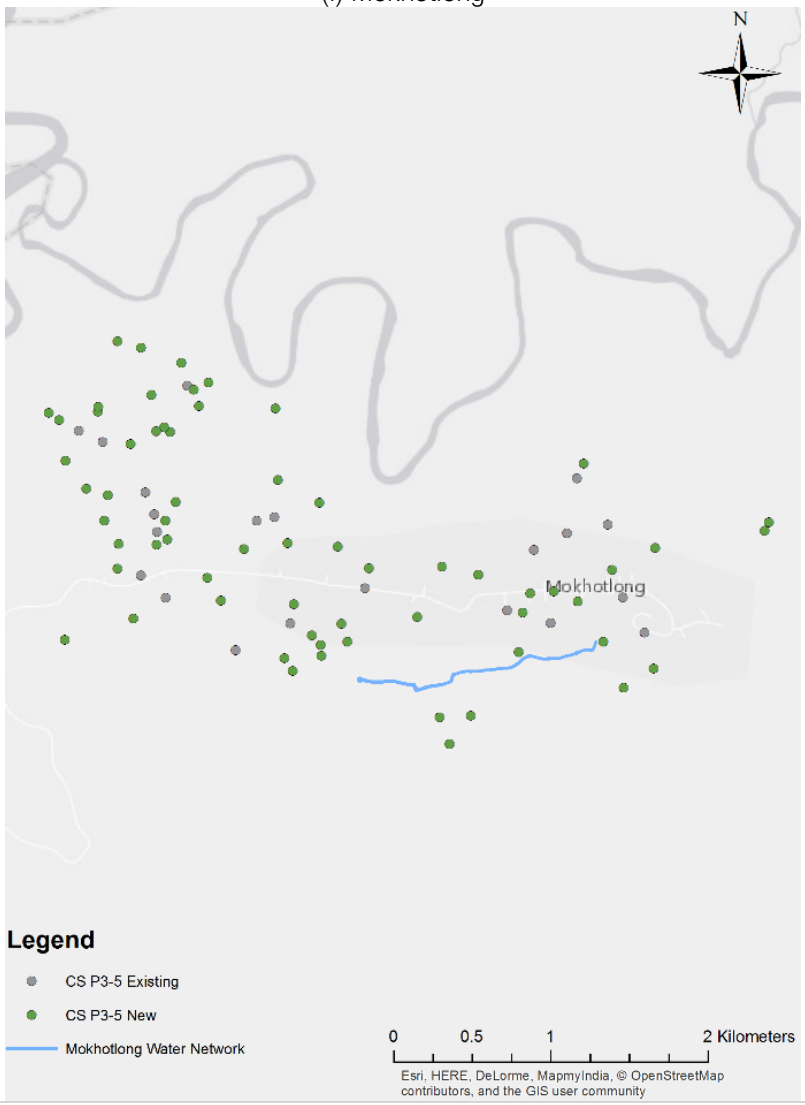
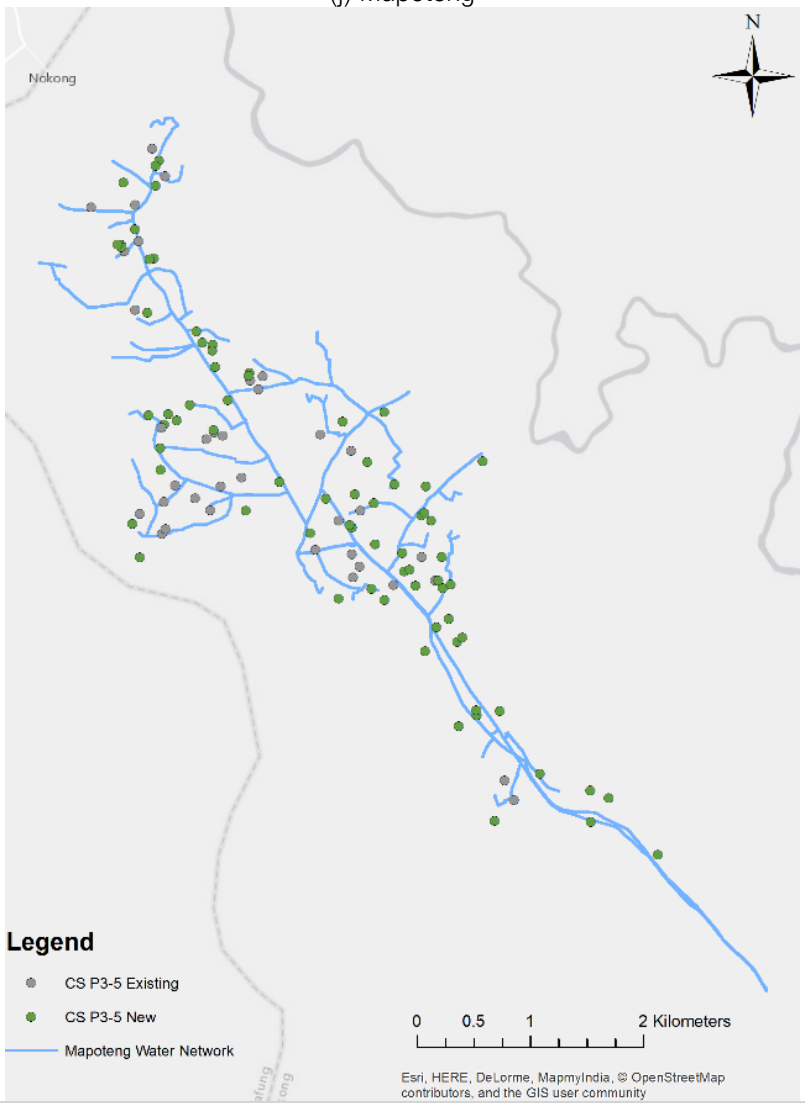


Figure 33. Map of surveyed households for Customer Survey (continued)

(i) Mokhotlong

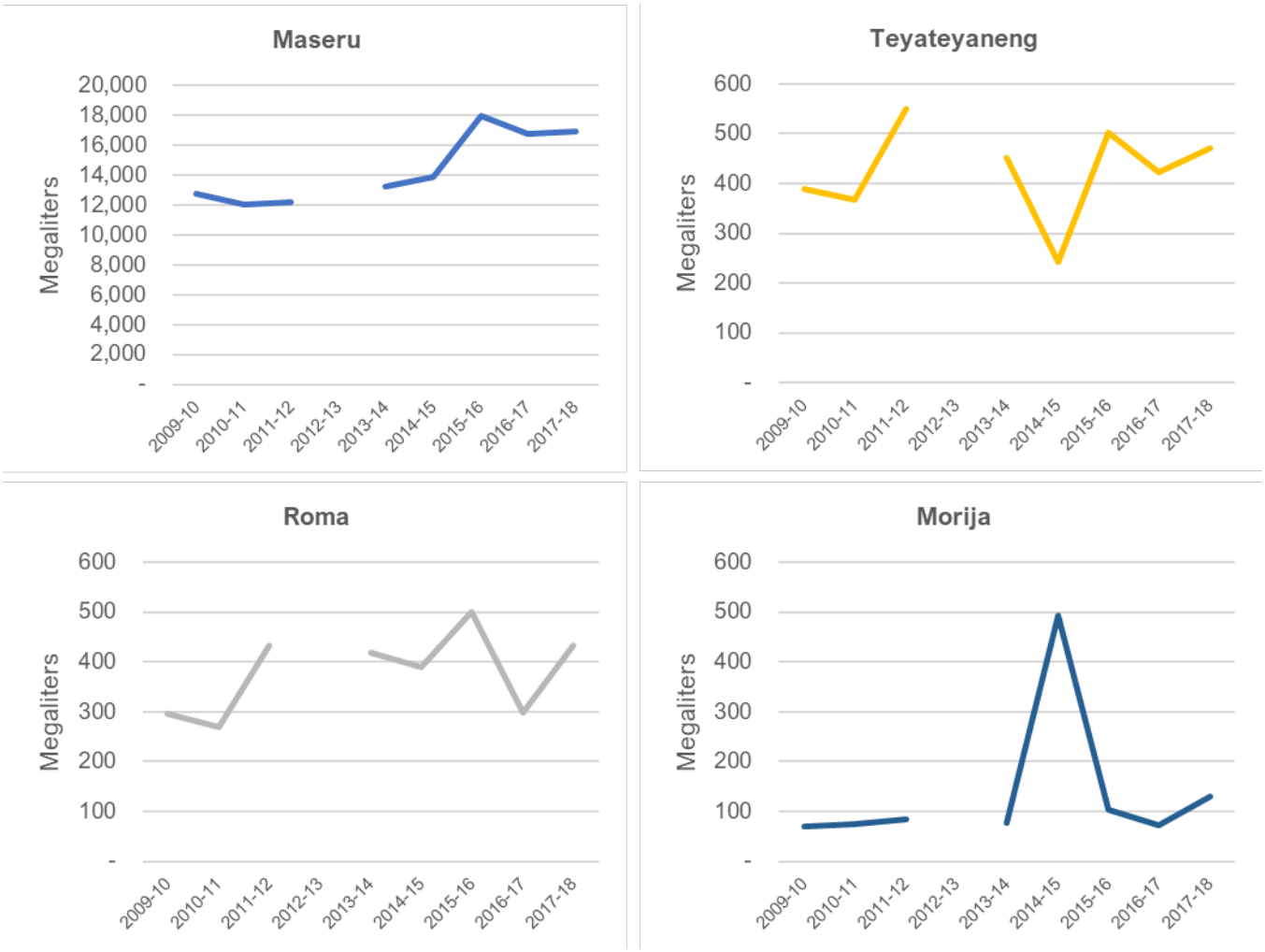


(j) Mapoteng



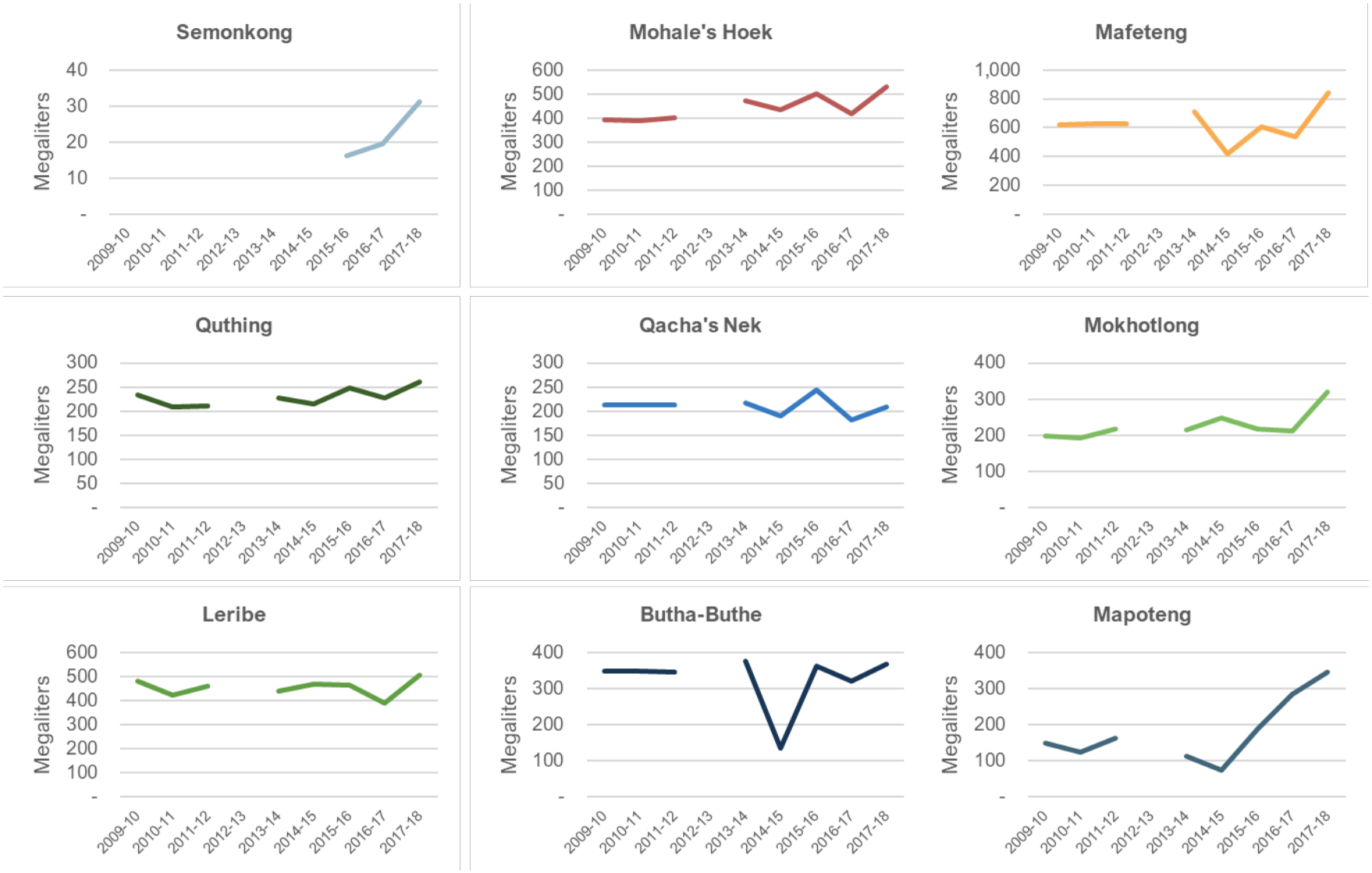
SHORT-TERM OUTCOMES: VOLUME PRODUCTION FROM WASCO M&E DATA

Figure 34. Volume production (ML) yearly totals 2009-2018, Package 1



Source: WASCO Monitoring and Evaluation data; data for 2012-13 was not provided. Data for Mazenod was not provided by WASCO; it is likely included within the Maseru total.

Figure 35. Volume production (ML) yearly totals 2009-2018, Packages 2-5



Source: WASCO Monitoring and Evaluation data; data for 2012-13 was not provided.

INTERMEDIATE OUTCOMES: PROPENSITY SCORE MATCHING TABLES & RESULTS

Table 51. Propensity Score Matching Selection Models, Logit – Odds Ratios

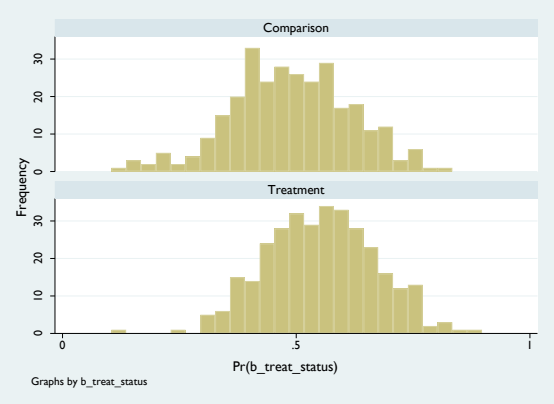
	Design B: Supply	Design A: Access	Design A: Access
Variables	Maseru Urban	Semonkong	Roma & Morija
Roma (indicator)	n/a	n/a	1.396
	n/a	n/a	(0.186)
Recall of main drinking water source: Tap on Premises	1.658	n/a	n/a
	(0.527)	n/a	n/a
Recall of main drinking water source: Other Improved Source	(ref.)	0.391**	1.364
	(ref.)	(0.035)	(0.301)
Recall of main drinking water source: Unimproved Source	omitted	(ref.)	(ref.)
	omitted	(ref.)	(ref.)
Recall: Average daily supply hours	1.009	n/a	n/a
	(0.662)	n/a	n/a
Distance (m) from WASCO network	1.000	0.989***	0.991***
	(0.802)	0.000	0.000
Density EA pre-UPUW WASCO connections (# connections per population)	not included	n/a	5.053
	not included	n/a	(0.111)
Recall liters of water collected per household per day, winter	0.998	1.000	0.992
	(0.802)	(0.981)	(0.534)
Recall minutes spent collecting water/day, winter	0.976	0.931	1.008
	(0.567)	(0.412)	(0.369)
Recall liters of water collected per household per day, summer	omitted	0.999	1.008
	omitted	(0.944)	(0.504)
Recall minutes spent collecting water/day, summer	omitted	1.081	0.995
	omitted	(0.373)	(0.589)
Recall Sanitation - Improved/Private	0.420	2.311**	3.523***
	(0.383)	(0.019)	(0.002)
Recall Sanitation - Improved/Shared	0.472	4.896***	2.100
	(0.460)	0.000	(0.142)
Recall Sanitation - Unimproved	omitted	omitted	1.302
	omitted	omitted	(0.555)
Recall Sanitation - No facility	(ref.)	(ref.)	(ref.)
	(ref.)	(ref.)	(ref.)
1st quintile (SES)	(ref.)	(ref.)	(ref.)
	(ref.)	(ref.)	(ref.)
2nd quintile (SES)	2.374	0.993	1.594*
	(0.111)	(0.984)	(0.078)
3rd quintile (SES)	2.227	4.341**	3.398***
	(0.134)	(0.011)	0.000
4th quintile (SES)	2.589*	2.965	5.653***
	(0.085)	(0.126)	0.000
5th quintile (SES)	2.196	omitted	5.231***
	(0.174)	omitted	0.000
Household size	1.262***	1.031	1.047
	0.000	(0.714)	(0.430)
Household Head Sex	0.859	0.777	1.529

	Design B: Supply	Design A: Access	Design A: Access
Variables	Maseru Urban	Semonkong	Roma & Morija
	(0.627)	(0.616)	(0.199)
Household Head Married or cohabitating	0.900	1.603	1.612*
	(0.656)	(0.251)	(0.082)
Household head Age	0.937	0.977	1.029
	(0.129)	(0.638)	(0.424)
Household head age, squared	1.000	1.000	1.000
	(0.243)	(0.594)	(0.543)
Dependency Ratio	0.999	1.003	1.001
	(0.389)	(0.100)	(0.341)
Percent of household members female	1.252	1.329	0.727
	(0.584)	(0.636)	(0.443)
Highest Ed of any household member-None	(ref.)	(ref.)	(ref.)
	(ref.)	(ref.)	(ref.)
Highest Ed of any household member-Primary	0.546	0.828	0.910
	(0.312)	(0.790)	(0.878)
Highest Ed of any household member-Jr. Secondary	1.013	1.210	1.264
	(0.983)	(0.789)	(0.701)
Highest Ed of any household member-Secondary	0.609	1.677	1.252
	(0.385)	(0.480)	(0.714)
Highest Ed of any household member-Tertiary	0.479	5.391**	1.448
	(0.201)	(0.046)	(0.558)
Dwelling owned	(ref.)	(ref.)	(ref.)
	(ref.)	(ref.)	(ref.)
Dwelling rented	1.052	0.625	0.328***
	(0.840)	(0.291)	(0.006)
Dwelling not owned or rented	1.178	3.223	1.901
	(0.630)	(0.357)	(0.320)
Rooms used for sleeping	0.857	1.564**	1.152
	(0.277)	(0.035)	(0.269)
Finished flooring material	0.588	4.805*	2.536**
	(0.259)	(0.060)	(0.032)
Finished roofing material	omitted	0.943	0.623
	omitted	(0.961)	(0.216)
Finished wall material	2.605*	2.337	1.239
	(0.090)	(0.354)	(0.490)
Constant	2.798	0.0593*	0.0146***
	(0.579)	(0.095)	(0.001)
Observations	*615*	*386*	*757*

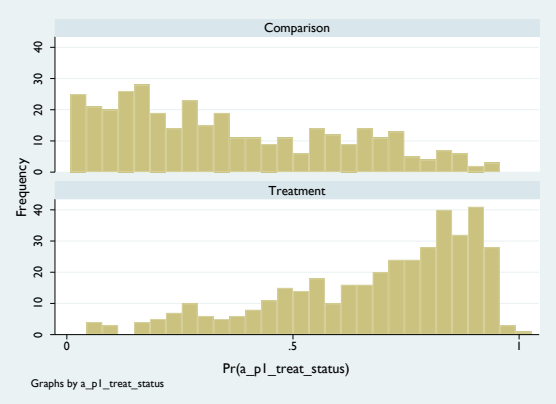
p-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1
(ref.)= reference category
omitted = model omitted the variable due to collinearity, no observations, or no variation
not included = not included in this model

Figure 36. Distribution of propensity scores (before matching)

(a) Design B



(b) Design A: Maseru peri-urban



(c) Design A: Semonkong

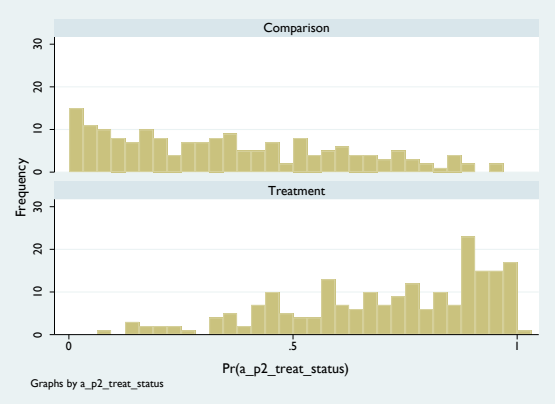
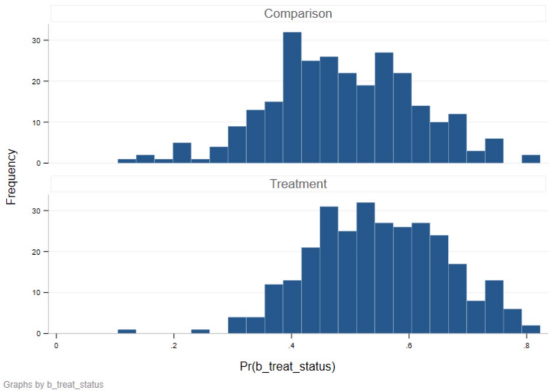
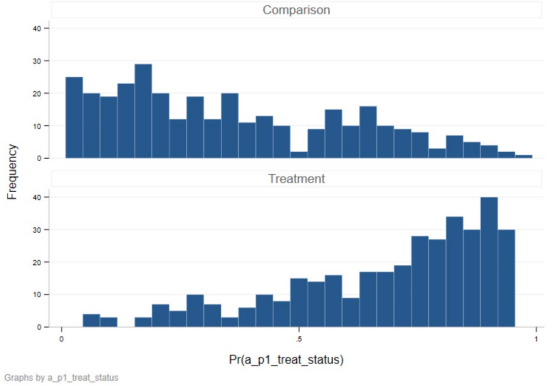


Figure 37. Distribution of propensity scores (after matching)

(a) Design B



(b) Design A: Maseru peri-urban



(c) Design A: Semonkong

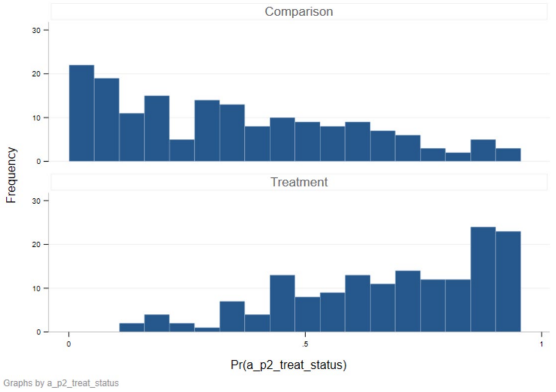


Table 52. Balance table for Design B (Maseru)

	Unmatched			Matched								
				5 Nearest Neighbor			Caliper			Gaussian Kernel		
Variable	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**
Household size	3.2	2.8	*(0.018)*	3.1	3.2	*(0.621)*	3.1	3.0	*(0.413)*	3.1	3.1	*(0.906)*
Highest Ed-Primary	8.4%	11.1%	*(0.286)*	8.5%	8.5%	*(1.000)*	8.5%	11.2%	*(0.269)*	8.5%	8.4%	*(0.969)*
Highest Ed-Jr. Secondary	12.5%	7.4%	*(0.044)*	11.6%	8.8%	*(0.264)*	11.6%	7.8%	*(0.126)*	11.6%	8.2%	*(0.175)*
Highest Ed-Secondary	33.7%	28.8%	*(0.210)*	34.0%	34.2%	*(0.958)*	34.0%	34.4%	*(0.931)*	34.0%	34.1%	*(0.982)*
Highest Ed-Tertiary	42.4%	50.6%	*(0.052)*	42.9%	45.6%	*(0.497)*	42.9%	42.9%	*(1.000)*	42.9%	46.9%	*(0.324)*
2nd asset quintile	12.8%	11.4%	*(0.622)*	12.2%	16.1%	*(0.178)*	12.2%	18.4%	*(0.039)*	12.2%	14.7%	*(0.380)*
3rd asset quintile	25.3%	24.0%	*(0.727)*	25.5%	23.2%	*(0.514)*	25.5%	19.7%	*(0.094)*	25.5%	22.9%	*(0.457)*
4th asset quintile	31.3%	26.9%	*(0.253)*	31.3%	30.4%	*(0.817)*	31.3%	30.3%	*(0.789)*	31.3%	31.5%	*(0.947)*
5th asset quintile	27.6%	33.2%	*0.147*	27.9%	28.6%	*0.841*	27.9%	28.9%	*0.784*	27.9%	28.7%	*0.837*
Recall Drinking Water - Other Improved	1.7%	3.3%	*(0.209)*	1.7%	1.0%	*(0.477)*	1.7%	1.7%	*(1.000)*	1.7%	1.4%	*(0.760)*
Recall Drinking Water - Improved	98.3%	96.7%	*0.209*	98.3%	99.0%	*0.477*	98.3%	98.3%	*1.000*	98.3%	98.6%	*0.760*
Household rented	27.9%	23.6%	*(0.240)*	27.6%	28.5%	*(0.798)*	27.6%	32.7%	*(0.178)*	27.6%	26.8%	*(0.832)*
Household not owned or rented	8.1%	7.7%	*(0.884)*	7.8%	7.2%	*(0.779)*	7.8%	12.9%	*(0.043)*	7.8%	7.4%	*(0.846)*
Recall liters of water collected/day, winter	1.8	3.9	*(0.194)*	1.8	1.1	*(0.509)*	1.8	2.4	*(0.681)*	1.8	1.3	*(0.669)*
Recall minutes spent collecting water/day, winter	0.2	0.7	*(0.142)*	0.2	0.1	*(0.698)*	0.2	0.3	*(0.673)*	0.2	0.2	*(0.916)*
Rooms used for sleeping	1.9	2.0	*(0.162)*	1.9	1.9	*(0.751)*	1.9	1.9	*(0.174)*	1.9	2.0	*(0.941)*
Finished flooring material	95.6%	96.7%	*(0.516)*	95.6%	96.7%	*(0.467)*	95.6%	96.3%	*(0.677)*	95.6%	96.3%	*(0.671)*
Finished roofing material	100.0%	100.0%	.	100.0%	100.0%	.	100.0%	100.0%	.	100.0%	100.0%	.
Finished wall material	98.7%	95.9%	*(0.044)*	98.6%	98.2%	*(0.691)*	98.6%	99.0%	*(0.704)*	98.6%	98.7%	*(0.935)*
Household Head Sex	39.7%	43.2%	*(0.406)*	39.8%	37.8%	*(0.624)*	39.8%	39.8%	*(1.000)*	39.8%	39.8%	*(0.994)*
Household Head married or cohabitating	55.9%	52.0%	*(0.357)*	55.8%	57.3%	*(0.703)*	55.8%	53.7%	*(0.620)*	55.8%	56.2%	*(0.918)*
Recall Sanitation-Unimproved	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.
Recall Sanitation-Improved/Shared	16.8%	12.5%	*(0.151)*	16.3%	19.0%	*(0.400)*	16.3%	24.2%	*(0.018)*	16.3%	15.6%	*(0.807)*
Recall Sanitation-Improved/Private	82.2%	87.1%	*(0.105)*	82.7%	80.8%	*(0.565)*	82.7%	75.5%	*(0.033)*	82.7%	84.0%	*(0.657)*
Household head age	43.3	45.7	*(0.029)*	43.3	43.1	*(0.834)*	43.3	42.8	*(0.632)*	43.3	43.8	*(0.670)*
Household head age, squared	2052.6	2264.8	*(0.055)*	2058.4	2025.3	*(0.755)*	2058.4	2023.4	*(0.752)*	2058.4	2083.1	*(0.816)*
Dependency ratio	46.6	43.1	*(0.508)*	45.9	45.9	*(0.992)*	45.9	46.3	*(0.945)*	45.9	43.8	*(0.678)*
Household % female	59.5%	59.8%	*(0.909)*	59.5%	59.7%	*(0.937)*	59.5%	61.3%	*(0.490)*	59.5%	60.0%	*(0.852)*
Distance (m) from WASCO network	37.9	40.2	*(0.586)*	38.0	38.9	*(0.813)*	38.0	39.4	*(0.726)*	38.0	39.0	*(0.796)*
Recall days per week of water service	22.2	21.9	*(0.351)*	22.2	21.8	*(0.271)*	22.2	21.3	*(0.726)*	22.2	22.0	*(0.486)*
Recall liters of water collected/day, summer	1.8	3.9	*(0.509)*	1.8	1.1	*(0.509)*	1.8	2.4	*(0.681)*	1.8	1.3	*(0.669)*
Recall minutes spent collecting water/day, summer	0.2	0.7	*(0.698)*	0.2	0.1	*(0.698)*	0.2	0.3	*(0.673)*	0.2	0.2	*(0.916)*

Table 53. Balance table for Design A (Semonkong)

	Unmatched			Matched								
				5 Nearest Neighbor			Caliper			Gaussian Kernel		
Variable	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**
Household size	4.1	3.7	*(0.045)*	4.0	4.2	*(0.448)*	4.0	3.8	*(0.302)*	4.0	4.1	*(0.642)*
Highest Ed-Primary	15.5%	30.2%	*(0.001)*	16.4%	19.1%	*(0.520)*	16.4%	16.4%	*(1.000)*	16.4%	20.5%	*(0.337)*
Highest Ed-Jr. Secondary	29.8%	40.8%	*(0.031)*	31.4%	34.1%	*(0.617)*	31.4%	33.3%	*(0.720)*	31.4%	33.3%	*(0.719)*
Highest Ed-Secondary	35.4%	20.7%	*(0.002)*	34.6%	33.2%	*(0.795)*	34.6%	41.5%	*(0.205)*	34.6%	33.7%	*(0.872)*
Highest Ed-Tertiary	16.0%	4.1%	*0.000*	14.5%	6.0%	*(0.013)*	14.5%	6.3%	*(0.017)*	14.5%	6.5%	*(0.020)*
2nd asset quintile	33.7%	20.7%	*(0.006)*	34.6%	30.4%	*(0.431)*	34.6%	22.0%	*(0.013)*	34.6%	29.0%	*(0.285)*
3rd asset quintile	16.0%	2.4%	*0.000*	11.3%	9.9%	*(0.690)*	11.3%	13.8%	*(0.500)*	11.3%	9.1%	*(0.513)*
4th asset quintile	12.2%	1.8%	*0.000*	12.0%	10.6%	*(0.697)*	12.0%	17.6%	*(0.156)*	12.0%	9.2%	*(0.433)*
5th asset quintile	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.
Recall Drinking Water - Other Improved	89.0%	92.9%	*(0.201)*	89.9%	89.3%	*(0.855)*	89.9%	95.0%	*(0.090)*	89.9%	89.9%	*(0.981)*
Recall Drinking Water - Improved	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.
Household rented	11.6%	15.4%	*(0.301)*	13.2%	12.6%	*(0.868)*	13.2%	9.4%	*(0.290)*	13.2%	13.7%	*(0.908)*
Household not owned or rented	1.1%	1.2%	*(0.945)*	1.3%	0.1%	*(0.225)*	1.3%	0.0%	*(0.157)*	1.3%	0.3%	*(0.358)*
Recall liters of water collected/day, winter	75.6	66.6	*(0.171)*	74.4	78.3	*(0.561)*	74.4	81.3	*(0.285)*	74.4	79.8	*(0.427)*
Recall minutes spent collecting water/day, winter	65.7	42.6	*(0.003)*	62.8	56.6	*(0.504)*	62.8	63.3	*(0.954)*	62.8	65.6	*(0.773)*
Rooms used for sleeping	2.0	1.5	*0.000*	1.9	1.9	*(0.815)*	1.9	1.8	*(0.217)*	1.9	1.9	*(0.560)*
Finished flooring material	98.3%	82.2%	*0.000*	98.1%	99.2%	*(0.378)*	98.1%	99.4%	*(0.316)*	98.1%	98.9%	*(0.567)*
Finished roofing material	98.3%	91.7%	*(0.004)*	99.4%	99.7%	*(0.613)*	99.4%	100.0%	*(0.318)*	99.4%	99.4%	*(0.955)*
Finished wall material	98.9%	89.3%	*0.000*	98.7%	99.4%	*(0.563)*	98.7%	99.4%	*(0.563)*	98.7%	99.0%	*(0.856)*
Household Head Sex	36.5%	49.7%	*(0.012)*	39.6%	37.6%	*(0.713)*	39.6%	37.1%	*(0.646)*	39.6%	39.4%	*(0.975)*
Household Head married or cohabitating	58.6%	38.5%	*0.000*	54.7%	57.1%	*(0.669)*	54.7%	59.1%	*(0.430)*	54.7%	55.2%	*(0.938)*
Recall Sanitation-Unimproved	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.
Recall Sanitation-Improved/Shared	22.7%	15.4%	*(0.085)*	22.6%	23.6%	*(0.832)*	22.6%	18.9%	*(0.408)*	22.6%	26.1%	*(0.479)*
Recall Sanitation-Improved/Private	65.2%	43.8%	*0.000*	64.2%	66.9%	*(0.605)*	64.2%	69.8%	*(0.285)*	64.2%	62.7%	*(0.782)*
Household head age	51.0	48.6	*(0.144)*	50.9	52.1	*(0.511)*	50.9	46.8	*(0.017)*	50.9	50.8	*(0.955)*
Household head age, squared	2786.4	2648.0	*(0.404)*	2789.5	3032.5	*(0.206)*	2789.5	2451.6	*(0.056)*	2789.5	2887.7	*(0.599)*
Dependency ratio	63.0	67.9	*(0.534)*	64.9	69.4	*(0.583)*	64.9	78.5	*(0.126)*	64.9	70.5	*(0.504)*
Household % female	55.1%	57.6%	*(0.440)*	55.6%	55.1%	*(0.871)*	55.6%	58.5%	*(0.365)*	55.6%	56.4%	*(0.798)*
Distance (m) from WASCO network	55.8	94.4	*0.000*	57.2	53.5	*(0.525)*	57.2	56.5	*(0.902)*	57.2	55.1	*(0.714)*
Recall liters of water collected/day, summer	78.8	67.1	*(0.072)*	75.4	74.9	*(0.942)*	75.4	76.2	*(0.904)*	75.4	78.1	*(0.704)*
Recall minutes spent collecting water/day, summer	70.8	42.6	*0.000*	62.8	56.7	*(0.507)*	62.8	63.4	*(0.951)*	62.8	65.7	*(0.768)*

Table 54. Balance table for Design A (Roma & Morija)

	Unmatched			Matched								
				5 Nearest Neighbor			Caliper			Gaussian Kernel		
Variable	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**	**T**	**C**	**p-val.**
Household size	3.9	3.6	*(0.029)*	3.9	4.1	*(0.118)*	3.9	4.0	*(0.256)*	3.9	4.0	*(0.404)*
Highest Ed-Primary	10.4%	21.0%	*0.000*	10.5%	12.3%	*(0.455)*	10.5%	12.2%	*(0.482)*	10.5%	10.0%	*(0.811)*
Highest Ed-Jr. Secondary	24.3%	26.3%	*(0.538)*	24.6%	20.9%	*(0.243)*	24.6%	22.9%	*(0.601)*	24.6%	23.0%	*(0.610)*
Highest Ed-Secondary	37.7%	35.9%	*(0.627)*	37.8%	42.7%	*(0.183)*	37.8%	40.3%	*(0.494)*	37.8%	43.3%	*(0.136)*
Highest Ed-Tertiary	25.1%	12.0%	*0.000*	24.9%	20.8%	*(0.190)*	24.9%	23.8%	*(0.729)*	24.9%	20.7%	*(0.180)*
2nd asset quintile	18.6%	27.5%	*(0.005)*	18.8%	19.1%	*(0.910)*	18.8%	18.2%	*(0.848)*	18.8%	20.3%	*(0.602)*
3rd asset quintile	26.2%	14.1%	*0.000*	26.5%	24.8%	*(0.598)*	26.5%	27.3%	*(0.802)*	26.5%	26.1%	*(0.900)*
4th asset quintile	28.1%	8.4%	*0.000*	27.9%	31.5%	*(0.284)*	27.9%	32.9%	*(0.146)*	27.9%	28.9%	*(0.766)*
5th asset quintile	13.7%	3.9%	*0.000*	13.3%	11.2%	*(0.402)*	13.3%	8.8%	*(0.058)*	13.3%	10.8%	*(0.302)*
Recall Drinking Water - Other Improved	90.7%	87.1%	*(0.130)*	90.6%	92.6%	*(0.335)*	90.6%	90.9%	*(0.898)*	90.6%	93.2%	*(0.209)*
Recall Drinking Water - Improved	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.	0.0%	0.0%	.
Household rented	3.6%	9.6%	*(0.001)*	3.6%	4.0%	*(0.757)*	3.6%	2.5%	*(0.387)*	3.6%	4.5%	*(0.534)*
Household not owned or rented	2.5%	1.8%	*(0.546)*	2.5%	2.3%	*(0.845)*	2.5%	2.2%	*(0.806)*	2.5%	2.7%	*(0.834)*
Recall liters of water collected/day, winter	75.2	58.3	*0.000*	73.6	68.7	*(0.270)*	73.6	69.8	*(0.384)*	73.6	68.9	*(0.291)*
Recall minutes spent collecting water/day, winter	35.3	26.3	*(0.036)*	31.9	26.4	*(0.104)*	31.9	27.4	*(0.179)*	31.9	25.6	*(0.052)*
Rooms used for sleeping	2.0	1.5	*0.000*	2.0	2.0	*(0.764)*	2.0	2.0	*(0.899)*	2.0	2.0	*(0.253)*
Finished flooring material	97.0%	83.5%	*0.000*	97.0%	96.1%	*(0.542)*	97.0%	95.6%	*(0.327)*	97.0%	96.5%	*(0.707)*
Finished roofing material	90.4%	89.8%	*(0.785)*	90.3%	92.6%	*(0.276)*	90.3%	95.9%	*(0.003)*	90.3%	93.4%	*(0.131)*
Finished wall material	92.6%	75.4%	*0.000*	92.5%	90.4%	*(0.300)*	92.5%	90.9%	*(0.419)*	92.5%	90.7%	*(0.362)*
Household Head Sex	44.8%	42.2%	*(0.490)*	45.0%	45.0%	*(1.000)*	45.0%	42.8%	*(0.550)*	45.0%	45.8%	*(0.832)*
Household Head married or cohabitating	49.2%	42.5%	*(0.077)*	48.9%	48.3%	*(0.882)*	48.9%	48.3%	*(0.882)*	48.9%	47.2%	*(0.649)*
Recall Sanitation-Unimproved	12.6%	26.3%	*0.000*	12.7%	12.3%	*(0.875)*	12.7%	13.5%	*(0.742)*	12.7%	13.6%	*(0.732)*
Recall Sanitation-Improved/Shared	7.9%	9.0%	*(0.615)*	7.7%	6.2%	*(0.414)*	7.7%	5.8%	*(0.301)*	7.7%	6.4%	*(0.478)*
Recall Sanitation-Improved/Private	77.3%	53.0%	*0.000*	77.3%	78.8%	*(0.641)*	77.3%	76.8%	*(0.860)*	77.3%	77.1%	*(0.937)*
Household head age	53.7	50.9	*(0.023)*	53.7	55.0	*(0.259)*	53.7	55.6	*(0.100)*	53.7	54.2	*(0.631)*
Household head age, squared	3132.9	2879.8	*(0.061)*	3127.5	3267.3	*(0.281)*	3127.5	3314.3	*(0.142)*	3127.5	3186.4	*(0.649)*
Dependency ratio	70.4	64.4	*(0.284)*	70.5	82.7	*(0.040)*	70.5	85.7	*(0.011)*	70.5	77.7	*(0.210)*
Household % female	54.1%	52.3%	*(0.425)*	54.4%	58.1%	*(0.090)*	54.4%	56.0%	*(0.471)*	54.4%	57.9%	*(0.103)*
Distance (m) from WASCO network	57.1	101.5	*0.000*	57.4	58.2	*(0.856)*	57.4	56.5	*(0.820)*	57.4	60.5	*(0.467)*
Density EA pre-UPUW WASCO connections	12.8%	12.0%	*(0.241)*	12.8%	14.1%	*(0.054)*	12.8%	14.8%	*(0.005)*	12.8%	14.1%	*(0.062)*
% in Morija	21.6%	33.2%	*(0.001)*	21.8%	23.8%	*(0.524)*	21.8%	24.9%	*(0.335)*	21.8%	24.1%	*(0.473)*
% in Roma	78.4%	66.8%	*(0.001)*	78.2%	76.2%	*(0.524)*	78.2%	75.1%	*(0.335)*	78.2%	75.9%	*(0.473)*
Recall liters of water collected/day, summer	76.0	59.3	*0.000*	74.4	69.1	*(0.231)*	74.4	69.8	*(0.291)*	74.4	69.3	*(0.249)*
Recall minutes spent collecting water/day, summer	36.3	27.3	*(0.044)*	32.9	26.8	*(0.083)*	32.9	27.4	*(0.117)*	32.9	25.9	*(0.042)*

Table 55. Design B Detailed Propensity Score Matching Results

	IE B (Maseru Urban)											
	Nearest Neighbor (5)				Caliper				Gaussian Kernel			
Variable	T	C	ATT	p-val.	T	C	ATT	p-val.	T	C	ATT	p-val.
Time spent collecting water, minutes/house/day winter	0.1	0.1	0.0	*(0.912)*	0.1	0.3	-0.2	*(0.749)*	0.1	0.1	-0.1	*(0.842)*
Amount spent on water, Maloti/house/month winter	64.6	83.2	-18.6	*(0.171)*	64.6	73.6	-8.9	*(0.583)*	64.6	88.2	-23.6	*(0.052)*
Amount spent on water (less payment from neighbors), Maloti/house/month winter	61.8	78.8	-17.0	*(0.215)*	61.8	68.9	-7.1	*(0.667)*	61.8	84.8	-23.0	*(0.061)*
Volume of water collected from outside the home, liters/person/day winter	0.1	0.1	-0.1	*(0.826)*	0.1	0.2	-0.2	*(0.719)*	0.1	0.2	-0.1	*(0.704)*
Volume of water consumed, liters/person/day winter	77.2	80.9	-3.7	*(0.734)*	77.2	75.8	1.4	*(0.912)*	77.2	85.9	-8.7	*(0.436)*
Hours per day of water supply, Winter	21.6	22.0	-0.4	*(0.358)*	21.6	22.2	-0.6	*(0.194)*	21.6	22.1	-0.5	*(0.168)*
Volume of water collected from outside the home, liters/house/day winter	0.3	0.4	-0.1	*(0.905)*	0.3	0.8	-0.5	*(0.757)*	0.3	0.5	-0.2	*(0.803)*
Time spent collecting water, minutes/house/day summer	0.1	0.1	0.0	*(0.912)*	0.1	0.3	-0.2	*(0.749)*	0.1	0.1	-0.1	*(0.842)*
Amount spent on water, Maloti/house/month summer	64.6	83.2	-18.6	*(0.171)*	64.6	73.6	-8.9	*(0.583)*	64.6	88.2	-23.6	*(0.052)*
Amount spent on water (less payment from neighbors), Maloti/house/month summer	61.8	78.8	-17.0	*(0.215)*	61.8	68.9	-7.1	*(0.667)*	61.8	84.8	-23.0	*(0.061)*
Volume of water collected from outside the home, liters/person/day summer	0.1	0.1	-0.1	*(0.826)*	0.1	0.2	-0.2	*(0.719)*	0.1	0.2	-0.1	*(0.704)*
Volume of water consumed, liters/person/day summer	77.2	80.9	-3.7	*(0.734)*	77.2	75.8	1.4	*(0.912)*	77.2	85.9	-8.7	*(0.436)*
Hours per day of water supply, Summer	21.9	22.0	-0.1	*(0.826)*	21.9	22.2	-0.3	*(0.639)*	21.9	22.3	-0.4	*(0.390)*
Volume of water collected from outside the home, liters/house/day summer	0.3	0.4	-0.1	*(0.905)*	0.3	0.8	-0.5	*(0.757)*	0.3	0.5	-0.2	*(0.803)*
% of children experiencing diarrheal illness, last two weeks	6.1%	5.5%	0.6%	*(0.913)*	6.1%	9.1%	-3.0%	*(0.734)*	6.1%	6.1%	0.0%	*(1.000)*

Nearest neighbor observations: 555 Caliper observations: 438; Gaussian Kernel observations: 565. Results from Gaussian kernel method are presented in the main body of the report.

Table 56. Design A Semonkong Detailed Propensity Score Matching Results

	IE A Package 2 (Semonkong)											
	Nearest Neighbor (5)				Caliper				Gaussian Kernel			
Variable	T	C	ATT	p-val.	T	C	ATT	p-val.	T	C	ATT	p-val.
Time spent collecting water, minutes/house/day winter	0.1	23.8	-23.8	*(0.000)*	0.1	22.8	-22.7	*(0.000)*	0.1	25.4	-25.3	*(0.000)*
Amount spent on water, Maloti/house/month winter	69.0	26.3	42.7	*(0.000)*	69.0	40.7	28.4	*(0.033)*	69.0	34.1	34.9	*(0.000)*
Amount spent on water (less payment from neighbors), Maloti/house/month winter	58.3	26.3	32.0	*(0.002)*	58.3	40.7	17.6	*(0.191)*	58.3	34.1	24.2	*(0.008)*
Volume of water collected from outside the home, liters/person/day winter	0.0	20.5	-20.5	*(0.000)*	0.0	24.0	-23.9	*(0.000)*	0.0	21.0	-21.0	*(0.000)*
Volume of water consumed, liters/person/day winter	67.0	20.5	46.5	*(0.000)*	67.0	24.0	43.0	*(0.000)*	67.0	21.0	46.0	*(0.000)*
Volume of water collected from outside the home, liters/house/day winter	0.3	83.6	-83.3	*(0.000)*	0.3	90.6	-90.3	*(0.000)*	0.3	84.4	-84.1	*(0.000)*
Time spent collecting water, minutes/house/day summer	0.1	22.7	-22.6	*(0.000)*	0.1	22.8	-22.7	*(0.000)*	0.1	24.4	-24.2	*(0.000)*
Amount spent on water, Maloti/house/month summer	69.0	26.3	42.7	*(0.000)*	69.0	40.7	28.4	*(0.033)*	69.0	34.1	34.9	*(0.000)*
Amount spent on water (less payment from neighbors), Maloti/house/month summer	58.3	26.3	32.0	*(0.002)*	58.3	40.7	17.6	*(0.191)*	58.3	34.1	24.2	*(0.008)*
Volume of water collected from outside the home, liters/person/day summer	0.0	20.3	-20.2	*(0.000)*	0.0	24.0	-23.9	*(0.000)*	0.0	20.8	-20.8	*(0.000)*
Volume of water consumed, liters/person/day summer	67.0	20.5	46.5	*(0.000)*	67.0	24.0	43.0	*(0.000)*	67.0	21.0	46.0	*(0.000)*
Volume of water collected from outside the home, liters/house/day summer	0.3	82.8	-82.5	*(0.000)*	0.3	90.6	-90.3	*(0.000)*	0.3	83.8	-83.4	*(0.000)*
% of children experiencing diarrheal illness, last two weeks	3.3%	7.3%	-4.0%	*(0.511)*	3.3%	0.0%	3.3%	*(0.511)*	3.3%	7.9%	-4.5%	*(0.456)*

Nearest neighbor observations: 270; Caliper observations: 224; Gaussian Kernel observations: 328 Results from Gaussian kernel method are presented in the main body of the report.

Table 57. Design A Roma & Morija Detailed Propensity Score Matching Results

	IE A Package 1 (Roma & Morija)											
	Nearest Neighbor (5)				Caliper				Gaussian Kernel			
Variable	T	C	ATT	p-val.	T	C	ATT	p-val.	T	C	ATT	p-val.
Time spent collecting water, minutes/house/day winter	6.7	19.5	-12.8	*(0.002)*	6.7	20.6	-13.9	*(0.000)*	6.7	18.5	-11.8	*(0.000)*
Amount spent on water, Maloti/house/month winter	97.5	80.2	17.4	*(0.749)*	97.5	65.6	31.9	*(0.589)*	97.5	88.0	9.5	*(0.834)*
Amount spent on water (less payment from neighbors), Maloti/house/month winter	93.3	80.2	13.1	*(0.810)*	93.3	65.6	27.7	*(0.639)*	93.3	88.0	5.3	*(0.912)*
Volume of water collected from outside the home, liters/person/day winter	3.6	20.5	-16.9	*(0.000)*	3.6	21.8	-18.2	*(0.000)*	3.6	19.8	-16.2	*(0.000)*
Volume of water consumed, liters/person/day winter	93.2	20.5	72.7	*(0.000)*	93.2	21.8	71.3	*(0.000)*	93.2	19.8	73.3	*(0.000)*
Volume of water collected from outside the home, liters/house/day winter	13.6	81.2	-67.5	*(0.000)*	13.6	83.4	-69.8	*(0.000)*	13.6	76.2	-62.6	*(0.000)*
Time spent collecting water, minutes/house/day summer	6.9	19.5	-12.6	*(0.000)*	6.9	21.2	-14.3	*(0.000)*	6.9	18.6	-11.7	*(0.000)*
Amount spent on water, Maloti/house/month summer	98.1	80.4	17.8	*(0.749)*	98.1	67.1	31.0	*(0.596)*	98.1	87.7	10.5	*(0.826)*
Amount spent on water (less payment from neighbors), Maloti/house/month summer	93.9	80.4	13.5	*(0.803)*	93.9	67.1	26.7	*(0.653)*	93.9	87.7	6.2	*(0.897)*
Volume of water collected from outside the home, liters/person/day summer	3.7	20.5	-16.7	*(0.000)*	3.7	21.9	-18.2	*(0.000)*	3.7	19.8	-16.1	*(0.000)*
Volume of water consumed, liters/person/day summer	93.2	20.5	72.8	*(0.000)*	93.2	21.8	71.4	*(0.000)*	93.2	19.8	73.4	*(0.000)*
Volume of water collected from outside the home, liters/house/day summer	14.0	80.8	-66.8	*(0.000)*	14.0	83.7	-69.7	*(0.000)*	14.0	75.9	-61.9	*(0.000)*
% of children experiencing diarrheal illness, last two weeks	10.6%	15.4%	-4.8%	*(0.516)*	10.6%	9.6%	1.0%	*(0.897)*	10.6%	14.7%	-4.1%	*(0.454)*

Nearest neighbor observations: 610; Caliper observations: 488; Gaussian Kernel observations: 696 Results from Gaussian kernel method are presented in the main body of the report.

CUSTOMER SURVEY SITE-SPECIFIC TABLES

Table 58. Service Delivery – Maseru & Mazenod

SERVICE DELIVERY	MASERU Existing Customer	MASERU New Customer	MASERU Total	MAZENOD Existing Customer	MAZENOD New Customer	MAZENOD Total
Average daily service hours	21.93	20.32	21.29	23.97	23.65	23.76
Average daily service hours – recall	22.04	N/A	22.04	22.82	N/A	22.82
Quality – *E. coli*, tap (% compliant)	96.8%	96.1%	96.5%	98.8%	94.6%	96.1%
Quality – *E. coli*, point of consumption (% compliant)	96.3%	89.1%	93.7%	84.4%	80.3%	81.8%
Quality – FCR, tap						
Non-detectable (<0.1)	40.5%	36.2%	38.9%	40.5%	43.0%	42.1%
Low (0.1-<0.2)	49.2%	49.6%	49.3%	59.5%	53.1%	55.4%
WHO recommended (0.2-0.5)	9.7%	14.2%	11.4%	0.0%	3.9%	2.5%
High (>0.5)	0.5%	0.0%	0.3%	0.00%	0.0%	0.00%
Perceived improvements in service since interventions						
No improvements	64.4%	N/A	64.4%	31.4%	N/A	31.4%
Reliability	23.9%	N/A	23.9%	32.2%	N/A	32.2%
Water quality	8.1%	N/A	8.1%	39.0%	N/A	39.0%
Pressure	3.6%	N/A	3.6%	2.5%	N/A	2.5%
Tariff/price	0.1%	N/A	0.1%	0.8%	N/A	0.8%
Smell	5.6%	N/A	5.6%	2.5%	N/A	2.5%
Color	9.1%	N/A	9.1%	5.9%	N/A	5.9%
Taste	4.3%	N/A	4.3%	2.5%	N/A	2.5%
Perceived problems in service since interventions						
No problems	77.7%	N/A	77.7%	87.3%	N/A	87.3%
Reliability	9.6%	N/A	9.6%	1.7%	N/A	1.7%
Water quality	2.0%	N/A	2.0%	0.8%	N/A	0.8%
Pressure	4.7%	N/A	4.7%	0.00%	N/A	0.00%
Tariff/price	4.1%	N/A	4.1%	4.2%	N/A	4.2%
Smell	0.8%	N/A	0.8%	0.00%	N/A	0.00%
Color	5.6%	N/A	5.6%	4.2%	N/A	4.2%
Taste	0.5%	N/A	0.5%	0.00%	N/A	0.00%
Perceived safety of main drinking water source						
Do not know	1.1%	1.4%	1.2%	2.5%	3.6%	3.2%
Yes, always	17.2%	13.8%	15.8%	39.8%	47.2%	44.8%
Yes, most of the time	57.2%	51.7%	55.0%	36.4%	26.9%	30.0%
Only sometimes	16.5%	15.2%	16.0%	11.9%	14.2%	13.4%
Never safe to drink	8.0%	17.9%	12.0%	9.3%	8.1%	8.5%
Perceived safety of WASCO water (scale of 0-10)	7.24	6.81	7.06	7.66	7.62	7.63
Perceived safety of own drinking water (scale of 0-10)	7.59	7.61	7.6	7.72	7.67	7.69

Table 59. Service Delivery – Teyateyaneng & Roma

SERVICE DELIVERY	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Average daily service hoursN	23.37	23.37	23.37	23.43	23.51	23.47
Average daily service hours – recall	19.68	N/A	19.68	21.16	N/A	21.16
Quality – *E. coli*, tap (% compliant)	98.7%	98.3%	98.5%	91.2%	96.5%	93.3%
Quality – *E. coli*, point of consumption (% compliant)	94.6%	98.4%	97.0%	82.3%	94.3%	88.2%
Quality – FCR, tap						
Non-detectable (<0.1)	0.0%	0.8%	0.5%	16.2%	22.3%	18.6%
Low (0.1-<0.2)	92.0%	80.0%	84.6%	77.7%	71.2%	75.1%
WHO recommended (0.2-0.5)	8.0%	19.2%	14.9%	6.1%	5.8%	6.0%
High (>0.5)	0.00%	0.0%	0.00%	0.0%	0.7%	0.3%
Perceived improvements in service since interventions						
No improvements	30.7%	N/A	30.7%	26.8%	N/A	26.8%
Reliability	36.0%	N/A	36.0%	33.3%	N/A	33.3%
Water quality	18.4%	N/A	18.4%	13.8%	N/A	13.8%
Pressure	2.6%	N/A	2.6%	11.4%	N/A	11.4%
Tariff/price	1.8%	N/A	1.8%	3.3%	N/A	3.3%
Smell	10.5%	N/A	10.5%	0.00%	N/A	0.00%
Color	21.1%	N/A	21.1%	4.1%	N/A	4.1%
Taste	7.0%	N/A	7.0%	0.8%	N/A	0.8%
Perceived problems in service since interventions						
No problems	76.3%	N/A	76.3%	49.6%	N/A	49.6%
Reliability	3.5%	N/A	3.5%	6.5%	N/A	6.5%
Water quality	2.6%	N/A	2.6%	4.9%	N/A	4.9%
Pressure	0.00%	N/A	0.00%	4.9%	N/A	4.9%
Tariff/price	4.4%	N/A	4.4%	19.5%	N/A	19.5%
Smell	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Color	6.1%	N/A	6.1%	3.3%	N/A	3.3%
Taste	0.00%	N/A	0.00%	0.8%	N/A	0.8%

SERVICE DELIVERY	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Perceived safety of main drinking water source						
Do not know	0.0%	1.6%	1.0%	2.2%	2.3%	2.2%
Yes, always	42.1%	29.7%	34.4%	23.4%	25.7%	24.6%
Yes, most of the time	28.9%	35.2%	32.8%	39.4%	42.1%	40.9%
Only sometimes	4.4%	9.9%	7.8%	23.8%	14.6%	18.9%
Never safe to drink	24.6%	23.6%	24.0%	11.2%	15.3%	13.4%
Perceived safety of WASCO water (scale of 0-10)	7.7	7.58	7.62	7.52	7.53	7.53
Perceived safety of own drinking water (scale of 0-10)	7.77	7.7	7.72	7.47	7.67	7.58

Table 60. Service Delivery – Morija & Mohale's Hoek

SERVICE DELIVERY	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Average daily service hours	23.37	22.33	22.65	10.36	9.59	9.89
Average daily service hours – recall	20.59	N/A	20.59	17.08	N/A	17.08
Quality – *E. coli*, tap (% compliant)	93.5%	96.8%	95.9%	89.5%	93.5%	92.0%
Quality – *E. coli*, point of consumption (% compliant)	89.6%	96.6%	95.2%	100.0%	89.5%	93.3%
Quality – FCR, tap						
Non-detectable (<0.1)	1.4%	1.1%	1.2%	33.3%	41.9%	38.8%
Low (0.1-<0.2)	77.9%	81.1%	80.1%	66.7%	51.6%	57.1%
WHO recommended (0.2-0.5)	20.7%	17.9%	18.7%	0.0%	6.5%	4.1%
High (>0.5)	0.00%	0.0%	0.00%	0.00%	0.0%	0.00%
Perceived improvements in service since interventions						
No improvements	32.7%	N/A	32.7%	83.7%	N/A	83.7%
Reliability	22.1%	N/A	22.1%	6.1%	N/A	6.1%
Water quality	30.8%	N/A	30.8%	10.2%	N/A	10.2%
Pressure	4.8%	N/A	4.8%	2.0%	N/A	2.0%
Tariff/price	3.8%	N/A	3.8%	0.00%	N/A	0.00%

SERVICE DELIVERY	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Smell	6.7%	N/A	6.7%	0.00%	N/A	0.00%
Color	22.1%	N/A	22.1%	2.0%	N/A	2.0%
Taste	5.8%	N/A	5.8%	0.00%	N/A	0.00%
Perceived problems in service since interventions						
No problems	79.0%	N/A	79.0%	28.6%	N/A	28.6%
Reliability	6.7%	N/A	6.7%	34.7%	N/A	34.7%
Water quality	5.7%	N/A	5.7%	22.4%	N/A	22.4%
Pressure	1.9%	N/A	1.9%	18.4%	N/A	18.4%
Tariff/price	4.8%	N/A	4.8%	16.3%	N/A	16.3%
Smell	1.9%	N/A	1.9%	12.2%	N/A	12.2%
Color	0.00%	N/A	0.00%	42.9%	N/A	42.9%
Taste	0.00%	N/A	0.00%	4.1%	N/A	4.1%
Perceived safety of main drinking water source						
Do not know	3.6%	1.7%	2.2%	0.00%	0.00%	0.00%
Yes, always	43.2%	33.9%	36.6%	14.3%	13.9%	14.1%
Yes, most of the time	19.5%	20.3%	20.1%	44.9%	38.0%	40.6%
Only sometimes	13.6%	20.3%	18.4%	22.4%	20.3%	21.1%
Never safe to drink	20.1%	23.7%	22.7%	18.4%	27.8%	24.2%
Perceived safety of WASCO water (scale of 0-10)	7.66	7.4	7.48	5.45	6.17	5.89
Perceived safety of own drinking water (scale of 0-10)	7.76	7.44	7.53	6.24	6.7	6.52

Table 61. Service Delivery – Mafeteng & Quthing

SERVICE DELIVERY	MAFETENG Existing Customer	MAFETENG New Customer	MAFETENG Total	QUTHING Existing Customer	QUTHING New Customer	QUTHING Total
Average daily service hours	20.35	20.65	20.51	22.69	22.64	22.66
Average daily service hours – recall	18.2	N/A	18.2	22	N/A	22
Quality – *E. coli*, tap (% compliant)	95.7%	100.0%	98.0%	100.0%	100.0%	100.0%
Quality – *E. coli*, point of consumption (% compliant)	92.9%	100.0%	96.8%	100.0%	100.0%	100.0%
Quality – FCR, tap						
Non-detectable (<0.1)	16.7%	14.8%	15.7%	31.6%	16.7%	22.4%
Low (0.1-<0.2)	29.2%	33.3%	31.3%	47.4%	70.0%	61.3%
WHO recommended (0.2-0.5)	54.2%	51.9%	53.0%	21.1%	13.3%	16.3%
High (>0.5)	0.00%	0.0%	0.00%	0.00%	0.0%	0.00%
Perceived improvements in service since interventions						
No improvements	57.4%	N/A	57.4%	28.8%	N/A	28.8%
Reliability	18.0%	N/A	18.0%	17.3%	N/A	17.3%
Water quality	19.7%	N/A	19.7%	34.6%	N/A	34.6%
Pressure	16.4%	N/A	16.4%	5.8%	N/A	5.8%
Tariff/price	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Smell	1.6%	N/A	1.6%	9.6%	N/A	9.6%
Color	3.3%	N/A	3.3%	9.6%	N/A	9.6%
Taste	3.3%	N/A	3.3%	0.00%	N/A	0.00%
Perceived problems in service since interventions						
No problems	73.8%	N/A	73.8%	63.5%	N/A	63.5%
Reliability	1.6%	N/A	1.6%	0.00%	N/A	0.00%
Water quality	1.6%	N/A	1.6%	3.8%	N/A	3.8%
Pressure	1.6%	N/A	1.6%	1.9%	N/A	1.9%
Tariff/price	6.6%	N/A	6.6%	3.8%	N/A	3.8%
Smell	9.8%	N/A	9.8%	1.9%	N/A	1.9%
Color	14.8%	N/A	14.8%	21.2%	N/A	21.2%
Taste	6.6%	N/A	6.6%	0.00%	N/A	0.00%
Perceived safety of main drinking water source						
Do not know	0.0%	2.9%	1.5%	3.8%	5.3%	4.7%
Yes, always	31.1%	27.5%	29.3%	23.1%	17.1%	19.5%
Yes, most of the time	36.1%	31.9%	33.9%	36.5%	39.5%	38.3%
Only sometimes	23.0%	13.0%	17.8%	23.1%	31.6%	28.2%
Never safe to drink	9.8%	24.6%	17.6%	13.5%	6.6%	9.4%
Perceived safety of WASCO water (scale of 0-10)	7.43	6.8	7.1	7.43	7.11	7.24
Perceived safety of own drinking water (scale of 0-10)	7.8	7.04	7.4	7.59	7.33	7.44

Table 62. Service Delivery – Qacha's Nek & Butha-Buthe

SERVICE DELIVERY	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Average daily service hours	21.93	23.67	23.04	9.56	10.82	10.35
Average daily service hours – recall	23.29	N/A	23.29	10.96	N/A	10.96
Quality – *E. coli*, tap (% compliant)	100.0%	91.4%	94.5%	87.5%	76.9%	80.8%
Quality – *E. coli*, point of consumption (% compliant)	91.7%	95.0%	93.7%	83.3%	73.7%	77.3%
Quality – FCRI, tap						
Non-detectable (<0.1)	0.0%	22.9%	14.9%	11.8%	8.0%	9.5%
Low (0.1-<0.2)	88.9%	65.7%	73.7%	52.9%	60.0%	57.2%
WHO recommended (0.2-0.5)	11.1%	11.4%	11.3%	35.3%	32.0%	33.3%
High (>0.5)	0.00%	0.0%	0.00%	0.00%	0.0%	0.00%
Perceived improvements in service since interventions						
No improvements	54.3%	N/A	54.3%	58.3%	N/A	58.3%
Reliability	13.0%	N/A	13.0%	6.3%	N/A	6.3%
Water quality	19.6%	N/A	19.6%	14.6%	N/A	14.6%
Pressure	4.3%	N/A	4.3%	6.3%	N/A	6.3%
Tariff/price	0.00%	N/A	0.00%	2.1%	N/A	2.1%
Smell	0.00%	N/A	0.00%	2.1%	N/A	2.1%
Color	2.2%	N/A	2.2%	4.2%	N/A	4.2%
Taste	0.00%	N/A	0.00%	4.2%	N/A	4.2%
Perceived problems in service since interventions						
No problems	67.4%	N/A	67.4%	31.2%	N/A	31.2%
Reliability	6.5%	N/A	6.5%	31.2%	N/A	31.2%
Water quality	2.2%	N/A	2.2%	6.3%	N/A	6.3%
Pressure	4.3%	N/A	4.3%	14.6%	N/A	14.6%
Tariff/price	10.9%	N/A	10.9%	18.8%	N/A	18.8%
Smell	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Color	8.7%	N/A	8.7%	4.2%	N/A	4.2%

SERVICE DELIVERY	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Taste	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Perceived safety of main drinking water source						
Do not know	4.3%	3.6%	3.9%	2.1%	5.1%	4.0%
Yes, always	32.6%	38.1%	36.1%	27.1%	29.5%	28.6%
Yes, most of the time	32.6%	29.8%	30.8%	31.2%	21.8%	25.3%
Only sometimes	19.6%	16.7%	17.7%	14.6%	19.2%	17.5%
Never safe to drink	10.9%	11.9%	11.5%	25.0%	24.4%	24.6%
Perceived safety of WASCO water (scale of 0-10)	7.96	8.17	8.09	6.46	6.15	6.27
Perceived safety of own drinking water (scale of 0-10)	7.65	8.15	7.97	6.27	6.09	6.16

Table 63. Service Delivery – Leribe & Mokhotlong

SERVICE DELIVERY	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Average daily service hours	10.47	7.72	8.55	17.68	17.44	17.5
Average daily service hours – recall	17.03	N/A	17.03	16.19	N/A	16.19
Quality – *E. coli*, tap (% compliant)	93.3%	94.3%	94.0%	100.0%	100.0%	100.0%
Quality – *E. coli*, point of consumption (% compliant)	100.0%	90.5%	93.5%	100.0%	90.0%	92.7%
Quality – FCR, tap						
Non-detectable (<0.1)	20.0%	22.9%	22.0%	22.2%	20.0%	20.6%
Low (0.1-<0.2)	66.7%	51.4%	56.0%	55.6%	44.0%	47.1%
WHO recommended (0.2-0.5)	13.3%	25.7%	22.0%	22.2%	36.0%	32.3%
High (>0.5)	0.00%	0.0%	0.00%	0.00%	0.0%	0.00%
Perceived improvements in service since interventions						
No improvements	76.3%	N/A	76.3%	48.5%	N/A	48.5%
Reliability	7.9%	N/A	7.9%	18.2%	N/A	18.2%
Water quality	10.5%	N/A	10.5%	12.1%	N/A	12.1%

SERVICE DELIVERY	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Pressure	2.6%	N/A	2.6%	3.0%	N/A	3.0%
Tariff/price	0.00%	N/A	0.00%	12.1%	N/A	12.1%
Smell	0.00%	N/A	0.00%	3.0%	N/A	3.0%
Color	7.9%	N/A	7.9%	0.00%	N/A	0.00%
Taste	0.00%	N/A	0.00%	9.1%	N/A	9.1%
Perceived problems in service since interventions						
No problems	34.2%	N/A	34.2%	12.1%	N/A	12.1%
Reliability	39.5%	N/A	39.5%	48.5%	N/A	48.5%
Water quality	18.4%	N/A	18.4%	12.1%	N/A	12.1%
Pressure	7.9%	N/A	7.9%	18.2%	N/A	18.2%
Tariff/price	5.3%	N/A	5.3%	12.1%	N/A	12.1%
Smell	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Color	5.3%	N/A	5.3%	6.1%	N/A	6.1%
Taste	0.00%	N/A	0.00%	0.00%	N/A	0.00%
Perceived safety of main drinking water source						
Do not know	0.0%	1.1%	0.8%	6.1%	1.1%	2.5%
Yes, always	7.9%	9.0%	8.7%	21.2%	17.8%	18.7%
Yes, most of the time	31.6%	55.1%	48.1%	33.3%	37.8%	36.6%
Only sometimes	34.2%	25.8%	28.3%	27.3%	27.8%	27.6%
Never safe to drink	26.3%	9.0%	14.1%	12.1%	15.6%	14.6%
Perceived safety of WASCO water (scale of 0-10)	5.84	5.66	5.72	5.16	5.98	5.76
Perceived safety of own drinking water (scale of 0-10)	7.39	5.87	6.32	5.36	6.23	5.99

Table 64. Service Delivery - Mapoteng

SERVICE DELIVERY	MAPOTENG Existing Customer	MAPOTENG New Customer	MAPOTENG Total
Average daily service hours	14.93	20.23	18.47
Average daily service hours – recall	14.29	N/A	14.29
Quality – *E. coli*, tap (% compliant)	94.1%	97.0%	96.0%
Quality – *E. coli*, point of consumption (% compliant)	100.0%	90.0%	93.3%
Quality – FCR, tap			
Non-detectable (<0.1)	5.9%	3.0%	4.0%
Low (0.1-<0.2)	82.4%	90.9%	88.0%
WHO recommended (0.2-0.5)	11.8%	6.1%	8.0%
High (>0.5)	0.00%	N/A	0.00%
Perceived improvements in service since interventions			
No improvements	46.5%	N/A	46.5%
Reliability	34.9%	N/A	34.9%
Water quality	11.6%	N/A	11.6%
Pressure	4.7%	N/A	4.7%
Tariff/price	0.00%	N/A	0.00%
Smell	2.3%	N/A	2.3%
Color	23.3%	N/A	23.3%
Taste	0.00%	N/A	0.00%
Perceived problems in service since interventions			
No problems	53.5%	N/A	53.5%
Reliability	23.3%	N/A	23.3%
Water quality	7.0%	N/A	7.0%
Pressure	2.3%	N/A	2.3%
Tariff/price	14.0%	N/A	14.0%
Smell	4.7%	N/A	4.7%
Color	14.0%	N/A	14.0%
Taste	2.3%	N/A	2.3%
Perceived safety of main drinking water source			
Do not know	0.00%	0.00%	0.00%
Yes, always	32.6%	44.7%	40.7%
Yes, most of the time	46.5%	40.0%	42.2%
Only sometimes	9.3%	5.9%	7.0%
Never safe to drink	11.6%	9.4%	10.1%
Perceived safety of WASCO water (scale of 0-10)	7.84	7.48	7.6
Perceived safety of own drinking water (scale of 0-10)	7.88	7.52	7.64

Table 65. Intermediate Outcomes – Maseru & Mazenod

INTERMEDIATE OUTCOMES	MASERU Existing Customer	MASERU New Customer	MASERU Total	MAZENOD Existing Customer	MAZENOD New Customer	MAZENOD Total
Intermediate Outcomes						
Time collecting water (min./day)	0.3	0.64	0.43	1.53	2.4	2.11
Consumption (lpcd)	83.18	67.94	77.1	126.42	95.15	105.4
Volume collected outside the home (liters per day)	1.04	4.65	2.47	12.96	8.76	10.12
Diarrheal illness prevalence, children under five	6.3%	8.2%	7.3%	9.5%	8.3%	8.7%
% of households with any children under five	23%	34%	27%	27%	29%	28%
Water expenditures (M/mo.) – all sources	78.02	92.71	84.00	156.27	100.29	118.53
Water expenditures (M/mo.) – water collected outside home	4.07	7.85	5.58	3.50	3.06	3.20
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	0.48	19.14	7.92	26.40	46.12	39.64
Volume collected outside the home (liters per day) – recall	3.12	61.67	25.89	29.32	63.77	52.61
Water expenditures (M/mo.) – water collected outside home*	0.74	50.82	20.17	2.39	39.00	26.88
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	13.95	22.47	17.32	14.32	20.41	18.27
Estimated baseline: time collecting water (min./day)	14.00	60.85	32.59	26.53	98.03	72.12
Estimated current value: water expenditures (M/mo.)	113.46	133.87	122.35	151.84	135.23	140.87
Estimated baseline value: water expenditures (M/mo.)	80.98	60.36	71.63	79.13	30.75	46.43

Table 66. Intermediate Outcomes – Teyateyaneng & Roma

INTERMEDIATE OUTCOMES	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Intermediate Outcomes						
Time collecting water (min./day)	2.65	4.4	3.73	2.2	5.8	4.14
Consumption (lpcd)	103.61	90.99	95.82	99.75	82.62	90.52
Volume collected outside the home (liters per day)	1.3	2.68	2.15	7.78	14.24	11.26
Diarrheal illness prevalence, children under five	8.7%	2.5%	4.7%	10.4%	6.6%	8.0%
% of households with any children under five	20%	26%	24%	28%	31%	30%
Water expenditures (M/mo.) – all sources	90.41	82.14	85.23	111.37	105.51	108.23
Water expenditures (M/mo.) – water collected outside home	0.00	0.55	0.34	2.33	16.37	9.90
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	5.95	23.58	16.83	8.16	26.76	18.19
Volume collected outside the home (liters per day) – recall	9.45	38.24	27.18	20.08	60.91	42.00
Water expenditures (M/mo.) – water collected outside home*	32.28	33.16	32.82	8.40	28.25	19.09
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	17.44	22.86	20.74	17.53	14.34	15.63
Estimated baseline: time collecting water (min./day)	27.97	127.42	86.92	35.14	85.41	63.74
Estimated current value: water expenditures (M/mo.)	111.39	91.41	98.53	126.49	122.51	124.28
Estimated baseline value: water expenditures (M/mo.)	51.18	22.36	32.94	69.78	17.98	40.06

Table 67. Intermediate Outcomes – Morija & Mohale's Hoek

INTERMEDIATE OUTCOMES	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Intermediate Outcomes						
Time collecting water (min./day)	1.51	4.16	3.38	3.24	8.04	6.22
Consumption (lpcd)	99.26	59.52	71.22	100.67	80.49	88.15
Volume collected outside the home (liters per day)	3.89	11.1	8.98	16.7	9.83	12.39
Diarrheal illness prevalence, children under five	3.0%	16.7%	13.8%	13.3%	17.4%	15.8%
% of households with any children under five	24%	36%	32%	29%	32%	30%
Water expenditures (M/mo.) – all sources	105.42	71.00	81.15	96.86	91.61	93.57
Water expenditures (M/mo.) – water collected outside home	8.00	6.26	6.77	6.83	13.75	11.12
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	4.86	47.51	34.95	21.10	80.11	57.72
Volume collected outside the home (liters per day) – recall	10.71	60.55	45.70	36.65	77.70	61.35
Water expenditures (M/mo.) – water collected outside home*	6.40	35.67	26.95	12.33	81.30	54.49
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	25.79	33.68	31.60	32.20	47.17	41.40
Estimated baseline: time collecting water (min./day)	41.96	103.67	86.55	41.08	142.78	103.25
Estimated current value: water expenditures (M/mo.)	137.38	108.58	116.81	132.14	101.75	112.63
Estimated baseline value: water expenditures (M/mo.)	74.31	6.38	23.15	74.35	33.00	47.68

Table 68. Intermediate Outcomes – Mafeteng & Quthing

INTERMEDIATE OUTCOMES	MAFETENG Existing Customer	MAFETENG New Customer	MAFETENG Total	QUTHING Existing Customer	QUTHING New Customer	QUTHING Total
Intermediate Outcomes						
Time collecting water (min./day)	23.93	34.86	29.66	0.19	10.03	6.06
Consumption (lpcd)	81.49	52.05	66.05	63.96	67.32	65.96
Volume collected outside the home (liters per day)	24	22	22.95	1.54	3.14	2.49
Diarrheal illness prevalence, children under five	18.7%	8.0%	12.3%	8.3%	11.1%	10.0%
% of households with any children under five	28%	36%	32%	31%	36%	34%
Water expenditures (M/mo.) – all sources	115.19	119.31	117.31	101.30	79.55	88.02
Water expenditures (M/mo.) – water collected outside home	38.89	63.56	51.83	0.58	1.31	1.02
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	32.13	47.69	40.29	18.75	35.35	28.66
Volume collected outside the home (liters per day) – recall	33.28	61.73	47.66	13.14	42.55	30.64
Water expenditures (M/mo.) – water collected outside home*	20.44	103.96	63.31	41.91	37.33	39.18
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	20.31	23.21	21.85	11.18	24.83	18.29
Estimated baseline: time collecting water (min./day)	56.39	84.68	71.52	60.69	126.56	94.46
Estimated current value: water expenditures (M/mo.)	93.51	104.83	99.38	158.68	105.18	125.45
Estimated baseline value: water expenditures (M/mo.)	86.19	49.57	67.50	98.67	28.86	55.20

Table 69. Intermediate Outcomes – Qacha's Nek & Butha-Buthe

INTERMEDIATE OUTCOMES	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Intermediate Outcomes						
Time collecting water (min./day)	0	1.13	0.72	13.4	8.03	10.02
Consumption (lpcd)	61.48	59.07	59.94	149.7	127.91	135.99
Volume collected outside the home (liters per day)	0	0.95	0.61	28.38	32.22	30.8
Diarrheal illness prevalence, children under five	16.7%	9.5%	11.2%	0.0%	6.3%	5.3%
% of households with any children under five	26%	36%	32%	6%	21%	15%
Water expenditures (M/mo.) – all sources	59.16	65.55	62.98	339.27	177.90	235.82
Water expenditures (M/mo.) – water collected outside home	0.00	0.00	0.00	214.98	93.14	138.33
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	10.53	20.04	16.61	16.13	40.72	31.60
Volume collected outside the home (liters per day) – recall	17.52	59.63	44.43	49.64	54.24	52.38
Water expenditures (M/mo.) – water collected outside home*	27.77	40.68	35.98	57.37	39.52	46.36
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	12.16	28.82	22.14	32.05	26.24	28.52
Estimated baseline: time collecting water (min./day)	47.66	67.16	59.68	60.86	75.19	69.70
Estimated current value: water expenditures (M/mo.)	82.84	88.05	86.22	108.24	107.99	108.08
Estimated baseline value: water expenditures (M/mo.)	61.88	32.66	42.74	100.40	44.28	66.87

Table 70. Intermediate Outcomes – Leribe & Mokhotlong

INTERMEDIATE OUTCOMES	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Intermediate Outcomes						
Time collecting water (min./day)	9.36	12.54	11.59	68.67	25.04	37.02
Consumption (lpcd)	102.13	99.53	100.3	116.08	82.55	91.76
Volume collected outside the home (liters per day)	18.42	20.57	19.92	52.4	39.65	43.15
Diarrheal illness prevalence, children under five	40.0%	4.2%	15.1%	9.1%	12.5%	11.1%
% of households with any children under five	29%	25%	26%	27%	19%	21%
Water expenditures (M/mo.) – all sources	107.14	120.95	116.89	335.84	126.26	184.30
Water expenditures (M/mo.) – water collected outside home	6.63	30.76	23.58	218.06	69.57	110.36
Reconstructed Baseline Values						
Time collecting water (min./day) – recall	18.29	57.77	46.02	25.22	41.06	36.71
Volume collected outside the home (liters per day) – recall	21.37	73.55	57.38	41.69	71.17	62.80
Water expenditures (M/mo.) – water collected outside home*	5.75	61.42	44.31	78.47	28.36	42.46
Alternative measures of outcomes						
Estimated current: time collecting water (min./day)	51.58	29.35	35.21	143.07	114.61	122.81
Estimated baseline: time collecting water (min./day)	44.25	123.71	102.27	169.64	111.97	128.34
Estimated current value: water expenditures (M/mo.)	103.91	118.72	114.49	110.73	74.39	84.96
Estimated baseline value: water expenditures (M/mo.)	79.00	36.26	47.92	82.32	29.84	45.69

Table 71. Intermediate Outcomes - Mapoteng

INTERMEDIATE OUTCOMES	MAPOTENG Existing Customer	MAPOTENG New Customer	MAPOTENG Total
Intermediate Outcomes			
Time collecting water (min./day)	23.22	5.33	11.27
Consumption (lpcd)	102.39	73.39	83.02
Volume collected outside the home (liters per day)	9.1	3.97	5.67
Diarrheal illness prevalence, children under five	11.1%	4.8%	6.6%
% of households with any children under five	19%	26%	23%
Water expenditures (M/mo.) – all sources	59.41	62.97	61.73
Water expenditures (M/mo.) – water collected outside home	0.00	4.29	2.87
Reconstructed Baseline Values			
Time collecting water (min./day) – recall	26.06	25.93	25.97
Volume collected outside the home (liters per day) – recall	17.31	35.87	29.71
Water expenditures (M/mo.) – water collected outside home*	35.87	59.50	51.66
Alternative measures of outcomes			
Estimated current: time collecting water (min./day)	17.08	15.07	15.70
Estimated baseline: time collecting water (min./day)	56.06	100.44	85.55
Estimated current value: water expenditures (M/mo.)	60.87	62.64	62.03
Estimated baseline value: water expenditures (M/mo.)	43.33	19.47	27.05

Table 72. Perceived Changes – Maseru & Mazenod

PERCEIVED CHANGES	MASERU Existing Customer	MASERU New Customer	MASERU Total	MAZENOD Existing Customer	MAZENOD New Customer	MAZENOD Total
Time spent collecting water (min./day)						
Do not know	1.5%	0.0%	0.9%	7.6%	13.7%	11.7%
Much more now	2.1%	1.4%	1.8%	2.5%	4.1%	3.6%
A little more now	4.3%	4.8%	4.5%	0.8%	1.5%	1.3%
About the same	85.3%	41.4%	67.8%	50.0%	16.2%	27.3%
A little less now	6.3%	40.0%	19.7%	22.9%	41.1%	35.1%
Much less now	0.5%	12.4%	5.3%	16.1%	23.4%	21.0%
Consumption (lpcd)						
Do not know	1.3%	0.7%	1.1%	4.2%	14.2%	10.9%
Much more now	5.5%	20.7%	11.5%	18.6%	29.4%	25.9%
A little more now	21.5%	25.5%	23.1%	11.0%	19.8%	16.9%
About the same	61.5%	39.3%	52.6%	48.3%	21.8%	30.5%
A little less now	9.3%	12.4%	10.6%	16.9%	12.7%	14.1%
Much less now	0.9%	1.4%	1.1%	0.8%	2.0%	1.6%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	96.5%	94.5%	95.7%	91.5%	98.0%	95.9%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	96.5%	70.3%	86.1%	66.9%	27.9%	40.7%
Diarrheal illness prevalence, children under five						
Do not know	11.0%	10.7%	10.8%	39.3%	49.1%	46.1%
More	1.1%	3.6%	2.4%	0.0%	3.8%	2.6%
Less	25.3%	46.4%	36.1%	46.4%	32.1%	36.4%
About the same	62.6%	39.3%	50.6%	14.3%	15.1%	14.9%
Water expenditures (M/mo.)						
Do not know	24.7%	11.7%	19.5%	17.1%	24.5%	22.1%
Much more now	7.9%	26.9%	15.5%	29.1%	30.1%	29.8%
A little more now	20.5%	16.6%	18.9%	14.5%	13.3%	13.7%
About the same	40.8%	28.3%	35.8%	24.8%	18.9%	20.8%
A little less now	5.2%	13.8%	8.6%	12.0%	10.2%	10.8%
Much less now	0.9%	2.8%	1.7%	2.6%	3.1%	2.9%

Table 73. Perceived Changes – Teyateyaneng & Roma

PERCEIVED CHANGES	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Time spent collecting water (min./day)						
Do not know	5.3%	6.6%	6.1%	19.7%	18.7%	19.1%
Much more now	8.8%	1.1%	4.0%	2.6%	0.0%	1.2%
A little more now	1.8%	5.5%	4.1%	1.9%	0.2%	1.0%
About the same	61.4%	38.5%	47.2%	50.2%	11.2%	29.2%
A little less now	13.2%	33.0%	25.4%	15.6%	38.2%	27.8%
Much less now	9.6%	15.4%	13.2%	10.0%	31.7%	21.7%
Consumption (lpcd)						
Do not know	3.5%	2.7%	3.0%	21.2%	18.0%	19.5%
Much more now	9.6%	14.3%	12.5%	13.4%	30.8%	22.8%
A little more now	26.3%	42.3%	36.2%	10.0%	24.5%	17.8%
About the same	39.5%	26.9%	31.7%	46.8%	22.2%	33.6%
A little less now	13.2%	9.3%	10.8%	5.9%	3.6%	4.7%
Much less now	7.9%	4.4%	5.7%	2.6%	0.9%	1.7%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	100.0%	98.4%	99.0%	97.0%	97.5%	97.3%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	76.3%	48.4%	59.1%	62.5%	31.2%	45.6%
Diarrheal illness prevalence, children under five						
Do not know	43.5%	27.5%	33.3%	48.7%	25.3%	34.6%
More	4.3%	2.5%	3.2%	5.1%	0.0%	2.0%
Less	30.4%	17.5%	22.2%	30.8%	42.2%	37.6%
About the same	21.7%	52.5%	41.3%	15.4%	32.5%	25.7%
Water expenditures (M/mo.)						
Do not know	12.3%	13.7%	13.2%	24.2%	23.8%	24.0%
Much more now	28.9%	27.5%	28.0%	19.7%	25.6%	22.9%
A little more now	26.3%	33.5%	30.8%	23.4%	26.7%	25.2%
About the same	17.5%	15.9%	16.6%	27.5%	17.8%	22.2%

PERCEIVED CHANGES	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
A little less now	8.8%	6.0%	7.1%	3.7%	4.7%	4.3%
Much less now	6.1%	3.3%	4.4%	1.5%	1.3%	1.4%

Table 74. Perceived Changes – Morija & Mohale's Hoek

PERCEIVED CHANGES	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Time spent collecting water (min./day)						
Do not know	4.1%	5.1%	4.8%	0.0%	1.3%	0.8%
Much more now	9.5%	8.5%	8.8%	6.1%	3.8%	4.7%
A little more now	5.9%	1.7%	2.9%	14.3%	5.1%	8.6%
About the same	52.7%	26.3%	34.0%	42.9%	26.6%	32.8%
A little less now	19.5%	39.8%	33.9%	26.5%	32.9%	30.5%
Much less now	8.3%	18.6%	15.6%	10.2%	30.4%	22.7%
Consumption (lpcd)						
Do not know	8.9%	4.2%	5.6%	0.00%	0.00%	0.00%
Much more now	14.8%	23.7%	21.1%	20.4%	19.2%	19.7%
A little more now	23.1%	39.0%	34.3%	20.4%	33.3%	28.4%
About the same	32.5%	17.8%	22.1%	30.6%	29.5%	29.9%
A little less now	17.2%	9.3%	11.6%	22.4%	15.4%	18.1%
Much less now	3.6%	5.9%	5.2%	6.1%	2.6%	3.9%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	97.6%	91.5%	93.3%	65.3%	67.1%	66.4%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	75.7%	28.8%	42.6%	73.5%	48.1%	57.7%
Diarrheal illness prevalence, children under five						
Do not know	36.1%	33.3%	34.0%	66.7%	15.8%	22.6%
More	2.8%	5.6%	4.9%	0.0%	5.3%	4.6%
Less	33.3%	19.4%	22.6%	0.0%	26.3%	22.8%
About the same	27.8%	41.7%	38.5%	33.3%	52.6%	50.0%

PERCEIVED CHANGES	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Water expenditures (M/mo.)						
Do not know	22.5%	13.6%	16.2%	2.0%	2.5%	2.3%
Much more now	20.1%	36.4%	31.6%	22.4%	43.0%	35.2%
A little more now	27.8%	37.3%	34.5%	20.4%	20.3%	20.3%
About the same	20.1%	7.6%	11.3%	38.8%	19.0%	26.5%
A little less now	6.5%	3.4%	4.3%	8.2%	8.9%	8.6%
Much less now	3.0%	1.7%	2.1%	8.2%	6.3%	7.0%

Table 75. Perceived Changes – Mafeteng & Quthing

PERCEIVED CHANGES	MAFETENG Existing Customer	MAFETENG New Customer	MAFETENG Total	QUTHING Existing Customer	QUTHING New Customer	QUTHING Total
Time spent collecting water (min./day)						
Do not know	4.9%	4.3%	4.6%	36.5%	40.8%	39.1%
Much more now	9.8%	7.2%	8.5%	0.00%	0.00%	0.00%
A little more now	0.0%	2.9%	1.5%	0.0%	1.3%	0.8%
About the same	52.5%	14.5%	32.6%	40.4%	7.9%	21.0%
A little less now	19.7%	29.0%	24.6%	13.5%	27.6%	21.9%
Much less now	13.1%	42.0%	28.3%	9.6%	22.4%	17.2%
Consumption (lpcd)						
Do not know	1.6%	4.3%	3.1%	36.5%	34.2%	35.1%
Much more now	26.2%	49.3%	38.3%	23.1%	15.8%	18.7%
A little more now	21.3%	15.9%	18.5%	5.8%	25.0%	17.2%
About the same	29.5%	17.4%	23.2%	25.0%	10.5%	16.4%
A little less now	8.2%	10.1%	9.2%	5.8%	10.5%	8.6%
Much less now	13.1%	2.9%	7.8%	3.8%	3.9%	3.9%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	93.4%	88.4%	90.8%	96.2%	92.1%	93.7%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	77.0%	49.3%	62.5%	42.3%	14.5%	25.7%
Diarrheal illness prevalence, children under five						
Do not know	46.7%	30.4%	36.9%	68.7%	68.2%	68.4%
More	6.7%	4.3%	5.3%	0.00%	0.00%	0.00%
Less	20.0%	21.7%	21.0%	0.00%	0.00%	0.00%
About the same	26.7%	43.5%	36.7%	31.3%	31.8%	31.6%
Water expenditures (M/mo.)						
Do not know	6.6%	14.5%	10.7%	44.2%	42.1%	43.0%
Much more now	23.0%	39.1%	31.4%	25.0%	26.3%	25.8%
A little more now	18.0%	17.4%	17.7%	9.6%	17.1%	14.1%
About the same	32.8%	13.0%	22.4%	15.4%	2.6%	7.8%
A little less now	11.5%	8.7%	10.0%	0.0%	7.9%	4.7%
Much less now	8.2%	7.2%	7.7%	5.8%	3.9%	4.7%

Table 76. Perceived Changes – Qacha's Nek & Butha-Buthe

PERCEIVED CHANGES	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Time spent collecting water (min./day)						
Do not know	10.9%	27.4%	21.4%	2.1%	14.5%	9.8%
Much more now	2.2%	2.4%	2.3%	6.3%	5.3%	5.6%
A little more now	2.2%	0.0%	0.8%	10.4%	11.8%	11.3%
About the same	60.9%	16.7%	32.6%	58.3%	17.1%	32.6%
A little less now	8.7%	23.8%	18.4%	14.6%	30.3%	24.4%
Much less now	15.2%	29.8%	24.5%	8.3%	21.1%	16.3%
Consumption (lpcd)						
Do not know	17.4%	25.0%	22.3%	0.0%	11.8%	7.4%
Much more now	15.2%	25.0%	21.5%	8.3%	15.8%	13.0%
A little more now	10.9%	4.8%	7.0%	25.0%	39.5%	34.0%
About the same	37.0%	22.6%	27.8%	33.3%	17.1%	23.2%
A little less now	15.2%	14.3%	14.6%	25.0%	9.2%	15.2%
Much less now	4.3%	8.3%	6.9%	8.3%	6.6%	7.2%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	97.8%	96.4%	96.9%	58.3%	53.8%	55.5%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	65.2%	23.8%	38.8%	33.3%	22.7%	26.7%
Diarrheal illness prevalence, children under five						
Do not know	63.6%	74.1%	71.0%	66.7%	35.7%	41.0%
More	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Less	36.4%	14.8%	21.2%	33.3%	28.6%	29.4%
About the same	0.0%	11.1%	7.8%	0.0%	35.7%	29.6%
Water expenditures (M/mo.)						
Do not know	37.0%	38.1%	37.7%	2.1%	14.5%	9.8%
Much more now	17.4%	32.1%	26.8%	14.6%	22.4%	19.4%
A little more now	15.2%	8.3%	10.8%	20.8%	34.2%	29.2%
About the same	23.9%	8.3%	14.0%	41.7%	21.1%	28.8%

PERCEIVED CHANGES	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
A little less now	2.2%	8.3%	6.1%	16.7%	6.6%	10.4%
Much less now	4.3%	4.8%	4.6%	4.2%	1.3%	2.4%

Table 77. Perceived Changes – Leribe & Mokhotlong

PERCEIVED CHANGES	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Time spent collecting water (min./day)						
Do not know	0.00%	0.00%	0.00%	6.1%	18.9%	15.4%
Much more now	5.3%	4.5%	4.7%	9.1%	3.3%	4.9%
A little more now	18.4%	2.2%	7.1%	0.0%	1.1%	0.8%
About the same	50.0%	27.0%	33.8%	45.5%	14.4%	23.0%
A little less now	13.2%	31.5%	26.0%	24.2%	38.9%	34.9%
Much less now	13.2%	34.8%	28.4%	15.2%	23.3%	21.1%
Consumption (lpcd)						
Do not know	2.6%	1.1%	1.6%	3.0%	16.7%	12.9%
Much more now	10.5%	33.7%	26.8%	27.3%	24.4%	25.2%
A little more now	18.4%	24.7%	22.8%	18.2%	33.3%	29.2%
About the same	36.8%	22.5%	26.8%	39.4%	18.9%	24.5%
A little less now	23.7%	14.6%	17.3%	12.1%	5.6%	7.4%
Much less now	7.9%	3.4%	4.7%	0.0%	1.1%	0.8%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	71.1%	70.8%	70.9%	75.8%	84.4%	82.1%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	63.2%	49.4%	53.5%	66.7%	37.8%	45.7%
Diarrheal illness prevalence, children under five						
Do not know	36.4%	0.0%	17.3%	14.3%	60.0%	40.8%
More	18.2%	8.3%	13.0%	28.6%	0.0%	12.0%

PERCEIVED CHANGES	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Less	27.3%	58.3%	43.5%	42.9%	40.0%	41.2%
About the same	18.2%	33.3%	26.1%	14.3%	0.0%	6.0%
Water expenditures (M/mo.)						
Do not know	5.3%	6.7%	6.3%	6.1%	22.2%	17.8%
Much more now	23.7%	37.1%	33.1%	30.3%	22.2%	24.4%
A little more now	18.4%	20.2%	19.7%	24.2%	28.9%	27.6%
About the same	28.9%	22.5%	24.4%	27.3%	10.0%	14.7%
A little less now	21.1%	10.1%	13.4%	12.1%	10.0%	10.6%
Much less now	2.6%	3.4%	3.2%	0.0%	6.7%	4.8%

Table 78. Perceived Changes - Mapoteng

PERCEIVED CHANGES	MAPOTENG Existing Customer	MAPOTENG New Customer	MAPOTENG Total
Time spent collecting water (min./day)			
Do not know	7.0%	8.2%	7.8%
Much more now	2.3%	0.0%	0.8%
A little more now	4.7%	0.0%	1.5%
About the same	48.8%	22.4%	31.1%
A little less now	30.2%	48.2%	42.3%
Much less now	7.0%	21.2%	16.5%
Consumption (lpcd)			
Do not know	4.7%	1.2%	2.3%
Much more now	9.3%	11.8%	10.9%
A little more now	39.5%	43.5%	42.2%
About the same	27.9%	30.6%	29.7%
A little less now	16.3%	8.2%	10.9%
Much less now	2.3%	4.7%	3.9%
Feels they have sufficient amount of water (considering all sources used) (% Yes)	97.7%	94.1%	95.3%
Feels they used to have a sufficient amount of water (considering all sources used) (% Yes)	62.8%	61.2%	61.7%
Diarrheal illness prevalence, children under five			
Do not know	25.0%	22.7%	23.3%
More	0.0%	4.5%	3.3%
Less	12.5%	50.0%	40.1%
About the same	62.5%	22.7%	33.2%
Water expenditures (M/mo.)			
Do not know	14.0%	14.1%	14.1%
Much more now	18.6%	32.9%	28.2%
A little more now	39.5%	32.9%	35.1%
About the same	7.0%	7.1%	7.0%
A little less now	7.0%	7.1%	7.0%
Much less now	14.0%	5.9%	8.6%

Table 79. Other Outcomes – Maseru & Mazenod

OTHER	MASERU Existing Customer	MASERU New Customer	MASERU Total	MAZENOD Existing Customer	MAZENOD New Customer	MAZENOD Total
Treatment of main drinking water source (current)						
Do not know	0.1%	0.0%	0.1%	0.00%	0.00%	0.00%
Yes, always	18.1%	17.9%	18.1%	4.2%	11.2%	8.9%
Yes, sometimes	14.4%	16.6%	15.3%	11.9%	5.6%	7.6%
Rarely/once in a while	11.5%	17.2%	13.8%	20.3%	19.3%	19.6%
No, never	55.9%	48.3%	52.8%	63.6%	64.0%	63.8%
Treatment of main drinking water source (recall)						
Do not know	0.8%	1.4%	1.0%	4.2%	11.2%	8.9%
Yes, always	14.4%	15.9%	15.0%	10.2%	8.6%	9.1%
Yes, sometimes	14.9%	11.0%	13.4%	10.2%	7.1%	8.1%
Rarely/once in a while	9.9%	19.3%	13.6%	19.5%	9.6%	12.9%
No, never	60.0%	52.4%	57.0%	55.9%	63.5%	61.0%
Stores water in household for any purpose (% Yes)	81.1%	81.0%	81.1%	80.5%	87.8%	85.4%
Main drinking water container used only for drinking (% Yes)	19.9%	36.7%	28.2%	37.8%	37.8%	37.8%
Safe storage practices (WHO/JMP)						
Full	0.4%	0.0%	0.2%	0.00%	0.00%	0.00%
Partial	97.9%	98.7%	98.3%	100.0%	96.5%	97.5%
Non-compliant	1.8%	1.3%	1.5%	0.0%	3.5%	2.5%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	0.00%	0.00%	0.00%	0.0%	0.5%	0.3%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	17.5%	14.5%	16.3%	24.6%	7.7%	13.3%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	32.6%	33.1%	32.8%	9.3%	32.8%	25.0%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	42.1%	43.4%	42.7%	59.3%	54.4%	56.0%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	2.5%	7.6%	4.6%	1.7%	2.6%	2.3%
NOT OBSERVED: No permission to see	5.2%	1.4%	3.6%	5.1%	2.1%	3.1%
Water is available where hands are washed (% Yes)	88.3%	78.0%	84.1%	90.9%	84.9%	86.8%

Table 80. Other Outcomes – Teyateyaneng & Roma

OTHER	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Treatment of main drinking water source (current)						
Do not know	0.0%	0.5%	0.3%	2.2%	0.2%	1.1%
Yes, always	13.2%	11.0%	11.8%	11.9%	12.8%	12.4%
Yes, sometimes	9.6%	6.0%	7.4%	11.2%	6.1%	8.4%
Rarely/once in a while	10.5%	10.4%	10.5%	31.2%	22.9%	26.7%
No, never	66.7%	72.0%	69.9%	43.5%	58.0%	51.3%
Treatment of main drinking water source (recall)						
Do not know	6.1%	9.3%	8.1%	13.8%	16.4%	15.2%
Yes, always	10.5%	6.6%	8.1%	7.8%	10.8%	9.4%
Yes, sometimes	2.6%	4.4%	3.7%	14.5%	7.6%	10.8%
Rarely/once in a while	6.1%	3.8%	4.7%	21.2%	11.5%	15.9%
No, never	74.6%	75.8%	75.3%	42.8%	53.7%	48.7%
Stores water in household for any purpose (% Yes)	73.7%	82.4%	79.1%	84.8%	88.1%	86.6%
Main drinking water container used only for drinking (% Yes)	36.5%	30.5%	32.8%	25.4%	21.1%	23.1%
Safe storage practices (WHO/JMP)						
Full	1.9%	0.0%	0.7%	0.00%	0.00%	0.00%
Partial	92.3%	98.8%	96.3%	99.2%	100.0%	99.6%
Non-compliant	5.8%	1.2%	3.0%	0.8%	0.0%	0.4%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	0.00%	0.00%	0.00%	1.5%	0.2%	0.8%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	18.4%	10.4%	13.5%	6.8%	6.5%	6.6%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	33.3%	26.9%	29.4%	7.1%	9.9%	8.6%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	17.5%	23.1%	21.0%	63.2%	53.6%	58.0%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	28.9%	34.6%	32.4%	7.5%	13.5%	10.8%
NOT OBSERVED: No permission to see	1.8%	4.9%	3.7%	12.0%	13.7%	13.0%
Water is available where hands are washed (% Yes)	67.1%	63.6%	65.1%	93.6%	85.9%	89.6%

Table 81. Other Outcomes – Morija & Mohale's Hoek

OTHER	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Treatment of main drinking water source (current)						
Do not know	0.0%	1.7%	1.2%	0.00%	0.00%	0.00%
Yes, always	15.4%	8.5%	10.5%	6.1%	12.7%	10.2%
Yes, sometimes	8.3%	9.3%	9.0%	18.4%	12.7%	14.8%
Rarely/once in a while	21.3%	12.7%	15.2%	20.4%	21.5%	21.1%
No, never	55.0%	67.8%	64.0%	55.1%	53.2%	53.9%
Treatment of main drinking water source (recall)						
Do not know	5.4%	7.6%	7.0%	0.0%	1.3%	0.8%
Yes, always	16.1%	9.3%	11.3%	2.0%	8.9%	6.3%
Yes, sometimes	8.3%	8.5%	8.4%	12.2%	3.8%	7.0%
Rarely/once in a while	13.7%	8.5%	10.0%	16.3%	16.5%	16.4%
No, never	56.5%	66.1%	63.3%	69.4%	69.6%	69.5%
Stores water in household for any purpose (% Yes)	75.7%	75.4%	75.5%	89.8%	94.9%	93.0%
Main drinking water container used only for drinking (% Yes)	34.9%	43.1%	40.5%	51.4%	32.1%	39.9%
Safe storage practices (WHO/JMP)						
Full	2.4%	0.0%	0.8%	0.00%	0.00%	0.00%
Partial	92.8%	98.0%	96.3%	100.0%	98.1%	98.9%
Non-compliant	4.8%	2.0%	2.9%	0.0%	1.9%	1.1%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	0.6%	0.0%	0.2%	0.00%	0.00%	0.00%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	14.2%	10.2%	11.4%	10.2%	5.1%	7.1%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	30.8%	25.4%	27.0%	20.4%	20.5%	20.5%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	23.1%	33.9%	30.7%	63.3%	47.4%	53.5%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	28.4%	22.9%	24.5%	6.1%	25.6%	18.2%
NOT OBSERVED: No permission to see	3.0%	7.6%	6.3%	0.0%	1.3%	0.8%
Water is available where hands are washed (% Yes)	73.0%	62.2%	65.3%	56.5%	64.9%	61.2%

Table 82. Other Outcomes – Mafeteng & Quthing

OTHER	MAFETENG Existing Customer	MAFETENG New Customer	MAFETENG Total	QUTHING Existing Customer	QUTHING New Customer	QUTHING Total
Treatment of main drinking water source (current)						
Do not know	0.00%	0.00%	0.00%	0.0%	2.6%	1.6%
Yes, always	3.3%	17.4%	10.7%	13.5%	5.3%	8.6%
Yes, sometimes	21.3%	11.6%	16.2%	15.4%	10.5%	12.5%
Rarely/once in a while	26.2%	21.7%	23.9%	21.2%	26.3%	24.2%
No, never	49.2%	49.3%	49.2%	50.0%	55.3%	53.1%
Treatment of main drinking water source (recall)						
Do not know	1.6%	8.7%	5.3%	34.6%	38.2%	36.7%
Yes, always	0.0%	13.0%	6.8%	1.9%	5.3%	3.9%
Yes, sometimes	14.8%	10.1%	12.3%	3.8%	5.3%	4.7%
Rarely/once in a while	31.1%	8.7%	19.4%	5.8%	3.9%	4.7%
No, never	52.5%	59.4%	56.1%	53.8%	47.4%	50.0%
Stores water in household for any purpose (% Yes)	90.2%	92.8%	91.5%	92.3%	93.4%	93.0%
Main drinking water container used only for drinking (% Yes)	25.5%	38.9%	32.3%	27.5%	21.1%	23.7%
Safe storage practices (WHO/JMP)						
Full	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Partial	98.0%	96.3%	97.2%	95.0%	96.5%	95.9%
Non-compliant	2.0%	3.7%	2.8%	5.0%	3.5%	4.1%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	1.6%	2.9%	2.3%	0.00%	0.00%	0.00%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	13.1%	21.7%	17.6%	7.7%	6.7%	7.1%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	23.0%	14.5%	18.5%	13.5%	10.7%	11.8%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	55.7%	56.5%	56.1%	75.0%	73.3%	74.0%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	4.9%	1.4%	3.1%	3.8%	6.7%	5.5%
NOT OBSERVED: No permission to see	1.6%	2.9%	2.3%	0.0%	1.3%	0.8%
Water is available where hands are washed (% Yes)	69.6%	68.8%	69.2%	98.0%	98.5%	98.3%

Table 83. Other Outcomes – Qacha's Nek & Butha-Buthe

OTHER	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Treatment of main drinking water source (current)						
Do not know	2.2%	0.0%	0.8%	0.00%	0.00%	0.00%
Yes, always	10.9%	10.7%	10.8%	6.3%	14.1%	11.2%
Yes, sometimes	15.2%	16.7%	16.1%	8.3%	1.3%	3.9%
Rarely/once in a while	15.2%	7.1%	10.1%	18.8%	20.5%	19.9%
No, never	56.5%	65.5%	62.2%	66.7%	64.1%	65.1%
Treatment of main drinking water source (recall)						
Do not know	15.2%	28.6%	23.8%	2.1%	11.7%	8.1%
Yes, always	6.5%	10.7%	9.2%	6.3%	16.9%	12.9%
Yes, sometimes	10.9%	1.2%	4.7%	8.3%	9.1%	8.8%
Rarely/once in a while	13.0%	6.0%	8.5%	14.6%	11.7%	12.8%
No, never	54.3%	53.6%	53.9%	68.8%	50.6%	57.4%
Stores water in household for any purpose (% Yes)	95.7%	90.5%	92.3%	95.8%	84.6%	88.8%
Main drinking water container used only for drinking (% Yes)	8.3%	6.8%	7.4%	59.5%	64.7%	62.6%
Safe storage practices (WHO/JMP)						
Full	0.00%	0.00%	0.00%	5.4%	2.0%	3.4%
Partial	94.4%	98.3%	96.8%	83.8%	92.2%	88.7%
Non-compliant	5.6%	1.7%	3.2%	10.8%	5.9%	7.9%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	6.5%	1.2%	3.1%	8.5%	9.2%	9.0%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	15.2%	13.1%	13.9%	31.9%	26.3%	28.4%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	69.6%	77.4%	74.6%	21.3%	26.3%	24.4%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	6.5%	7.1%	6.9%	36.2%	34.2%	34.9%
NOT OBSERVED: No permission to see	2.2%	0.0%	0.8%	2.1%	3.9%	3.3%

OTHER	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Water is available where hands are washed (% Yes)	95.2%	85.7%	89.1%	75.9%	70.2%	72.3%

Table 84. Other Outcomes – Leribe & Mokhotlong

OTHER	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Treatment of main drinking water source (current)						
Do not know	0.00%	0.00%	0.00%	3.0%	0.0%	0.8%
Yes, always	18.4%	14.6%	15.7%	24.2%	11.1%	14.7%
Yes, sometimes	23.7%	7.9%	12.6%	18.2%	13.3%	14.7%
Rarely/once in a while	15.8%	16.9%	16.5%	33.3%	32.2%	32.5%
No, never	42.1%	60.7%	55.1%	21.2%	43.3%	37.3%
Treatment of main drinking water source (recall)						
Do not know	0.0%	1.1%	0.8%	3.0%	4.4%	4.1%
Yes, always	15.8%	9.0%	11.0%	27.3%	12.2%	16.4%
Yes, sometimes	23.7%	10.1%	14.2%	24.2%	13.3%	16.3%
Rarely/once in a while	10.5%	7.9%	8.7%	27.3%	22.2%	23.6%
No, never	50.0%	71.9%	65.4%	18.2%	47.8%	39.6%
Stores water in household for any purpose (% Yes)	84.2%	93.2%	90.5%	93.9%	98.9%	97.5%
Main drinking water container used only for drinking (% Yes)	60.0%	40.6%	45.2%	36.0%	38.0%	37.5%
Safe storage practices (WHO/JMP)						
Full	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Partial	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Non-compliant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Handwashing station in household						
NOT OBSERVED: Other reason, specify	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

OTHER	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
OBSERVED: Fixed facility observed (sink/tap) in dwelling	21.1%	19.3%	19.8%	6.5%	3.5%	4.3%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	26.3%	38.6%	34.9%	12.9%	4.7%	6.9%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	31.6%	34.1%	33.3%	64.5%	58.1%	59.9%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	18.4%	5.7%	9.5%	0.0%	5.8%	4.2%
NOT OBSERVED: No permission to see	2.6%	2.3%	2.4%	16.1%	24.4%	22.2%
Water is available where hands are washed (% Yes)	76.7%	72.8%	73.9%	65.4%	64.3%	64.6%

Table 85. Other Outcomes – Mapoteng

OTHER	MAPOTENG Existing Customer	MAPOTENG New Customer	MAPOTENG Total
Treatment of main drinking water source (current)			
Do not know	0.00%	0.00%	0.00%
Yes, always	7.0%	8.2%	7.8%
Yes, sometimes	2.3%	7.1%	5.5%
Rarely/once in a while	11.6%	10.6%	10.9%
No, never	79.1%	74.1%	75.8%
Treatment of main drinking water source (recall)			
Do not know	2.3%	7.1%	5.5%
Yes, always	4.7%	12.9%	10.2%
Yes, sometimes	2.3%	5.9%	4.7%
Rarely/once in a while	2.3%	4.7%	3.9%
No, never	88.4%	69.4%	75.7%
Stores water in household for any purpose (% Yes)	88.4%	81.2%	83.6%
Main drinking water container used only for drinking (% Yes)	14.8%	20.0%	17.8%
Safe storage practices (WHO/JMP)			
Full	0.00%	0.00%	0.00%
Partial	100.0%	97.1%	98.4%
Non-compliant	0.0%	2.9%	1.6%
Handwashing station in household			
NOT OBSERVED: Other reason, specify	0.00%	0.00%	0.00%
OBSERVED: Fixed facility observed (sink/tap) in dwelling	9.3%	3.5%	5.4%
OBSERVED: Fixed facility observed (sink/tap) in plot/yard	27.9%	30.6%	29.7%
OBSERVED: Mobile object observed (bucket/jug/kettle, etc.)	48.8%	41.2%	43.7%
NOT OBSERVED: No handwashing place in dwelling/yard/plot	14.0%	23.5%	20.4%
NOT OBSERVED: No permission to see	0.0%	1.2%	0.8%
Water is available where hands are washed (% Yes)	67.6%	54.7%	59.4%

Table 86. Allocations of Time – Maseru & Mazenod

ALLOCATIONS OF TIME	MASERU Existing Customer	MASERU New Customer	MASERU Total	MAZENOD Existing Customer	MAZENOD New Customer	MAZENOD Total
Use of extra time						
Nothing	2.6%	6.9%	6.4%	0.0%	6.2%	5.0%
Paid work/Earn Money	13.2%	4.2%	5.4%	0.0%	1.2%	1.0%
Unpaid work	0.0%	6.9%	6.0%	25.0%	14.8%	16.8%
Study	2.6%	1.4%	1.6%	8.3%	2.5%	3.6%
Household chores	34.2%	58.3%	55.1%	70.8%	67.9%	68.5%
Household business	2.6%	2.8%	2.8%	0.0%	1.2%	1.0%
Rest or relaxation/leisure activities	52.6%	43.1%	44.3%	25.0%	16.0%	17.8%
Household does less…						
Nothing	21.4%	25.0%	23.2%	33.3%	14.3%	19.2%
Paid work/Earn Money	0.0%	0.0%	0.0%	33.3%	0.0%	8.6%
Unpaid work	7.1%	0.0%	3.6%	0.0%	14.3%	10.6%
Study	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Household chores	42.9%	75.0%	58.8%	33.3%	42.9%	40.4%
Household business	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	21.4%	25.0%	23.2%	0.0%	14.3%	10.6%

Table 87. Allocations of Time – Teyateyaneng & Roma

ALLOCATIONS OF TIME	TEYATEYANENG Existing Customer	TEYATEYANENG New Customer	TEYATEYANENG Total	ROMA Existing Customer	ROMA New Customer	ROMA Total
Use of extra time						
Nothing	17.4%	16.9%	17.0%	11.4%	22.1%	20.5%
Paid work/Earn Money	21.7%	21.1%	21.3%	5.7%	8.3%	7.9%
Unpaid work	43.5%	32.4%	35.1%	8.6%	6.9%	7.1%
Study	30.4%	26.8%	27.7%	0.0%	2.5%	2.2%
Household chores	65.2%	66.2%	66.0%	65.7%	56.2%	57.6%
Household business	0.0%	2.8%	2.1%	2.9%	1.1%	1.4%
Rest or relaxation/leisure activities	39.1%	25.4%	28.7%	20.0%	27.9%	26.7%
Household does less…						
Nothing	40.0%	77.8%	64.4%	25.0%	16.7%	20.7%
Paid work/Earn Money	20.0%	11.1%	14.3%	0.0%	33.3%	17.2%
Unpaid work	0.0%	11.1%	7.2%	0.0%	0.0%	0.0%
Study	0.0%	11.1%	7.2%	25.0%	0.0%	12.1%
Household chores	40.0%	11.1%	21.4%	25.0%	33.3%	29.3%
Household business	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	0.0%	0.0%	0.0%	25.0%	16.7%	20.7%

Table 88. Allocations of Time – Morija & Mohale's Hoek

ALLOCATIONS OF TIME	MORIJA Existing Customer	MORIJA New Customer	MORIJA Total	MOHALE'S HOEK Existing Customer	MOHALE'S HOEK New Customer	MOHALE'S HOEK Total
Use of extra time						
Nothing	13.2%	15.6%	15.3%	5.0%	7.1%	6.6%
Paid work/Earn Money	18.4%	17.2%	17.4%	30.0%	5.4%	11.8%
Unpaid work	26.3%	21.9%	22.5%	5.0%	7.1%	6.6%
Study	31.6%	15.6%	18.0%	5.0%	0.0%	1.3%
Household chores	68.4%	68.8%	68.7%	45.0%	71.4%	64.5%
Household business	5.3%	4.7%	4.8%	15.0%	5.4%	7.9%
Rest or relaxation/leisure activities	34.2%	20.3%	22.4%	20.0%	14.3%	15.8%
Household does less…						
Nothing	20.0%	71.4%	62.6%	20.0%	25.0%	21.4%
Paid work/Earn Money	0.0%	0.0%	0.0%	20.0%	0.0%	14.2%
Unpaid work	20.0%	14.3%	15.3%	20.0%	0.0%	14.2%
Study	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Household chores	40.0%	14.3%	18.7%	40.0%	50.0%	42.9%
Household business	20.0%	14.3%	15.3%	10.0%	0.0%	7.1%
Rest or relaxation/leisure activities	0.0%	0.0%	0.0%	0.0%	25.0%	7.2%

Table 89. Allocations of Time – Mafeteng & Quthing

ALLOCATIONS OF TIME	MAFETENG Existing Customer	MAFETENG New Customer	MAFETENG Total	QUTHING Existing Customer	QUTHING New Customer	QUTHING Total
Use of extra time						
Nothing	5.0%	6.8%	6.2%	16.7%	12.5%	13.6%
Paid work/Earn Money	10.0%	4.5%	6.3%	0.0%	12.5%	9.1%
Unpaid work	0.0%	4.5%	3.1%	16.7%	12.5%	13.6%
Study	0.0%	4.5%	3.1%	0.0%	6.3%	4.6%
Household chores	70.0%	77.3%	75.0%	83.3%	68.8%	72.7%
Household business	5.0%	4.5%	4.7%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	20.0%	20.5%	20.3%	0.0%	6.3%	4.6%
Household does less…						
Nothing	100.0%	0.0%	12.8%	0.0%	0.0%	0.0%
Paid work/Earn Money	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unpaid work	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Study	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Household chores	0.0%	57.1%	49.8%	0.0%	0.0%	0.0%
Household business	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	0.0%	28.6%	24.9%	0.0%	0.0%	0.0%

Table 90. Allocations of Time – Qacha's Nek & Butha-Buthe

ALLOCATIONS OF TIME	QACHA'S NEK Existing Customer	QACHA'S NEK New Customer	QACHA'S NEK Total	BUTHA-BUTHE Existing Customer	BUTHA-BUTHE New Customer	BUTHA-BUTHE Total
Use of extra time						
Nothing	20.0%	6.7%	8.6%	15.4%	6.9%	9.4%
Paid work/Earn Money	0.0%	10.0%	8.5%	15.4%	27.6%	23.9%
Unpaid work	20.0%	20.0%	20.0%	7.7%	3.4%	4.7%
Study	0.0%	3.3%	2.8%	0.0%	3.4%	2.4%
Household chores	20.0%	60.0%	54.1%	38.5%	48.3%	45.3%
Household business	0.0%	0.0%	0.0%	7.7%	6.9%	7.1%
Rest or relaxation/leisure activities	40.0%	13.3%	17.2%	15.4%	20.7%	19.1%
Household does less…						
Nothing	0.0%	0.0%	0.0%	0.0%	20.0%	14.5%
Paid work/Earn Money	0.0%	0.0%	0.0%	0.0%	20.0%	14.5%
Unpaid work	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Study	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Household chores	0.0%	0.0%	0.0%	100.0%	20.0%	42.2%
Household business	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	0.0%	0.0%	0.0%	0.0%	20.0%	14.5%

Table 91. Allocations of Time – Leribe & Mokhotlong

ALLOCATIONS OF TIME	LERIBE Existing Customer	LERIBE New Customer	LERIBE Total	MOKHOTLONG Existing Customer	MOKHOTLONG New Customer	MOKHOTLONG Total
Use of extra time						
Nothing	0.0%	4.9%	4.4%	0.0%	10.3%	8.5%
Paid work/Earn Money	0.0%	6.6%	5.9%	12.5%	2.6%	4.3%
Unpaid work	0.0%	3.3%	2.9%	0.0%	2.6%	2.1%
Study	0.0%	0.0%	0.0%	0.0%	2.6%	2.1%
Household chores	57.1%	63.9%	63.2%	75.0%	76.9%	76.6%
Household business	0.0%	8.2%	7.4%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	57.1%	29.5%	32.3%	25.0%	25.6%	25.5%
Household does less…						
Nothing	40.0%	40.0%	40.0%	0.0%	0.0%	0.0%
Paid work/Earn Money	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unpaid work	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Study	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Household chores	60.0%	40.0%	50.0%	0.0%	0.0%	0.0%
Household business	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest or relaxation/leisure activities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 92. Allocations of Time – Mapoteng

ALLOCATIONS OF TIME	MAPOTENG Existing Customer	MAPOTENG New Customer	MAPOTENG Total
Use of extra time			
Nothing	13.3%	5.0%	6.6%
Paid work/Earn Money	6.7%	11.7%	10.7%
Unpaid work	46.7%	45.0%	45.3%
Study	46.7%	26.7%	30.6%
Household chores	60.0%	60.0%	60.0%
Household business	6.7%	3.3%	4.0%
Rest or relaxation/leisure activities	53.3%	28.3%	33.3%
Household does less…			
Nothing	0.0%	0.0%	0.0%
Paid work/Earn Money	0.0%	0.0%	0.0%
Unpaid work	0.0%	0.0%	0.0%
Study	0.0%	0.0%	0.0%
Household chores	100.0%	0.0%	100.0%
Household business	33.3%	0.0%	33.3%
Rest or relaxation/leisure activities	0.0%	0.0%	0.0%

INDUSTRY: SITE VISIT PHOTOGRAPHS

Table 93. CMT Textile Factory Processes

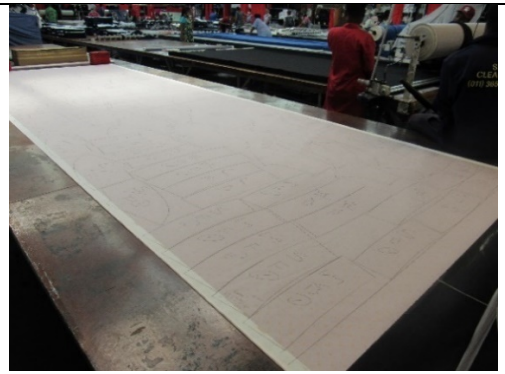
Create Yarn (Step C) From left: a table in Tai Yuan where various templates are sketched with fabric unrolled on tables in the background; lucky manufacturing with fabric unrolled and weighted with paper on top to draw stencils for cutting; more cutting tables at Tai Yuan.			
"Make" (Step D) Assembly line at Tai Yuan where sewing is taking place.			
"Trim/ Pack/ Iron" (Step F) From left: Ironing station for trousers before packing at Tai Yuan; ironing station for blouses before packing at Lucky Manufacturing; packed garments at Lucky Manufacturing			

Table 94. Wet Processes

Make yarn (Step A) From left, all from Formosa: raw cotton; yarn being spooled; spool of yarn ready for sizing/dyeing (pre-wet processes, no water required)			
Dye, treat, and weave yarn into fabric (Step B) From left, all from Formosa: Thread being run through sizing solution to strengthen for weaving; sized thread being run through dye for dyeing; dyed/sized thread being woven into denim fabric.			
"Wash, bleach, desize, etc. garment" (Step E) From left (all from Nien Hsing): machines for stone washing (see jeans with pumice outside machines); station for bleaching; spot dyeing/treatment of some garments.			

Table 95. Textile Factory Wastewater Runoff and Treatment

Waste-water Runoff From left: wastewater runoff in Nien Hsing wash plant, wastewater runoff in Formosa textile factory, closeup of soapy wastewater.			
Waste-water Treatment From left (all CGM): separation of solids overseeing filtration beds; sludge dehydration machine concentrating solid dye particles, pumice, and thread from wastewater; final product—clean water recycled to wash room for further use.			

ANNEX C: STAKEHOLDER COMMENTS

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
1	MCC M&E Lead	Overall	Please review the report for small typos throughout	Done, thank you.
2	MCC M&E Lead	vi	For references to disbursed funds, please use the audit reports of final MCC and GOL funding (See Report NO. M-000-14-010-N--this was included in background docs for the evaluation) rather than the Weekly Financial Report that has been cited in footnote 6	Corrected with reference to Report NO. M-000-14-010-N, thank you.
3	MCC M&E Lead	vi	Please define "WB" before using it in footnote 7; also double-check abbreviations throughout to ensure they occur at first reference to full names	Done, thank you.
4	MCC M&E Lead	viii	Figure 2: fix "health outcomes" so it's more legible; change direction of arrow in "Manufacturing opportunities" box	In our view of the document, health outcomes is fully visible and legible. We will ensure it is so in the final PDF version as well. Thank you for the correction on the arrow, fixed.
5	MCC M&E Lead	viii	Ensure no section headings appear at the end of a page in the final version; see "Evaluation Summary" at the bottom of this page (and other examples elsewhere).	Done, thank you.

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
6	MCC M&E Lead	xiii	Please state why you opted for reporting the Gaussian kernel results in the body of the report (here and in the corresponding discussion in the main report)	Best practice is to compare results from multiple propensity score algorithms, on the basis of how well each does to improve balance of the two groups being compared, and because different algorithms treat the data and propensity scores differently in the estimation of the ATT. As all the algorithms we compared produced similar results, we opted to present results from just one of the algorithms in the report for simplicity. The Gaussian kernel method was chosen because it produced a matched sample of T and C with good balance. While the five nearest-neighbor algorithm also produced good balance, Kernel methods in general use weighted averages of the comparison observations on the basis of the propensity score so it is generally expected that kernel methods are able to use more of the information that is available within the data to produce estimates. We thus opted to present the Gaussian kernel results within the body of the report. Similar language is now entered in section 5.3.2.2.1 of the report.
7	MCC M&E Lead	xv	Are WASCO's complaints that it was problematic to introduce Metolong to their aging system valid? What would have been a more appropriate strategy?	We have added text in the executive summary and section 5.2.2.1 to address this point. In sum, this potential issue was unknown at the time of Compact formulation but was likely knowable after a hydraulic assessment was completed around the time of Compact signing (MCC Investment Memo). To the Metolong Authority's point, it would have been incumbent on WASCO and the GoL to anticipate this problem after the assessment was completed and install pressure reducing/sustaining valves. A more appropriate strategy would have been - and still could be - the installation of offtakes from the bulk supply main, with pressures in the distribution networks being controlled by pressure reducing / pressure sustaining valves. There are very low associated maintenance costs and capital costs for these multiple valve installations which could be offset by reduction in plant operating costs in two to three years. The Maseru water treatment plant could be dismantled or mothballed until it is needed to supplement the Metolong Supply.
8	MCC M&E Lead	xviii	I was confused about who LogiProc was so suggest introducing their role sooner	Their role has been added to the identical footnotes on current pages xviii and 40, as it is summarized on the LogiProc website: http://www.logiproc.co.za/project/site-operating-maintance-project/
9	MCC M&E Lead	xix	SI is very positive about the Metolong O&M plan--is that mostly based on the completeness of their plans or because there is	We have added to the executive summary and section 5.2.5.2 that these are not only complete but also were observed being implemented. SI's positive

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
			evidence that they are being implemented?	opinion of the O&M procedures stemmed from the implied assurance from key informants that the strong implementation would continue.
10	MCC M&E Lead	xxii	Can you estimate baseline levels of water-related disease from other data sources for context as we consider what kinds of reductions might have been feasible?	As this evaluation was done ex-post, baseline values for diarrheal illness were not collected, and it was not feasible to ask questions in the survey to reconstruct a baseline. Other sources of data, however, can shed some light on the baseline conditions in similar populations of interest. * Lesotho DHS 2004 - Urban areas: 8.9% prevalence of diarrheal illness among children under five, in last two weeks. The DHS 2004 report does not provide a breakdown of prevalence by households with different primary drinking water sources according to the JMP improved or unimproved criteria. * Lesotho DHS 2009 - Urban areas: 9.8% prevalence of diarrheal illness among children under five, in last two weeks. Also reported in the DHS 2009 is under-five diarrheal illness prevalence among those whose main drinking water source is improved (10.6% prevalence), versus unimproved (12.9%). [Note: The two values for improved and unimproved reported in the DHS 2009 were used as the basis for sample size calculations for Design A and Design B impact evaluations in this report – see Annex B as well as Summative EDR for more detail on sample size calculations.] * Lesotho DHS 2014 – Urban areas: 10% prevalence of diarrheal illness among children under five, in last two weeks. Also reported in the DHS 2014 is under-five diarrheal illness prevalence among those whose main drinking water source is improved (11% prevalence), versus unimproved (14%). * The NORC baseline (conducted in conjunction with the Lesotho Bureau of Statistics IEMS 2012 survey), did not report on diarrheal illness prevalence according to the same definition above; that instrument asked whether anyone in the household experienced diarrheal illness in the last two weeks, and whether any children under five experienced diarrheal illness in the last two weeks, and for each of those a follow-up asking for the number of such people. Additional follow up questions related to illness were asked only for one child, in cases where more than one child was reported to have diarrheal illness. This IEMS dataset does not allow for reporting on baseline values with the same definition as above. The dataset provided to SI has very few observations (n=12) for the answer to how many children under five in the household experienced diarrheal illness in the last two weeks.

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
11	MCC M&E Lead	1	Where does the reference to satisfying demand through 2020 come from as part of the project's objective?	This reference comes from the 2007 Additional Feasibility Study, which makes various references to Metolong outputs being sized to meet the medium-demand scenario for 2020 (see pages 2-3, 2-29, 7-20) and where the medium-demand scenario for 2020 roughly approximates the ultimate 75 Ml/day capacity selected for the Dam. However, the study later states on page S-30 that "the Metolong scheme will, as long as the capacity of the existing water supply system in Maseru is maintained, ensure water demands are met well beyond 2020." We have revised the objective text on this page as such.
11.1	MCC M&E Lead	1	(Follow-up to evaluator response above) There's a reference on p. xvii and some other pages to satisfying demand through "2030"; should those references also point to 2020?	Yes, thank you, we have corrected these references. We were pointing out that the overall supply now is in the range that the feasibility study suggested would be required for demand around 2030, but WASCO's own data suggests demand has not increased at this pace. So, the supply is sufficient well into the foreseeable future.
12	MCC M&E Lead	10	Which "problem diagnostic" are you referring to in Section 3.1?	We are referring to the problem diagnostic as it is understood in MCC's Project Evaluability Assessment Framework and as we specifically detailed with reference to these investments in Section 4.4.1 of our evaluability assessment. Footnote added to clarify.
13	MCC M&E Lead	18	Was the issue of the pressure-reducing valves considered during compact development? What information did SI receive that validates that the areas selected for MCC support were not systematically different from the areas not selected for compact support?	As far as we can tell, they were not considered. Perhaps because of the ongoing hydraulic assessment mentioned earlier. To clarify, we did not evaluate any areas that were not supported by the MCC Compact. All the areas included in the evaluation are Compact supported areas. Within the IE designs, counterfactuals were identified within areas where the compact support was active, using households who had not been exposed to the intervention in specific ways. If the question is specifically referencing Metolong-connected versus non-Metolong connected townships within Design B in Maseru, no WASCO Staff interviewed for the evaluation could express any reason why the townships connected to Metolong were selected vs. those that were not. Indeed, our Design B impact evaluation shows that the households in these townships even prior to matching are quite similar across several relevant observable characteristics.

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
14	MCC M&E Lead	21	Re reference to "Appendix 1," there doesn't seem to be an Appendix 1.	We have changed this to refer to a separate document, as the tools will not be included in the final report itself.
15	MCC M&E Lead	22	How many households were covered by water quality tests?	Added the following to page 22 to clarify "These tests covered 2,812 households in total--1,119 connected households with tests from their tap , 1,353 connected households with tests from their tap AND point of consumption, and 340 unconnected households from their point of consumption."
16	MCC M&E Lead	22	Did you look at the correlation between recall of bill amounts vs. actual bill amounts?	Sampling differed for Design A and B such that available information about customers' WASCO account numbers differs between the two designs, thus the answer to this question differs for Design A households vs. Design B. For Design A, it proved much more challenging than expected to obtain water account numbers from survey respondents as a way to match their records to the WASCO billing data, reportedly because many households now receive SMS messages with their bill which do not include their account number and many did not retain paper records of their account number. For Design B and the customer survey, we did not take the step of comparing reported average bill amount to the WASCO billing database, but this is a step that can be done since their account numbers are known as the WASCO database was used to sample - however note that SI was able to obtain billing data from WASCO from their database through March 2018, so comparison of recall bill amount (average) vs. a calculated average would also be subject to the limitation that we are missing the most recent 1.5 years of billing data from WASCO. For households whose bill we did observe, we also asked for their average bill. While these can be compared, they are not directly comparable since one is for the most recent month (or in practice, in some cases it was a past bill if that is what they were able to find), while the other question is in regard to the average bill.
17	MCC M&E Lead	22-23	Can you show the logit and ATT models and describe whether you used covariates (and which if you did) in the latter models?	All logit and ATT models are already shown in the detailed annex B. The covariates used in the logit models are fully described there. Propensity score matching methodology only calls for covariates in the selection models, and the ATT estimation is done based on the calculation of propensity scores according to the three methods shown in the report (nearest neighbor, caliper, and Gaussian kernel).

No.	Reviewer Name/ Institution	Draft Report Page Number	Comment	Evaluator Responses
18	MCC M&E Lead	23	It sounds as if multiple people coded the FGDs; if you checked ICR, please report it	Focus group discussions were coded using a structured codebook. The team involved in coding conducted multiple iterations of concurrent coding and reconciling to ensure consistent coding methodology before coding of all transcripts proceeded, and coding was systematically reviewed on multiple occasions for quality control by individuals other than the one mainly responsible for coding a given transcript. Our approach was not to double-code all transcripts collected and thus ICR was not calculated.
19	MCC M&E Lead	24	Report exposure period as a range if it varied across respondents and align with what's in the Evaluation Brief	Changes made and aligned with the Evaluation Brief, thank you.
20	MCC M&E Lead	26	I suggest referencing that readers can find the scoring criteria in Annex B as context for considering the various criteria	Added this reference, thank you
21	MCC M&E Lead	28	Did Unik's performance differ across the two Activities?	The only comment that SI can make on this issue is that work carried out by Unilk as contractor for the UPUW was deemed in an independent review by Gibb (another engineering firm) to have been executed to the specifications and drawings provided. There was some indication by WASCO staff that pipelaying was not up to specification in some areas of the UPUW, but this was not verified. Largely, though, the different results between the projects seems to stem from project management, design, and construction supervision. Have added a footnote to make this more clear.
22	MCC M&E Lead	31	There's a reference to WASCO's hope to retire non-Metolong water sources; can you update this following our mission, especially considering the status of the Tikoe Thetsane facility?	We have revised to reflect that only the Maseru Water Supply facilities remain open, which WASCO would have liked to shut down. We also revised the text in sections 5.3.3, 5.4.1, and the executive summary to reflect this correction, as the industrial firms are supplied by the Maseru Water Supply and not the Tikoe Thetsane Industrial Water Supply
23	MCC M&E Lead	36	Clarifying that MCC could not verify the amounts budgeted or *spent* on post-Compact O&M.	Added text to this effect, thank you

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24	MCC M&E Lead	43	Is it clear how construction contractors were able to be released from their contracts without delivering (adequate) O&M manuals?	This is likely related to the mutual decision between MCA-L and the DCSE to part ways at the end of the DCSE's fixed-term contract. The DCSE would normally be responsible for reviewing, augmenting, and approving reviewing, augmenting, and approving the O&M manuals so that they were relevant to the plant as a whole and not just populated by manufacturer's literature on plant components. The final manuals issued by the DCSE were no better than a catalogue of electro-mechanical components, with no guidance towards good operation and maintenance or troubleshooting.
24.1	MCC M&E Lead	43	(Follow-up to evaluator response above) Should these then be separate deliverables in the contracts, with associated payments?	Yes, O&M manuals should be a separate deliverable with associated payments. Even if there are only partial upgrades to a plant, rather than a whole new plant, partial upgrades can have an impact on the O&M of the whole plant, particularly in remote installations. A concommitant issue is ensuring the contract covers the duration of the construction/installation period and includes an adequate post construction defects notification and remediation period. The manuals could not be finalized, in some of the cases like occurred in UPUW, where the DCSE contract ended before works were commissioned, but should have been sufficient to cover the full new or refurbished works and intended operation .
25	MCC M&E Lead	52	Figure 18: there's no dotted line for the end of the compact	Added, thank you!
26	MCC M&E Lead	59, 61, 64	Please check Table 16-18 against the corresponding ATT tables in the annex as some values seem to come from the nearest neighbor models rather than the Gaussian kernel models, and ensure consistency with the corresponding text (see e.g., time savings p. 64)	Checked and reconciled.
27	MCC M&E Lead	63	How was the selection model determined?	The selection model was determined in accordance with similar research and best practices based on the team's literature review, including relevant demographic, socioeconomic, and geographic characteristics as well as factors most likely to influence a household's decision to connect for design A.

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28	MCC M&E Lead	72	Do we know why households in P3-5 were more likely to treat their water even though P1 residents trusted the quality less?	Perhaps the sentence was unclear--P1 residents trust the quality less (rate quality 7.09/10 compared to 7.87/10 for P3-5 respondents, per Table 21) and treat the water more (per table 25, 30.9% of P1 respondents treat water at least sometimes compared to 24.2% of P3-5 respondents). Updated sentence to make more clear.
29	MCC M&E Lead	75	What is "WTP" referring to in this context? If "water treatment plant," we need another acronym since WTP is otherwise used for "willingness to pay"	We have edited so that WTP refers to "water treatment plant" and WtP refers to Willingness to Pay, and reflected this change in the Acronyms table.
30	MCC M&E Lead	82	Table 26: Seems odd that the average number of P1 neighbors is 1.35 when the averages for P1 existing and P1 new are both separately higher.	Thank you for catching this. The column header has been corrected. The figures in the first column refer to the Roma and Morija newly connected households only. These households are a subset of the P1 new, so the P1 new column includes the households that are also separately represented in the first column.
31	MCC M&E Lead	86	I suggest adding a footnote that Maloti = Rand since both currencies are referenced on this page	Footnote added.
32	MCC M&E Lead	91	Is it clear how or why outages still exist?	Our understanding is that these are largely scheduled, maintenance-related shutdowns for service on some upstream section of the reticulation. Rarely, unscheduled outages can still occur if there is an accidental pipe burst or leakage from a construction project, for example.
33	MCC M&E Lead		Figure 29(b) why are data missing for one of the case study firms?	Although Global Garments is a member of the Nien Hsing Group, we did not speak with them as part of our case studies. We have omitted the CMT firms from this figure, as they are not heavy water users.
34	MCC M&E Lead		What proportion of positive samples had high levels of contamination? Are positive samples concerning even if the levels aren't "high"?	Across all water quality tests, 4.0% of tests taken directly from the tap and 10.6% of those taken from the point of consumption tested positive for the presence (in a 100ml sample) of *E. coli*. Of the 4% of positive tap tests, 37% (36 of 98) had high levels of contamination (i.e., contamination detected in only 1ml sample). Of the 10.6% of positive POC texts, 47% (84 of 180) had high levels of contamination. The WHO states that any presence of *E. coli* in a 100ml sample makes water unsafe for drinking, but the water may still be

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				suitable for washing, bathing, or recreation. High contamination (detectable in a 1ml sample) means that the water is unsafe even for washing, bathing, or recreation. *E. coli* is an "indicator bacteria" that suggests the possible presence of directly harmful pathogens which are not considered feasible or cost effective to monitor by the WHO.
35	MCC M&E Lead	118-119	Are notes available where currently blank? Table 33 notes repeat the dependent installations.	Where note field is blank, no specific notes were made on the scorecards. The detailed site observation checklists would contain additional information but have not been included in the report for brevity. They can be provided to MCC. Thank you for the correction on Table 33; there were no entered notes for the dependent installations in the scorecard and the repeats have been deleted.
36	MCC M&E Lead	122	Re "Motor pump control centers may be acceptable but the pump and pipeline situation must be assessed and understood *before the MCC can be tested and accepted*," has this not happened yet?	As far as we are aware, this situation has not been resolved. Anticipated discussions with WASCO in January 2020 did not take place, despite all SI efforts.
37	MCC M&E Lead	131	There appear to be several instances of overlap between pink and black symbols--is this just because this is a small map or could it result from errors in the supply servicing various households? If the latter, can you discuss SI's assessment of the match?	There does appear to be some possible erroneous overlap that is not due to the enumerator or survey error, but because township may be inaccurately recorded in WASCO's database. In a certain location near industrial areas to the southwest, what may appear to be overlap visually is simply small townships we believe to have been accurately delineated. Re-running results excluding 35 households that appear to have inaccurately recorded townships, models produce nearly identical results (no coefficients or levels of significance change) and we don't believe that results are sensitive to these observations. If MCC requests, we can revise content without these overlapping observations.
37.1	MCC M&E Lead	131	(Follow-up to evaluator response above) Not necessary.	Noted, thank you.

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38	ESP		Did the evaluation team learn anything noteworthy about wastewater treatment in Semonkong? Is WASCO upholding its agreement to only connect households with some form of wastewater treatment? Are there any negative effects being experienced at the community level, as a result of there not being centralized wastewater treatment (assuming that this has not been constructed to date)? Are there any plans for wastewater treatment in the area?	Regarding wastewater treatment in Semonkong, we were told the following (direct quote): "I don't know what we are doing with our wastewater now. We are discussing an integrated water management plan with the sewage manager. We need one at some point but right now only two buildings in Semonkong use a septic tank. As the town grows we are aware there is a need for a plan, but there are not enough septic tanks to benefit from such a situation currently. For now, the town is used to VIP latrines. Demand will be the driver for when we will develop a plan."
38.1	MCC M&E Lead		(Follow-up to evaluator response above) To confirm, did the team observe any issues with wastewater while in Semongkong, or is this not something they looked at?	The team did not directly observe any wastewater infrastructure in Semonkong, this subject was covered in the key informant interviews alone as established in the process evaluation EDR. In practice, there was no infrastructure to inspect anyway, save the stated two septic tank installations. In our opinion, the installation of sewerage and a wastewater treatment plant will be a major and costly work, since the terrain is flat to mildly sloping and ground conditions will require extensive rock excavation. This will be difficult to complete and the tariffs for sewerage connections and sewage treament will be high. This does not diminish the need for overall wastewater treatment, as the life of pit toilets is limited by the ground conditions.
39	MCC M&E/Evaluation Lead	xxvii	Typo in this sentence, should be "consideration": Additional **considering** might also be given to estimating the economic value of avoiding an acute water supply shortage—WASCO's consumption and NRW data suggests that the pre-existing Maseru supply might have been sufficient to satisfy non-industrial demand with the assistance of the Tikoe Thetsane	Updated to "consideration". Thank you.

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			supply to the present day, and even potentially some years into the future.	
40	MCC M&E/Evaluation Lead	General	It's important for the report to explicitly reference the achievement (or not) of the program objective. The report definitely speaks to these outcomes but doesn't call them out as the objective. The LSO Compact states one program objective as: "(a) improve the water supply for industrial and domestic needs and enhance urban and rural livelihoods through improved watershed management;" I suggest referencing this object explicitly in the ES and intro (you've paraphrased it on page 1); you may also consider adding it to the TOC. I also suggest providing a summary statement about your assessment of the achievement of the objective in the ES and findings section (before moving to lessons learned/conclusion).	We have included the program objective in the executive summary (compact overview) as well as the body of the report (theory of change section). We have also added a new, standalone section (5.3.4) synthesizing the headline findings against this objective.
40.1	MCC M&E/Evaluation Lead	General	(Follow up to evaluator response above) I recognize the Lesotho Compact referred to their objectives as "program objectives." However, referring to them as "Compact-level" objectives is confusing given	References to Compact-level objectives removed, and some brief notes on the economic analysis added to section 5.3.4.

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			the way MCC generally frames objectives, i.e., usually at the project level and distinct from the compact goal, which is always to reduce poverty through economic growth. Please remove the references to "compact" and "compact-level" objectives. Also, this one is a little tricky because the relevant objective is at a lower level (i.e., a means to an end) than the program logic diagram and economic analysis used to justify the interventions. Can you mention the economic analysis (in addition to the the theory of change, which is already referenced) in Section 5.3.4 when you expand the discussion about benefits? That should help contextualize why it's important to describe outcomes other than supply which is the gist of the objective.	
41	MCC M&E/Evaluation Lead	General - exec summary	Please state the exposure period explicitly in the executive summary. I think it's implied in there already, but would be best to highlight the point that HHs have been exposed to the infra for at least 5 years.	Added language: "Survey data were collected in the summer of 2019, following four to six years of exposure to interventions depending on the site."

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42	MCC M&E/Evaluation Lead	47	Re this sentence: This portion of the summative evaluation was conducted using PE methodologies, including key informant interviews, site visits and case studies, and secondary data analysis. // We consider these to be data collection approaches, rather than evaluation methodologies. For lack of a better term, when the PE is essentially doing ex-post assessment, triangulating across data sources, we've named this approach: ex-post thematic analysis. Generally, we expect PEs to employ pre-post, but certain eval questions call for this type of thematic analysis. I didn't catch the terminology issue in the methodology section, but it's possible an adjustment needs to be made there too.	We have adjusted language accordingly in this section (5.3) and the methodology (4.4.3.2).
43	MCC M&E/Evaluation Lead	48	Section 5.3.1.1. - there's a formatting error or missing text at the start of this section	Corrected.
44	MCC M&E/Evaluation Lead	61	Section 5.3.2.2.2. - formatting error at start	Updated cross-reference, thank you.

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45	ESP	Xviii, xix, 42	**Institutional sustainability**. The report concludes "At the time of the process study, four years after Compact closure, there was no articulated, company-wide plan for maintenance of WASCO infrastructure." A good plan is just a step toward sustainability; implementing a plan is more difficult and important. Yet the finding of this omission sounds important. While the MCC model is built on the notion of transformative change, we're seeing the limits to that model as our institution matures. But two elements of this idea are key to being an effective agency: the benefits of our investments should be (1) broader than just our project footprints and (2) sustained. The reports finding suggests we are falling short on both fronts. I would also like to see this finding highlighted and the discussion expanded in terms of how MCC might learn from the Lesotho experience.	The production and approval of a company plan for sustained operation and maintenance of the new infrastructure should be a condition precedent on the signing of the Compact, with the plan being based on the Preliminary Design Report proposed in our response to the next comment). Proposed staff structures can be commented on and new or upgraded staff can be trained for new positions, from Project Supervision through to plant and process controllers, prior to commissioning.

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46	ESP	xxii, 106	The importance of contract type and oversight in achieving results. The report concludes: "If details including project scope and design can be fixed at the project preparation phase stage, MCC's preference for fixed fee contracts may be workable. However, if a Design and Build Engineer or Design and Construction Supervision must design and scope work iteratively over the course of the Compact, as was the case in the Urban and Peri-Urban Water (UPUW) Activity, selecting a fixed fee contract over a more typical cost-reimbursable model may open the project up to risk. This is especially true if the contract does not ensure an adequate liability period following commissioning of the works—as a best practice, contracts should include at least two years following the defects remediation period for design and supervision engineer liability. Finally, the difference in performance between the Metolong Program Management Unit and the various iterations of the Urban and Peri-Urban Water PIU underscore the necessity of adequate project management by a qualified entity in ensuring project success."	One of the lessons learnt over 50 years of engineering practice, is that the Project Proponent must take as much of the risk of Project time and cost overruns as is feasible. When a contractor or DCSE has to take risks on costs, these are assessed at the time of tender on the information available and built in to the prices tendered. For either of these, contractor or engineer, cost overruns are an effective subsidy to the Proponent, which cannot be recouped except by claims which are time consuming and expensive to lodge and may not be successful in the end. The contractor or engineer cannot recoup these losses in their next tenders - their prices would be too high and their likelihood of successful tendering very low. Financially, each project has to stand on its own. The clear definition of a project, be it scope of design and construction, geotechnical information or construction environment, results in a significant reduction of financial risk to both contractor and engineer, which is in turn generally reflected in lower tender prices. The Project Proponent must spend more time in the definition of the project and in preliminary investigations and make budget provisions for increases in the overall cost of the Project due to unknowns and variations, but the end result will be to the Project Proponent's benefit. Moving on to the initial stages of setting up the Compact, the identification and scoping of the Project is understood to be essentially done in the Due Diligence phase and refined to a degree into the Compact scope. This is a very short and apparently somewhat superficial study which could be expanded in a second phase into a full engineering Feasibility or Preliminary Design Report. This report can then be commented on by the institutions that will manage the completed Project, with a detailed scope of work being agreed by all interested and affected institutions. This report also informs the Basic Information Report, needed for environmental applications, reporting and public participation. Environmental licensing / approval can then be initiated and carried out before the Compact commences, thus removing a major time constraint from both the environmental reporting and approvals and the project implementation. Project implementation would then be through a Design and Construction Supervision Contract and a Construction Contract - or Turnkey Contract. The Preliminary Design Report would be on a time and cost contract, with the final DCSE contract either an extension of this or re-bid on the basis of percentage fees (preferred) or fixed sum fees, neither of which are fixed term contracts. Liability for design would rest with

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			This is an important finding with broad relevance to many sectors and investments. Does the evaluator have any additional advice about how MCC might better address these shortcomings in future investments?	the DCSE and the period for latent defects should be three to five years, depending on the scope / cost of the Works. Latent defects liability should also apply to the construction contractor. Operation and Maintenance issues are very relevant in mechanical / electrical installations and water or wastewater treatment works. They are less important in basic civil works - as can be seen in the difference in day to day management requirements for the Metolong dam as against the pump stations and water treatment works. Responsibility for maintenance and troubleshooting manuals should finally rest with the DCSE, using input from manufacturers and process designers.
47	Metolong Authority	General (commented verbally in Maseru at LMDA presentation)	The assisted operations phase was funded by the European Investment Bank, not the World Bank	Corrected in executive summary and body of the report, thank you.

SOCIAL IMPACT, INC.
2300 CLARENDON BLVD. SUITE 1000
ARLINGTON, VA 22201

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