MEMORANDUM

To: Sixto Aquino, Managing Director, M&E, Millennium Challenge Corporation (MCC)
From: Ryan Moore, Associate Director, M&E, MCC
Date: 2/22/2013
Re: Regional Infrastructure Development Impact Evaluation Project

This document briefly describes the Impact Evaluation Design developed by TBSC for the evaluation of Regional Infrastructure Development (RID) Project. It is divided into three sections. The first section describes the original methodology utilized by TBSC. The second section describes the implementation of the evaluation's activities, while the final section describes the problems encountered during the project and a recommendation not to continue with further evaluation of the RID Project.

ORIGINAL RID IMPACT EVALUATION DESIGN

Given the scope of the Regional Infrastructure Development Project and the Key Research Questions, TBSC identified six potential "impact areas":

- Individual Households
- Individual Firms
- Water Utilities
- Governmental Institutions
- Overall Economy
- Complementary Activities (other MCG financed projects)

In order to understand and measure the impact of RID on all six impact areas, TBSC developed several analytical methods, since it was not possible for a single method to measure impact on all six areas. This approach was overly ambitious in terms of the ability of the evaluator to produce such a large volume of analysis. In addition, the work plan depended on the ability of multiple methodologies to triangulate an impact estimation, but a number of weaknesses on individual aspects left the evaluation unable to triangulate a coherent storyline of the activity's impacts. A summary of the analysis strategy by "impact areas" is presented in Annex 1, a summary of the individual analytical methods are presented below (with key drawbacks to each as sub-bullets):

- **Baseline and follow-up surveys (i.e. Pre-Post methodology)** – the idea was to collect baseline indicators on as many impact areas as possible and after completion of the RID and allowing some time for impact do develop, conducting follow-up surveys. The original design included baseline interviews with 4,400 households and 900 enterprises.
    - The baseline surveys were of limited use in estimating impacts, as the effects were expected at a district level or among residences with low water pressure only (on hills or higher floor apartments). The survey's sample was not designed to pick up changes at these levels.

- **Treatment and Control Group Surveys** – initial idea was do double differences, which required not only baseline and ex-post surveys, but also identification of control group. In addition to five target towns, surveys were conducted in eight similar comparison areas.

    - This design was judged to not be credible given the number of intervening factors during the compact which differed across the treatment and comparison cities (i.e. DiD method would not generate an unbiased estimator of impact).

- **Micro Model Analysis** – using micro-models the Team aimed at estimating coping costs of poor water supply for households, firms and water utilities by using an engineering approach. For example, for individual households TBSC prepared a model that uses engineering-oriented inputs such as the number of well pumps, hours of operation and efficiency to estimate the money spent by the household on coping with irregular water supply. The money spent on coping would have been avoided in case of 24/7 water supply.

    - Upon reviewing TBSC's deliverables, MCC's analysis is that micro-modeling would be of limited use in evaluating impacts, as there was not a clear enough structure with which to generate a credible counterfactual.

- **Social Accounting Matrix and Computable General Equilibrium Models** – micro-model analysis method relies on engineering-oriented inputs at the level of the individual household or firm to determine direct impact. SAMs and CGE analysis, on the other hand, takes individual household and firm data, aggregates it to the macro-level and then directly produces macro-economic results (*e.g.*, change in GDP attributable to the RID projects). The macro-impact includes direct impact (as from the micro-model analysis) plus indirect and induced impacts.

    - The consortium partner originally planned to carry out this complex economic analysis (ISET) was eventually excluded from the consortium, severely weakening the Consortium's ability to carry out this analysis. In addition, MCC judged that the number of assumptions which would underlie this analysis would weaken its ability to produce credible results.

- **Micro-simulation analysis** – this approach takes macro-level results (*e.g.*, change in average individual household income level) and disaggregates it to an estimated distribution of household income (*i.e.*, percent of households at each income level). In other words, it tries to understand influence of macro-level impact on individual households using regression analysis.

    - MCC's M&E lead does not find this type of analysis credible in constructing a counterfactual of the impact on non-beneficiaries. In addition, this type of micro-founded modeling exercise was carried out sufficiently by the ERR model calculated in TBSC's deliverable DD (Annex 2).

- **Case Studies** – Qualitative information was used to fill gaps in the evaluation work plan of the Consortium. The objective of cases studies was to collect qualitative information and based on that get more insights into the nature of impact.

- The qualitative aspects of TBSC's deliverables are considered a valuable resource, although case studies as such were never carried out

IMPLEMENTATION AND RE-SCOPING

The first phase of the project included development of impact evaluation design and data collection design, while the second phase envisaged actual data collection, cleaning and analysis. The third phase of the project was optional and largely dependent on timely completion of RID rehabilitation and construction works.

During the 2009 and most if 2010 TBSC and its partner market survey firm, ACT, worked on the first and second phases of the project. All the data required by the impact evaluation design approved by MCG was collected and cleaned. There were some delays in TBSC work, which was largely due to one of their original consortium member organization ISET, which failed to perform its responsibilities and was excluded from the Consortium. However, the delays did influence the quality of the work.

After the completion of the Phase 2 TBSC and MCG recognized the risk that actual construction works would not be finished before the End of Compact. Even if they were finished on time, it was suboptimal to conduct the complete Phase 3 Evaluation of the project, since impact required some time to develop results. This meant that the optional Phase 3 of the evaluation would not be useful to be carried out before the completion of compact. Per TBSC suggestion and in discussion with MCG and MCC, MCG made decision to fund Phase 3 of the evaluation with a limited scope. The limited scope included checking the progress of the RID works and the outputs of the project at hand just before the End of Compact. The largest piece of Phase 3 was revision of ERR calculations or drafting the new ERR models based on most recent available data.

TBSC together with ACT conducted interviews in target towns with about 250 households, up to 40 firms and all target water utility companies. Based on the collected information TSBC analyzed the results of RID project which has been realized to date and documented the improvement in water supply and sewer service for various impact groups.

Based on these findings, TSBC did estimations about the future improvements RID could have after the completion of all rehabilitation works. These forecasts served as a basis for the ERR models. TBSC created ERR models for households, businesses and water utility companies, quantified and estimated benefits for each of them and aggregated the results, based on most recent on-the-ground data. They tested the model using various assumptions and under the most pessimistic scenario had obtained ERR of 0.7 percent, while for more optimistic the ERR was 2.5% percent. MCC Economist Peter Rosner reviewed this ERR model and has provided non-objection to the quality of the ERR model.

OTHER PROBLEMS IDENTIFIED AND MCC RECOMMENDATION

This section summarizes the assessment of key issues which have prevented completion of TBSC's evaluation planning for a Third Phase of evaluation work.

The primary issue was that the sample was not designed to detect changes at the level which the adjusted program logic assumed they would be realized, and thus any evaluation would

be of very low power and unlikely to be able to detect differences from the null hypothesis. This was due to the project implementation design changing from when the evaluation was designed. The survey design was challenging but seems appropriately designed to measure effects at the household and business level were effects expected at the level of cities. The problem ended up being that the effects are expected at a district level or among residences with low water pressure only (on hills or higher floor apartments).

Another key complexity of the project was its scope, which was very broad, involved too many impact areas, which on the other hand required significant amount of data collection and analysis. During the third phase of the project the scope was reduced to the manageable and more realistic levels. We can list below the major bottlenecks faced by the evaluation:

-Delay in the set up and implementation of the RID IEP evaluation team

-Consortium Management problems, which caused finally exclusion of ISET from Consortium (who was the partner with the capacity to do SAM and CGE in the first place)

-Delays in the implementation of actual construction works by RID Activity itself

-Too much time dedicated to the creation of SAM and CGE models, which were later deemed unsatisfactory by MCC and MCG

- Lack of communication and involvement from the side of international experts hired by TBSC

- Because 24/7 water never arrived, behavior change did not occur as assumed in theory of change

- Data was not collected appropriately to measure impacts either in a simplistic pre-post methodology or even in highly stylized SAM and CGE modeling.

M. Shapiro, former MCC M&E lead for Georgia recommended against continuing the evaluation as of 2012. This memo constitutes a confirmation of this recommendation as of February 2013 by MCC M&E lead for Georgia, R. Moore, in light of both the acceptance of the ERR model and lack of a clear path forward to take advantage of the work which has already been done.

As a plethora of obstacles have weakened the ability of an independent evaluator to significantly measure the impacts or performance of this project beyond the evaluation work which has already been carried out, it is advised that MCC formally review the ERR recalculation/revision created by TBSC, along with the other qualitative and quantitative evaluation deliverables provided by TBSC. A formal review process will provide documentation (where feasible) that the Georgia I EMC has reviewed and accepted these deliverables as a sufficiently detailed evaluation to be considered an independent ERR recalculation and best approximation to an independent evaluation that is feasible under the circumstances.

Annex 1: Analytical Methods Used For Each Impact Sub-Category

IMPACT GROUP	IMPACT CATEGORY	IMPACT SUB-CATEGORY	ANALYTICAL METHOD USED					
			BASLINE AND EX-POST SURVEY	TREATMENT AND CONTROL	MICRO-MODELS	SAMs AND CGE	MICRO-SIMU-LATION	CASE STUDIES
Individual Households	Total Water And Sewer Cost	Monetary Costs		√	√			
		Willingness To Switch	√	√	√			
		Coping Time		√	√			
		Water Consumption	√ (water audit)	√				
	Quality Of Life	Health Incidents	√	√				
		Perceptions Of Safety	√	√				
		Perceptions Of Organoleptic Properties	√	√				
		Public Sanitation Information	√	√				
		Individual Sanitation Practices	√	√				
		Time And Inconvenience Of Not 24/7 Water	√	√				
		Self-Reported Water Consumption	√	√	√			
		Gender Issues	√	√				
Individual Firms	Total Water And Sewer Costs	Monetary Costs		√	√			
		Willingness To Switch		√	√			
		Water Consumption		√	√			
	Business Enablers	Expand Existing Business			√			√
		Enter New Business			√			√
Water Utilities	Operations	Supply		√	√			
		Demand		√	√			
		Water Quality		√	√			
	Finance	Cost Structure		√	√			
		Financial Viability		√	√			
		Efficiency		√	√			
Governmental Institutions	Public Health System	Institutional Arrangements						√
		Water Borne Disease Incidence						√
	Other Budgetary Institutions	Prisons			√			
		Military Bases			√	√		
Overall Economy	Output	GDP				√		
		Productivity Of Labor				√		
		Productivity Of Capital				√		
	Prices	Real prices				√		
		Inflation				√		
	Poverty	Employment Level				√		
		Wages				√		
		Expenditures				√		
	Inequality	Household Expenditures				√	√	
		Gender				√	√	
		Wealth				√	√	
	National Accounts	Current Account				√		
		Capital Account				√		
		Public Finance			√	√		
Complementary Activities	S-J Road Project	Tourism						√
	ADA	Agricultural Output						√
	GRDF	Economic Activity At Micro (company) Level						√
	Free Industrial Zone (FIZ)	General Economic Activity In The FIZ						√
		General Economic Activity In Poti						√

Source: RID IEP Analysis.

MILLENNIUM CHALLENGE GEORGIA FUND / MCG
REDUCING POVERTY THROUGH GROWTH

Millennium Challenge Georgia Fund

RID Impact Evaluation Project

Phase III

Deliverable DD

Revision Process Used For Updating ERR Values For RID Projects

May 6, 2011

TBSC CONSULTING

DETAILED TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ACT	ACT Research
DS	Department of Statistics of Georgia
ERR	Economic Rate of Return
EUR	Euro
FDI	Foreign Direct Investment
MCC	Millennium Challenge Corporation
MCG	Millennium Challenge Georgia
NRW	Non-Revenue Water
RID Project	The entire Regional Infrastructure Rehabilitation Project
RID Projects	The individual city projects within the RID Project
RID IEP	RID Impact Evaluation Project
SPSS	Statistical Package for Social Sciences
TBSC	Tbilisi Business Service Center
USD	United States Dollar

1 INTRODUCTION

The objective of the RID Impact Evaluation Project (RID IEP) is to assess the impact of the five RID Projects and estimate the Economic Rate of Return of the investment undertaken by MCG. Originally, the RID IEP was divided into three phases. The first phase aimed at creating an evaluation design for the whole project, while the second phase envisaged data collection as required by the evaluation design. Third Phase of RID IEP was optional and it was contingent upon the timely completion of RID rehabilitation works.

Due to various reasons, RID project completion was delayed and as a result the third phase of the project was decided to be done with a limited scope. This means that the Team had to rely on the current outputs and outcomes of the Project, achieved by May 2011 and do estimations and forecasts about the future developments. In other words, the Team had to make estimations and forecasts about current and future monetary and non-monetary benefits to be obtained by households, businesses, water utilities and public institutions.

In order to achieve this result and introduce realistic assumptions, the RID IEP Team conducted a mini-survey with a limited number of interviews (150 households and 35 enterprises) in the target cities to understand the outcomes of the RID Projects, instead of a large scale ex-post survey as it was done during the second phase. Respondents were asked to provide information about current and past water supply schedule, changes in water quality, changes in monetary and time costs and so forth. Based on the survey results, RID IEP Team introduced certain assumptions and estimated the benefits of various impact groups. Eventually, forecasted benefits to be obtained by various impact groups were monetized and included in the ERR model, created within the scope of the project. Using the ERR model, Economic Rate of Return for each individual project (for all five cities) as well as an aggregate ERR for the whole RID Project were calculated.

The purpose of this report is to introduce the ERR Model and interpret the results. As for the assumptions and estimations, the RID IEP Team created several spreadsheets, which are self contained and include all the assumptions related to figures and calculations given in the model.

2 ORIGINAL ERR

Before the commencement of the RID Project, several foreign engineering and consulting companies worked on the feasibility studies of the five water systems, three of which included sewer systems as well. Based on the information available at that time and expectations about the future developments the assumption was made about the 24/7 water supply availability as a result of RID Project completion in all five cities. This assumption is also included in the board memos prepared by Municipal Development Fund.

As a result, expectations about the amount of potential savings to be obtained by households, businesses, water utilities, public institutions and other potential beneficiaries were reflected on the original ERR estimates developed by these consulting companies. The following table presents investment undertaken by MCG and other donors and original ERR estimates for individual cities and for the aggregate project.

1. Initially Estimated ERR Of Individual And Total RID Project

		MCG's Investment	MCG's Share	Other Donors	Other's Share	Total Investment	Share of Total	Expected ERR
1	Kutaisi	10,4	51%	10,1	49%	20,5	23%	34,6%
2	Poti	5,6	35%	10,3	65%	15,9	18%	22,7%
3	Kobuleti	18,8	85%	3,4	15%	22,2	25%	15,5%
4	Borjomi	12,5	56%	9,7	44%	22,2	25%	15,3%
5	Bakuriani	7,7	85%	1,4	15%	9,1	10%	17,8%
6	Total	**55,0**	**61%**	**34,8**	**39%**	**89,8**	**100%**	**21,3%**

Source: MCG, Board Memos.

Soon after the commencement of the RID works it became apparent that the length of water supply schedule can be increased only marginally in some cities. For example, in Borjomi and Bakuriani it is expected that water supply schedule will reach 24/7, while in Poti and Kutaisi, schedule will be no more than 5-8 hours a day. Autofactory district in Kutaisi is an exception and they are expected to have 24/7 water supply. Kobuleti is also expected to receive water for up to 18 hours a day, with a potential to increase it up to 24/7.

Based on new expectations, assumptions about the expected savings had to be revised by the RID IEP Team. In addition, the consulting companies who did the ERR estimates for the feasibility studies did not conduct large scale surveys among households and enterprises to understand coping costs. The RID IEP Team on the other hand conducted large scale survey in RID target and control cities and collected more precise information about the baseline coping costs spend by households and businesses.

These two things (realistic expectations and more precise coping costs) caused significant difference between the original ERR estimates and the ones calculated by the RID IEP Team in May, 2011.

3 METHODOLOGY FOR UPDATING ERR

There are several impact groups to be affected by the RID Project in target cities, but the RID IEP Team originally selected six areas and focused its attention on measuring impact of the project on these areas. These areas include:

- Households
- Businesses
- Water Utilities
- Public Institutions
- Public Health System
- Complementary Activities

These six impact areas were reduced to four (the first four items from the above list) as a result of reducing the scope of the Phase III of the project. For each four group, we identified and agreed on a list of potential benefits to be estimated. These benefit types for each impact group are presented below in the tables. These benefits are graded as A, B and C. A grades stand for those types of benefits which are monetized and included in our final ERR Model, while B and C grades reflect those types of benefits, which were not included in our ERR Model.

3.1.1 Potential Benefits for Water Utilities

Since water utilities are recipients of the RID Project investment, benefits accrued to this group is very important. Having interviewed representatives of local water utility companies several times during the past two years we can say that there are two main types of benefits to be obtained by these companies as a result of RID Project.

2. Potential Benefits to Water Utility Companies and Their Relative Importance

Benefits Related to Water Utility	Importance for Final RID IEP ERR Model (A,B,C)
Water and Sewer infrastructure maintenance cost savings	A
Energy savings related to water and sewer infrastructure improvements	A

Source: RID IEP Analysis

- Water and sewer infrastructure maintenance cost savings – before the rehabilitation of water supply and sewer infrastructure (not in all target cities) breaks on the system and their maintenance was a significant part of total costs. It is expected that after rehabilitation is complete, water utilities will save significant amount on repairs.

- Energy savings related to water and sewer infrastructure improvements – this is an important part of water utility expenditure in most of the cities, since the water is pumped from the ground as opposed to gravity flow. In most of the target cities water utilities had old and inefficient pumps, which were replaced with efficient and modern pumps within the framework of the project.

3.1.2 Potential Benefits For Household Impact Group

Households are the largest impact group among others and benefits to be obtained by them should be evaluated very carefully. We identified three sources of benefits for households, which are presented in the following table, with relative grades from A to C, where A is important for our ERR model and C is less important or less significant in terms of measuring the benefits of the RID Project.

3. Potential Benefits to Households and Their Relative Importance

Benefits Related to Households	Importance for Final RID IEP ERR Model (A,B,C)
Monetary savings on coping costs	A
Time savings	A
Health benefits	B

Source: RID IEP Analysis

- Monetary savings on coping costs – people spend significant amount of money on water and sewer related costs. These costs are expected to be totally or partially eliminated as a result of RID intervention. This impact area clearly deserves A grade due to its scale and importance.

- Time savings – households spend significant amount of time on handling water related problems, fetch water from nearby spring or take care of sewer problems. Time spent on these activities can alternatively be used on other things, including income generating activities.

- Health benefits – health benefits are of course very important and water borne diseases create significant inconvenience for people. However, based on our baseline data we know that in the RID target cities it is not a significant problem for households.

3.1.3 Potential Benefits For Business And Public Institutions Impact Group

Businesses are among the three largest impact groups, since they use water and sewer service to produce their products and services. Some of the companies are more water intensive than other and their dependence on water supply is higher. For example, it is crucial for a brewery to have a good water supply, while for a small corner shop it is not. During the baseline analysis, we will divide companies according to water consumption and evaluate the costs of more and less water intensive companies separately. The only benefit which is important for business is monetary saving on water and sewer coping costs.

4. Potential Benefits to Businesses and Their Relative Importance

Benefits Related to Businesses	Importance for Final RID IEP ERR Model (A,B,C)
Monetary savings on coping costs	A

Source: RID IEP Analysis

Monetary coping costs to businesses are significant for businesses in RID target cities. This is especially true for water intensive businesses who have to source water from alternative sources. Savings in monetary costs is the key benefit analyzes using the ERR model and given its importance we graded it as A.

Similar to businesses, public institutions in the RID target cities face same problems. As a result, monetary savings on coping costs are also included in the ERR Model.

3.1.4 Estimation Methods

Based on the current outputs and outcomes of the RID Project, as well as expectations about the situation in the RID target cities after rehabilitation works we have estimated potential savings for all the above mentioned impact groups.

Main outcome of the project, on which we based our assumptions was length of water supply schedule. It was assumed that Borjomi and Bakuriani would get 24/7 starting from 2012, since the project ends by the end of 2011. This assumption was confirmed with the head of the local water utility head.

For Kobuleti 18/7 water supply schedule was assumed, while for Kutaisi and Poti this indicator was assumed to be 8/7 and 5/7 respectively. In Autofactory district, where 23 percent of Kutaisi population lives, we assumed 24/7 water supply. These assumptions are in line with the expectations of local water utilities. More details about the water schedule related assumptions are given in the separate spreadsheets, which are part of the Deliverable DD.

Based on these assumptions, we estimated the amount of savings to be obtained by three types of households and businesses:

- Households/businesses with municipal water (sewer) only
- Households/businesses with municipal and alternative water (sewer) only
- Households/businesses with alternative water (sewer) only

For each group, we have estimated the amount of savings on coping costs for various types of coping assets over time, including water sources and different handling methods. Assumptions about the size of potential savings are given in the spreadsheets devoted to each impact group.

4 UPDATED ERR VALUES

After estimating the amount of benefits to be accrued to various impact groups over time for each city, we identified the amount of investment devoted to the project by MCG and other donors. Based on these information we calculated the ERR and ENPV for the aggregate project. ERR for the whole RID Project was estimated at 0.7 percent. Assuming 10 percent discount rate for future benefits we obtained a negative value for ENPV, which is more than GEL 46 million.

5. ERR And ENPV For The Aggregate RID Project

1	ERR For All RID Cities	0,7%
2	Discount Rate For All RID Cities	10%
3	NPV For All RID Cities	(46 882 387)

Source: RID IEP Analysis

The following table shows the amount of investment devoted to RID Project by MCG and other donors during 2007 – 2011.

6. RID Project Investments By MCG And Other Donors

	Year	MCG RID Investments	Other RID Investments	Total Investments
		GEL	GEL	GEL
1	2 007	2 796 329	4 206 675	7 003 004
2	2 008	2 494 928	3 751 482	6 246 410
3	2 009	21 073 517	5 068 509	26 142 026
4	2 010	44 468 711	13 096 569	57 565 280
5	2 011	10 937 130	3 347 426	14 284 556

Source: RID IEP Analysis

Despite the fact that overall ERR is positive, for some cities this indicator is negative. For example, in Poti, Kobuleti and Borjomi ERR values are negative, ranging from -8.6 to -1.9 percent. The highest positive ERR is for Kutaisi, 7.5 percent, which is mainly due to expected 24/7 water supply schedule for the Autofactory district. ENPV values are negative for all cities.

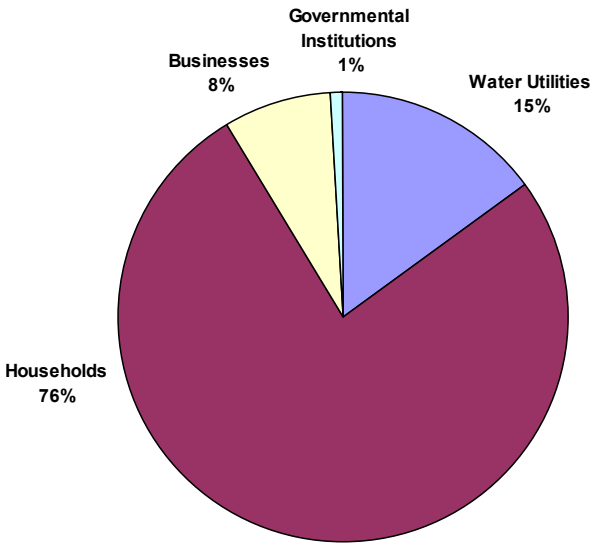
7. ERR And ENPV Values For Individual RID Target Cities

		UNIT	Kutaisi	Poti	Kobuleti	Borjomi	Bakuriani	Aggregate
1	ERR	%	7,5%	(8,6%)	(2,6%)	(1,9%)	0,5%	0,7%
2	Discount Rate	%	10%	10%	10%	10%	10%	10%
3	ENPV	GEL	(4 485 722)	(11 096 531)	(16 874 919)	(15 041 050)	(6 899 195)	(46 882 387)

Source: RID IEP Analysis

RID Project related benefits are allocated across various impact groups unequally. Largest beneficiaries are households, which obtain 76 percent of total RID benefits in all target cities. Water utilities, which are direct recipients of RID investments gained 15 percent of total benefits, while businesses gained only 8 percent. As already mentioned, Governmental institutions have similar coping costs as businesses and the amount of benefits to be obtained by this impact group is proportional to businesses, scaled down according to the amount of total water consumed.

8. Breakdown Of Benefits By Various Impact Groups



Source: RID IEP Analysis

In value terms, over the next 20 years the value of benefits to be obtained by households in all RID target cities exceeds GEL 92 million. Benefits to be obtained by water utilities is valued at GEL 18.3 million, while benefits to businesses and Governmental institutions reaches GEL 9.6 million and GEL 1 million respectively.