Institutional Development Services for the Secondary Cities Project

Contract No. 263-C-00-95-00092-00

Assessment of the Economic Impacts of the Project

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ACRONYMS

B/C	Benefit Cost Ratio
CuM	Cubic Meter
CVM	Contingent Valuation Method
DHS	Demographic and Health Survey
EHHUES	Egypt Household Health Services Utilization and Expenditure Survey
EIRR	Economic Internal Rate of Return
EOCC	Economic Opportunity Cost of Capital
GOE	Government of Egypt
LE	Egyptian Pound
NOPWASD	National Organization for Potable Water and Sanitary Drainage
NPV	Net Present Value
O & M	Operations and Maintenance
OM&T	Operations, Maintenance and Training – the final phase of all USAID funded construction contracts under the SCP
PEA	Public Economic Authority
IDS/SCP	Secondary Cities Project, Institutional Development Services
SCP/ED-CM	Secondary Cities Project, Engineering Design – Construction Management Services
SV	Switching Value
UFW	Unaccounted-For-Water
USAID	United States Agency for International Development
WTP	Willingness to Pay

Executive Summary

With the USAID funded Secondary Cities Project coming to a close at the end of June 2004, a study has been commissioned to make an assessment of how effective the project has been and will be in the future, in achieving measurable and sustainable beneficial results. The projects included for assessment are the Secondary Cities – Institutional Development Services Project (SCP-IDS), the Secondary Cities – Engineering Design – Construction Management Project (SCP-ED/CM) and the USAID construction program carried out in the four governorates covered by the two SCP projects. The benefit-cost (B/C) ratio, a conventional economic indicator, was selected to be used in determining whether not the project has/will produce beneficial impacts in the utility organizations, the communities they serve and the national economy.

The approach to the study involved identifying, quantifying and valuing (i) the costs associated with the project and (ii) the benefits to be derived as a result of project implementation. The assessment is based on the incremental costs incurred as a result of the project and the benefits resulting from the associated improvements. The incremental benefits are those that are realized *with the project* compared with the situation that would have occurred *without the project.* Costs and benefits are presented in constant value Egyptian Pounds, with 2002 selected as the base year.

In round figures, the two SCP projects and the construction program costs amount to a total of nearly US $325 million. Of the total, about US $29 million was attributable to the SCP-IDS, US$ 49 million to the SCP-ED/CM project and US $ 246 million was expended on the construction projects in the four governorates. These costs have been essentially fully realized with only relatively small amounts remaining to be disbursed. Thus the major portion of costs are known. However the costs of replacements and annual operating costs to be incurred over the discounting period are estimated and more subject to the risks of inaccuracy associated with all forecasts. The discounted value of all costs included in the assessment is approximately LE 950 million.

The process of identifying, quantifying and valuing benefits was divided into two components, each focusing on specific types of benefits: (i) benefits related to direct utility services and (ii) benefits related to improvements in health conditions in the communities affected by the projects. The universe of prospective benefits related to utility services identified by the study team with the assistance of the SCP staff was very large. This group was narrowed to a “long list” of 28 prospective benefits that had to meet the criteria that they were indeed valid benefits, but without consideration of whether or not the benefits could be quantified and valued. A further narrowing of benefits to include only those that could be quantified and valued, resulted in the final list of nine utility services benefits included in the assessment.

Health related benefits were considered in three groups: (i) averted health care expenditures, (ii) wages not foregone and (iii) child deaths averted. Disease agents considered are diarrhea, schistosomiasis, hepatitis, typhoid and paratyphoid and eye and skin infections. Health reports on the incidence of diseases and information gained from the health departments in the governorates showed significant reductions in disease. Based

on extensive research and analysis, it was determined that a portion of this benefit could be attributed to the implementation of the project. The discounted value of the combined utility based and health related benefits is nearly LE 1,500 million.

The B/C ratio for the total project is computed as 1.6; the B/C ratios for the governorates range from a high of 2.2 for Daqhalyia to a low of 1.1 for South Sinai. The ratios for Luxor and Aswan are 1.5 and 1.2 respectively. Sensitivity analyses were computed that showed that the B/C ratio for the base case is relatively insensitive to adverse conditions that may be encountered, such as unexpected increases in costs or decreases in the realization of benefits

SIGNIFICANT COST/BENEFIT

For every $1000 US Dollars USAID spent on the IDS/SCP Project, Egypt is gaining $1600 US Dollars in benefits

These findings show strong economic indicators that support the conclusion that the SCP will have a highly beneficial impact on the utility organizations, the project communities and the economy of Egypt for many years. In addition to exhibiting strength in terms of economic measurements, sensitivity analysis show that the project can withstand substantial adverse experiences in the future in terms of increased costs and decreased benefits and still remain vibrant and continue to produce positive impacts. Further, additional factors in support of the findings of a highly beneficial project, include the fact that benefits were consistently quantified and valued on the low side of possible values. Many prospective benefits that were not included in the short list because of practical problems in the quantification process, are known to have real and tangible benefits that if quantification was possible, would surely give further strength to the base case economic indicators. The main point here is that the figures computed for the base case B/C ratios represent a very conservative estimate of the beneficial impacts of the SCP. The additional factors give positive reinforcement to the conclusions of strong and sustainable economic impacts made for base case conditions which are well buffered from adverse circumstances that may be encountered in the years ahead.

SECTION I

INTRODUCTION AND BACKGROUND

The USAID-funded Institutional Development Services for Secondary Cities Project in Egypt (IDS/SCP)[1] has been active since 1995 to improve the quality and sustainability of water and sanitation services in four governorates in Egypt. Over this nine year period, SCP has been effective in gaining institutional improvements and providing essential training in seven divisions (municipalities) of the four governorate level utilities. A companion project conducted in parallel with the SCP, was effective in the implementation of capital improvements in most of the same communities. The SCP ED/CM, was assigned the tasks of preparing the engineering designs for new/expanded utility plant, and of providing construction management services for the resultant investments. With the SCP projects coming to closure on June 30, 2004, it is important to make an assessment of how effective the projects have been in (i) achieving beneficial results to date, and (ii) to project beneficial impacts expected to be realized in future years.

Overall, it is believed that SCP programs have made a major positive impact on the lives of people and the local utilities in the involved governorates - Aswan, Luxor, Daqahliya, and South Sinai. This is despite the fact that cost recovery levels have been disappointing and most of the utility organizations continue to function at less than full cost recovery.

The purpose of this study therefore, is to identify and quantify the beneficial impacts that are expected to be gained in the involved governorates over an extended period, say 40 years from the start date of the SCP and 35 years after completion of construction, and to compare them with the costs incurred in achieving them. The study approach emphasizes *economic* as opposed to *financial* measures[2] and involves, primarily, the preparation of a conventional benefit – cost (B/C) assessment. During the course of the work it may also be found useful to present information on economic internal rate of return (EIRR) or other indicators to help illustrate the magnitude of the benefits.

[1] In common usage, this is shortened to “SCP”

[2] Financial analyses influence the decisions of project participants, whereas economic assessments record the consequences of those decisions on the national economy

SECTION II

APPROACH USED TO MEASURE ECONOMIC IMPACTS

The methodology employed is based on guidelines issued by the Asian Development Bank, and the Research Triangle Institute[3], and includes four principal steps as listed below; other references are shown in the Bibliography:

1. Identification of the economic costs and benefits (and the identity of the direct and indirect beneficiaries) associated with the institutional development and the USAID financed construction projects in each of the four governorates
2. Quantification of the identified costs and benefits; for benefits that are intangible in nature and difficult to quantify, describe the beneficial aspects and their likely impacts to the extent possible
3. Valuation of the costs and benefits in economic (vs. financial) terms
4. Comparison of benefits and costs and computation of the B/C ratio; where practical and relevant, computation of the economic internal rate of return (EIRR) and/or other economic indicators of project viability

Features of the methodology used in this assessment are listed as follows:

- Achievement of identified benefits on a sustainable basis is dependent upon the sustainability of the enterprise as a whole; since this assessment addresses the impacts of the institutional and construction projects and project investments only***, the sustainability of the governorate level utilities is assumed as a given***
- Benefits are estimated through a comparison of **the *with-project situation*** (past and projected) ***and the without-project situation***; the without-project situation may vary over time (e.g. improve or worsen in forecast years)
- Zones or areas where beneficial impacts may have occurred vary among the different types of projects and geographic locations; for example the benefits of the UFW reduction program in Daqahliya are considered to be governorate-wide since the SCP program implemented in Mansoura has been expanded throughout the governorate; also, benefits related to avoided costs for septic tank cleaning vary according to the locations where high groundwater conditions exist or do not exist and within the areas that have received sewer service under the USAID sponsored construction program
- Costs include both the IDS/SCP and the SCP ED/CM contract costs, the Government of Egypt (GOE) contributions and the additional costs brought about as a result of the SCP projects (e.g. operational

[3] Asian Development Bank, Economics and Development Resource Center: (i) Guidelines for the Economic Analysis of Projects, 1997 and (ii) Framework for the Economic and Financial Appraisal of Urban Development Projects, 1994, and, Research Triangle Institute, Benefit-Cost Assessment Handbook for Water Programs, April, 1983.

costs resulting from the incremental flow of potable water and the resulting incremental flow of wastewater)

- Costs and benefits will be expressed in constant (real) prices with the base year being 2002; data for inflation are taken from World Bank sources; costs incurred prior to 2002 are ***inflated*** and costs and benefits incurred after 2002 are shown at 2002 price levels that in some cases requires application of a ***deflator***
- Taxes, duties and subsidies[4] are considered as neutral transfer payments and are excluded from costs; USAID financed projects are assumed to be free of tax liability and subsidy effects have been ignored as having little impact on the results of the assessment
- Reflecting limitations on the availability of time and resources, the methodology does not attempt to employ techniques that are incorporated in some economic analyses such as (i) shadow pricing, (ii) estimation of consumer surplus, (iii) the effect of market distortions, (iv) working capital as a cost factor, (v) the effect of exchange rates and (vi) the conduct of willingness-to-pay (WTP) or contingent valuation method (CVM) surveys.
- Benefit – cost analyses were carried out separately for each division/governorate receiving assistance under SCP, and then consolidated in an overall assessment of the project as a whole.

A variety of information sources were tapped in the preparation of the assessment. The staff of the IDS/SCP[5] project played a key role in identifying sources of information on costs. Given their intimate and detailed knowledge of the *with and without project* situations in each locale, they were also instrumental in identifying and quantifying many of the benefits and beneficiaries. The assistance of Dr. Fatma Zanaty and the staff of El-Zanaty and Associates was critical in the identification of data sources and in the collection of data on health related matters and greatly facilitated completion of those aspects of the assessment related to health. Overall guidance on the conduct of economic assessments in general, and in the unique circumstances associated with the conduct of such studies in Egypt was provide by Dr. Ahmed Gaber of Chemonics Egypt.

[4] In some instances, subsidies are considered to be an economic cost

[5] Mr. Dewey Bryant, The Chief of Party and many of the key staff have been assigned to the project since its inception in 1995.

SECTION III

IDENTIFICATION OF PROJECT COSTS

Project costs were identified and defined in a three-step process, (i) identification of costs at market prices, (ii) revaluation of costs in economic (real) terms and (iii) allocation of costs among the governorates/divisions. The major categories of costs are (i) institutional development costs, (ii) capital investment and replacement costs, (iii) engineering design and construction management costs and (iv) incremental operating costs to be incurred as a result of the expansion of utility plant in each locale.

3.1 Institutional Development Costs

IDS/SCP contract costs totaling in excess of US$29 million, capture all significant institutional development costs and are the only costs considered in this cost category. Contributions of local utilities were relatively small and difficult to quantify. Annual costs are based on actual disbursements and are allocated among the various divisions and governorates in proportion with two factors: (i) the number of training days provided for each locality and (ii) the number of travel days spent in each locality by IDS/SCP staff. Costs are adjusted for inflation to be expressed in terms of 2002 prices. Inflation factors are shown in the inset box and the cost data used in the assessment are shown in Table 3.1. Figures for 2004 are estimated.

Computation of Escalation (Deflation) Factors

Year	Inflation	Escal. Rate	Cumul. Factor
1995	0.0%	0.966	0.743
1996	7.1%	0.939	0.769
1997	5.9%	0.956	0.819
1998	3.4%	0.973	0.857
1999	2.2%	0.957	0.881
2000	6.7%	0.953	0.920
2001	3.2%	0.966	0.966
2002	3.9%	1.000	1.000
2003	4.0%	1.040	1.040
2004	4.0%	1.040	1.081

Table 3.1
IDS/SCP Costs Per Jurisdiction, 1995 - 2004
Calendar Year Basis

Year	Aswan	Luxor	Dakhaliya	South Sinai	Total - $	Total - LE 000	
			.....US $			Current Prices	2002 Prices
1995	257,518	214,598	300,438	85,839	858,393	2,919	3,930
1996	895,757	746,464	1,045,050	298,586	2,985,857	10,152	13,203
1997	1,258,207	1,048,506	1,467,908	419,402	4,194,022	14,260	17,413
1998	707,948	589,957	825,940	235,983	2,359,828	8,023	9,363
1999	867,246	722,705	1,011,787	289,082	2,890,820	9,829	11,157
2000	1,419,734	1,183,111	1,656,356	473,245	4,732,445	16,090	17,486
2001	1,669,895	1,391,579	1,948,211	556,632	5,566,316	18,925	19,597
2002	807,467	672,889	942,045	269,156	2,691,556	9,151	9,151
2003	180,959	150,799	211,118	60,320	603,195	2,051	1,973
2004	651,503	542,919	760,087	217,168	2,171,677	7,384	6,830
Totals	8,716,233	7,263,527	10,168,938	2,905,411	$ 29,054,109	98,784	110,104

3.2 Engineering Design and Construction Management Costs

Detailed and specific information on the SCP ED/CM contract costs and disbursement patterns was not available. However the total contract price was given at US$49 million. Cost allocations among localities were made in proportion to the capital expenditures (which are known in considerable detail) made in each and annual disbursements were

estimated to occur in parallel with the capital program. Prices were adjusted to 2002 price levels as indicated above. Cost data for the SCP ED/CM project are shown in Table 3.2 below.[6]

Table 3.2
SCP ED/CM Costs Per Jurisdiction, 1995 - 2004
Calendar Year Basis

Year	Aswan	Luxor	Dakhaliya	South Sinai	Total - $	Total - LE 000	
	.....US $					Current Prices	2002 Prices
1995	675,000	240,000	480,000	105,000	1,500,000	5,100	6,868
1996	1,125,000	400,000	800,000	175,000	2,500,000	8,500	11,055
1997	1,800,000	640,000	1,280,000	280,000	4,000,000	13,600	16,608
1998	2,250,000	800,000	1,600,000	350,000	5,000,000	17,000	19,837
1999	2,700,000	960,000	1,920,000	420,000	6,000,000	20,400	23,156
2000	3,375,000	1,200,000	2,400,000	525,000	7,500,000	25,500	27,712
2001	3,825,000	1,360,000	2,720,000	595,000	8,500,000	28,900	29,926
2002	3,150,000	1,120,000	2,240,000	490,000	7,000,000	23,800	23,800
2003	2,250,000	800,000	1,600,000	350,000	5,000,000	17,000	16,354
2004	900,000	320,000	640,000	140,000	2,000,000	6,800	6,290
Totals	22,050,000	7,840,000	15,680,000	3,430,000	$ 49,000,000	166,600	181,607

3.3 Capital Investment and Replacement Costs

The capital improvement program was managed under SCP ED/CM through the various stages of planning, design, contracting, construction management and operations and maintenance training and handover. Construction was administered through a series of 5 major contracts addressing the construction undertaken in each of the four governorates (two contacts for projects in Daqahliya). Capital investments were made in each of the seven localities included in the IDS/SCP project, with the exception of Sharm El Sheikh which opted-out of the USAID construction program.

The first construction work was initiated in 1998 and projects were 95% complete by the end of 2003, with some projects having been complete and operational for several years.. Much of the remaining work is in the Operations and Maintenance and Training (OM&T) phase and is projected to be complete in 2005. An overview of the types of capital improvements, completed and scheduled, for each locality is shown in Table 3.3 on the following page. The schedule of capital costs is shown below in Table 3.4.

Table 3.4
SCP ED/CM Summary of Constructions Costs Per Jurisdiction, 1998 - 2004
Calendar Year Basis

Year	Aswan	Luxor	Daqahliya	South Sinai	Total - $	Total - LE 000	
	.....US $					Current Prices	2002 Prices
1998	2,913,221	0	3,228,622	0	6,141,843	20,759	24,224
1999	21,032,539	0	17,240,827	0	38,273,366	129,364	146,843
2000	33,677,280	0	13,254,413	2,273,133	49,204,826	166,358	180,791
2001	38,489,795	2,400,020	10,480,365	8,819,256	60,189,436	203,665	210,895
2002	12,540,606	16,186,695	7,914,323	5,547,921	42,189,546	146,081	146,081
2003	1,014,733	21,396,922	10,552,863	3,626,246	36,590,764	132,096	127,076
2004	0	1,099,270	11,386,570	0	12,485,840	51,561	47,694
2005	0	69,414	1,210,283	0	1,279,698	5,319	5,319
Totals	109,668,175	41,152,321	75,268,267	20,266,556	246,355,319	855,203	888,923

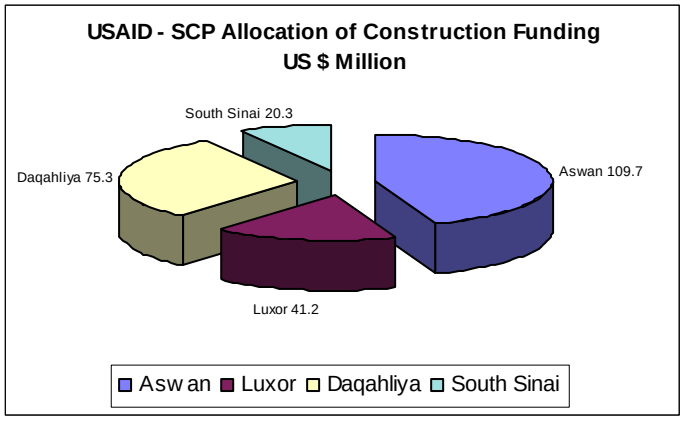
[6] The currency exchange rate effective for both SCP contracts is LE 3.4 to US $ 1.00.

Table 3.3
USAID Financed Capital Improvements
Secondary Cities Project – Engineering Design/Construction Management

Project Jurisdictions – PEA/Governorate – Divisions[7]						
South Sinai		**Daqahliya**		**Aswan**		
Sharm El Sheikh	**Nuweiba**	**Mansoura**	**Luxor**	**Kom Ombo**	**Daraw**	**Nasr City**
Wastewater Projects						
- No USAID sponsored projects -	• Sewerage • Wastewater pumping stations (4) • Force Mains • Stabilization ponds (2)[8]	• Trunk sewerage (gravity and force mains)[9] • Wastewater pumping stations (2)	• Sewerage • Force mains • Stabilization (2 new, 1 rehab.)	• Sewerage • Wastewater pumping stations • Force mains	• Sewerage • Wastewater pumping stations • Force mains	• Sewerage • Wastewater pumping stations • Force mains • Stabilization ponds
				• Stabilization ponds (Balana)		
Water Projects						
- No USAID sponsored projects -	• Distribution system (new network)	• New water treatment plant (1,200 lps) • Rehab. Existing water treatment plant • Rehab. 4 existing raw water pumping stas. • Water transmission mains[10]	- No USAID sponsored projects -	• Rehabilitation and expansion of existing water treatment plant	Rehabilitation of existing water treatment plant	- No USAID sponsored projects -
Estimated Populations at Design Year 2025						
	42,000	830,000	225,000	148,000	63,000	12,000

[7] USAID contracts, administered by NOPWASD are referred to as Contracts A and D for Mansoura, Contract B for Aswan, Contract C for Luxor and Contract E for Nuweiba
[8] Serving the North and South sides of the city plus the village of Tarabin
[9] Total length of 9,159 meters, diameters ranging from 800 mm to 2,000 mm, for delivery to existing wastewater treatment plant
[10] Total length of 5,983 meters, ranging in diameter from 600 mm to 1,000 mm

The total value of construction is in excess of $246 million with an equivalent value in LE at exchange rates in effect on the dates that the various contracts were awarded; in Contract A for Mansoura, Contract B for Aswan and Contract E for Nuweiba the exchange rate is LE3.38 to US$1.00. The rate for Contract C for Luxor is LE 3.40 to US$ 1.00 and the rate for Contract D, also for Mansoura, is LE 4.20 to US$ 1.00. Capital expenditures allocated to each governorate are shown in the inset graphic.



Replacement costs have been estimated to account for the expenditures necessary to replace the elements of the facilities being constructed that have relatively short economic lives. Elements of the construction program fitting this description include electrical and mechanical items such as pumps, motors, heavy mobile equipment and instrumentation. It has been assumed that such items account for about 15% of construction costs and have an economic life of 12 years.

3.4 Incremental Operating Costs

Operating and maintenance costs incurred as a result of the projects for both water supply and wastewater operations have been estimated and are included among project costs. Operating and maintenance costs have been estimated with due consideration of several important factors:

- In most of the local utility organizations, there is little or no experience with carrying out O & M responsibilities; many projects have only recently reached the stage when operations can be commissioned and in such cases O & M responsibilities are being carried out by contractors in the OM&T phases of their contracts
- Historic data on O & M expenses provides a general indication of how the commissioning and operation of new utility plant will affect operating expenses; however care must be taken to take into account the fact that new facilities may be more efficient to operate (thus incur lower unit costs), some new facilities may actually reduce operational expenses and staffing levels may be sufficient in some cases to absorb operational responsibilities of new facilities without the recruitment of additional staff

Under these circumstances, the judgment of experienced professionals in utility engineering and financial management is crucial in the generation of meaningful estimates of the funding required to operate and maintain new utility plant on a sustainable basis. The SCP staff includes a number of such professionals that have gained an intimate knowledge of the utility organizations and the capital improvements through their tenure on the SCP in many cases that has extended over the full life of the project. The estimates of O & M expenses used in this assessment therefore, have been prepared in consideration of all available data and with, most importantly, the guidance of SCP's technical and financial advisors.

3.5 Tabulation of Costs

Costs are organized in categories as described above and “cost streams” are prepared covering the period from 1995 through 2035. This time horizon allows the full period of institutional development and engineering costs to be included while providing for a full 30 year discounting period following completion of construction. In year 2035, provision is made for inclusion of salvage values in the cost stream to give recognition to the remaining useful lives of the utility plant constructed under the project or for plant replacements made during the discounting period. Costs are totaled for each year in the cost stream and the net present value is computed based on the selected discount rate. The resultant figure becomes the “C” in computing the B/C ratio.

SECTION IV

IDENTIFYING AND QUANTIFYING THE BENEFITS OF IMROVED UTILITY SERVICES

This phase of the assessment involved extensive research and analysis to identify, quantify and value the potentially beneficial impacts of the project. As a first step, a "brainstorming" session was conducted with the staff of the IDS/SCP to develop the initial list of prospective benefits. Participants were encouraged to be completely open-minded and to bring forward all prospective benefits that may come to mind, even though they may seem of marginal relevance or difficult to quantify. In this process, participants were asked to visualize situations *without the project* in comparison with the situation *with the project* to identify prospective benefits. A three step process was used in selecting of benefits to be included in the assessment: identification, quantification and valuation.

4.1 Identification of Prospective Benefits

The main category of benefits that were sought for inclusion in this assessment is referred to as "resource cost savings." Benefits of this type include such items as (i) reduced operating expenses associated with reductions in unaccounted-for water (UFW),[11] (ii) for households connected to sewers as a result of the project, avoided costs of septic tank cleaning and (iii) cost savings due to improved efficiency in the use of staff resources (staff rationalization). After identification of a long list of prospective benefits, the next steps consisted of preparing a short list of benefits and the quantifying and valuing each of them. Benefits arising directly from improvements in utility services were considered separately from those related to improved health conditions which are described in Section V.

The long list of prospective benefits was selected from a much larger group that had been included for initial considered with few limitations. To be included on the long list, a prospective benefit was only required to meet the test of validity, whether or not it was considered practical to quantify and value it. The long list included 28 items and is presented in Annex I along with comments on each prospective benefit indicating whether on not it could be included in the economic impact assessment. The final short list of benefits to be included in the assessment is shown with brief descriptions in the inset box.

Short List of Utility Based Benefits Included in the Economic Assessment of SCP

1. Reduced operating expenses attributable to reduced levels of UFW
2. Savings in staffing costs due to optimization of staffing levels
3. Savings in the cost of water purchased commercially and reduced time (spent by women) in carrying water
4. Reduced cost of chemicals in water treatment as a result of SCP's "chemical optimization" program
5. Avoided costs of clean-up of areas flooded by sewer overflows
6. Savings in electricity charges (penalties) through power factor improvement
7. Avoided costs of septic tank cleaning by households connected to sewer systems
8. Avoided losses by PEA through no longer providing septic tank cleaning services at a loss
9. Improvement in collections reducing interest

[11] More accurately referred to as "non-revenue water" since some elements of UFW are known and accounted-for.

As the process of narrowing the range of benefits proceeded, it became clear that some prospective benefits were intangible in nature and not readily subject to quantification. These were placed in a separate category for inclusion in the final report section providing a qualitative assessment of such benefits. Examples of benefits of an intangible nature that are difficult to quantify are given below:

- Environmental benefits that may be primarily related to improved aesthetics and/or ecological diversity
- Gender based benefits e.g. related to improvement of the status of women in the household and/or the community
- Developmental benefits related to the attraction of new business, industry or tourism to a community due to improved water supply and/or improvements in water quality making swimming, fishing and diving more attractive.
- Social benefits, such as those related to poverty alleviation, may be present but not readily subject to quantification
- Numerous accomplishments of the IDS/SCP that are difficult to quantify, but that have real beneficial impacts on the utilities and communities served; the project's massive training program that imparted training to more than 8,000 employees is just one example

Economic assessments conducted elsewhere have attempted to quantify some of these types of benefits through the use of *willingness-to-pay* (WTP) or *contingent valuation method* (CVM) surveys as proxies. The conduct of such surveys however is beyond the scope of this assessment. However, while difficult to quantify, intangible benefits may in some cases be quantifiable and will be quantified when possible

4.2 Quantification and Valuation of the Benefits on the Short List

The benefits selected for the short list were quantified and valued in terms of *units* that best represent the quantity of the resource saved or avoided. Quantification and valuation of health related benefits are presented in Section V. A few examples relating to utility service based benefits are:

- Savings in the costs of chemicals as a result of chemical optimization; savings were realized in Luxor in the amount of 1 Piaster per cubic meter of production and in Mansoura the savings was 1.4 Piasters per cubic meter Electric utility penalties avoided in Mansoura due to improved power factor, LE 5.0 million per year
- Avoided costs of water for customers newly connected to the network, on average, is estimated is LE 12 per month; 28 hours per month saved in carrying or otherwise obtaining water, savings per hour of LE 2.8 (see sub-section 4.3 and footnote 12)
- Number of sewer back-ups avoided in Mansoura, 15 per day, 365 days per year; cost of evacuation trucks is LE 50 per day
- Cost per cubic meter for septage removal services varies according to conditions, but averages LE 12 to LE 15 each occasion; tanks need emptying 40 to 44 times per year.

Similar estimates were made for each benefit category on the short list. In addition to determining unit values for each of the identified benefits, and quantifying the economic values, it was necessary to establish the benefit "streams" over the discounting period. This was done in consideration of the fact that benefits will gradually reach their full potential several years after completion of the construction work. The quantified and valued benefit streams may begin during the year in which operations of the new facilities are commenced or at a later date if it is determined that there will be a delay prior to the realization of benefits.

4.3 Computation of Utility Based Benefits

The net present values of the utility based benefits total more than LE 1.1 billion. This is the sum of all the utility based benefits, discounted through the year 2035. The largest component is savings related to the avoided costs of purchasing water from vendors and the savings in time for homeowners (typically women) in carrying or otherwise collecting and transporting water to their homes. It amounts to 36% of the utility based benefits and about 27% of all benefits. Data for quantification and valuation was obtained with the assistance of SCP project staff, the staff of El Zanaty and Associates and corroborated in various reference materials, including a study report on the economic benefits of water and wastewater conducted in Cairo.[12]

Summary of Utility Based Benefits

Item	UFW Reduction	Staff Rational-ization	Savings Water Purchase	Miscel-laneous	Total Utility Based
NPVs - LE 000	97,099	290,049	403,175	324,449	1,114,771
% of Total Utility	9%	26%	36%	29%	100%
%of Overall Total	6.5%	19.5%	27.1%	21.8%	75.0%

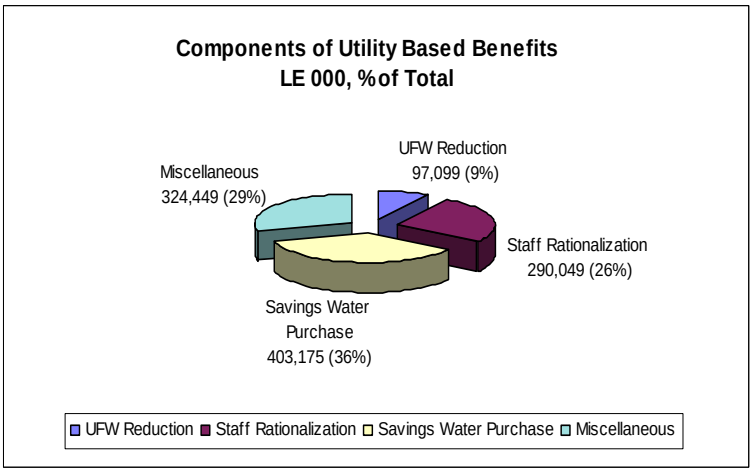
The Cairo study was based on information gained in consultation with focus groups followed-up by surveys employing CVM. Individuals participating were selected to represent a cross-section of socioeconomic backgrounds and were drawn from neighborhoods both inside and outside the water and sewer networks including individuals that had recently gained connection to extensions of the networks. The study determined that in addition to households becoming connected to water systems for the first time, households already connected to the water systems also gained significant benefits as a result of system improvements. Quotations of several participants in the focus group sessions (see inset box) are instructive concerning the benefits to be derived from having a piped water connection in the home that provides reliable service.

Comments of Focus Group Participants On The Value of Reliable Water Service

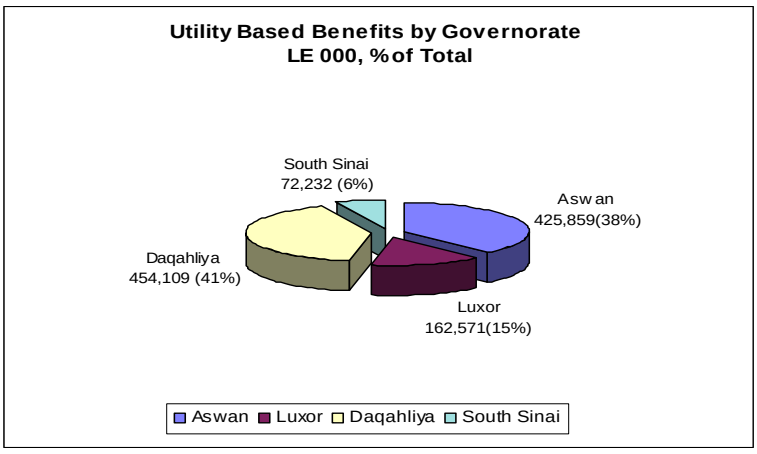
- "We store water at night …. because of the cutoffs …….. The bathtub in my house never gets empty …..to reduce the risk when water gets cut."
- "…laundry day was terrible. I used to store water. We used to fetch water around 13 times on that day, me and my daughter…."
- "…we fetch water from surrounding areas… the distance is very long and carrying water is difficult….half an hour's walk plus embarrassment and humiliation .."
- "I bring water from the street behind me, a 15 minute walk…I pay money …..for six to seven trips per day …sometimes they let me use more"

[12] Hoehn, John P. and Krieger, Douglas, Estimating the Economic Benefits of Water and Wastewater Investments: Residential Demands in Cairo, Egypt, Environmental and Resource Economics Program, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan, 1998

The second largest benefit category is “miscellaneous” which includes six of the smaller benefits: (i) savings from the chemical optimization program, (ii) avoided costs of clean-up following wastewater flooding episodes, (iii) savings in electricity charges due to power factor optimization , (iv) avoided costs of septic tank cleaning, (v) avoided losses of the PEA due to the provision of septic tank cleaning services below cost and (vi) avoided interest payments on bank overdraft loans due to increased liquidity from improved collections performance. The miscellaneous category comprises 29% of utility based benefits and about 22% of overall total benefits. The benefits of staff rationalization comprise 26% of utility based benefits and nearly 20% of overall total benefits. Operating cost savings due to decreases in leakage and overall UFW represent 9% of utility based benefits and about 6% of overall total benefits. The amounts and proportions of utility based benefits are shown graphically in the inset box.



While each of the individual benefits were found, in many instances, to be present in each of the four governorates, they were not so uniformly. Benefits accruing from the carried water savings for example, do not accrue in Luxor because the SCP had no water programs that would affect that practice. Also, since wastewater flooding has not been an issue in Luxor, there could be no benefit in that category attributable to the project in Luxor. On the other hand, Daqahliya was the only utility to gain benefits from lower electricity charges due to the improvement of the power factor in its pumping facilities. In South Sinai/Nuweiba, the only benefits (other than health benefits covered in Section V) are from savings in the carried water category plus a small benefit from staff rationalization. Utility based benefits by governorate are shown in the inset box. Detailed computations of benefits are presented in the spreadsheets in Appendix I.



SECTION V

HEALTH IMPACTS AND THEIR ECONOMIC BENEFITS

Among the impacts that are expected to result from the implementation of water and sanitation projects is a reduction in the burden of water-borne diseases in the involved communities. It is generally understood and widely accepted that health impacts of this type represent real economic benefits to communities. However in many if not most studies conducted elsewhere, it has been assumed that such benefits are intangible and not subject to quantification and valuation. In the present assessment however, the conventional wisdom has not been accepted at face value. A sub-set of the study team consisting of expatriate and Egyptian health experts conducted extensive research into the incidence of water borne (and related) diseases in the project areas. Although not ideal, relevant and credible data was identified that showed declining trends in the incidence of some diseases that can be attributed, at least in part, to project impacts. This section provides a description of the approach used in identifying, quantifying and valuing health related benefits of the SCP projects.

At the outset, the health benefits were expected to vary according to the geographic conditions in each of the communities. Regional differences were expected based on differences in the prevalence of certain disease agents, such as schistosomiasis which is more prevalent in Lower Egypt. Differences can also exist because of environmental conditions; diarrhea-related illnesses for example, are said to be less common in Upper Egypt because of drier prevailing conditions relative to conditions found in the Delta.

5.1 Information Sources on Health Conditions

Ideally, health impacts would be measured by comparing disease burden in project communities before and after the interventions were completed, with sufficient lag time after completing the interventions to be able to detect changes. This analysis was constrained by the fact that a baseline survey was available only for the Aswan project area and no post-project data specific to project communities was available with respect to disease and illness experience. The approach used to estimate health impacts therefore included analysis of information from other relevant sources as follows:

- **Household survey datasets** - including the 1998 and 2002 Egypt Household Health Services Utilization and Expenditure Survey (EHHUES) and the 1995 and 2003 Demographic and Health Survey (DHS) – Each of these surveys was nationally representative and although they did not permit reliable analysis of the project communities (due to small sample sizes), they did provide estimates of illness experiences for urban communities in Lower and in Upper Egypt. These datasets provided information on diarrhea illness, eye and skin infections, patterns of health care seeking behavior, and costs of health care services obtained.
- **Health services utilization statistics** - from health departments in project communities – Although limited, Mansoura, Luxor and Aswan health departments (information was not obtained from South Sinai) provided information about patients seen for schistosomiasis infection, diarrhea,

hepatitis A, typhoid, and paratyphoid. In addition, health departments provided information about child deaths due to diarrhea.

- **Population Data** - IDS/SCP staff provided population estimates for each project community for the year 2025, the year for which water and sanitation systems capacities were designed. Using national population growth data, the population for each year was estimated/projected for each project community from 1996 to 2025. Age structures for each community were constructed using the age structure of the national population, which included information about the changing structure due to the demographic transition which is underway in Egypt. It was assumed that the shift away from the younger age groups is occurring more rapidly in Lower Egypt than in Upper Egypt project communities.
- **Literature** – A literature review was undertaken to obtain information about water-related disease burdens, both broadly and specific to Egypt, and the impact of improved water and sanitation systems on this burden. A list of documents reviewed is provided in the bibliography.

5.2 Economic Benefit Categories for Health Conditions

Three main categories of economic benefits of improved health were considered in the process of assessing prospective benefits:

- **Averted health care expenditures** – The proportion of people who seek health services for which they must pay varies by (i) the disease category, (ii) who becomes ill, and (iii) region. For example, a higher proportion of children under 5 who become ill with diarrhea receive health care outside the home compared to older children and adults. Significantly fewer people who experience an eye or a skin infection seek such services as compared to those who experience an episode of diarrhea. For those who do seek services when ill, the choice of health care providers also affects the amount of savings. In Egypt, more people report seeking care from more expensive private sector providers than from public sector providers, for example. The EHHUES surveys obtained detailed information about all expenditures associated with seeking care, including clinic registration fees, direct payments to providers for consultations, supplies, drugs, ancillary exams and lab tests, and transportation.
- **Wages not foregone** – The value of lost wage-earning time was estimated for adults who experienced episodes of illness. Based on expert opinion among SCP staff, the average wage earned per month in communities that benefits from project interventions was estimated at LE 500 per month. This was converted to a daily wage rate and based on survey data on the duration of an episode of illness, the number of days of work lost was estimated. It was assumed that a non-wage-earner was the primary caretaker and that the time spent caring for the sick child represented an opportunity cost for this person. The opportunity cost of the caretaker's time was assumed to be one-half the wage rate for a wage earner.
- **Child deaths averted** – savings due to averted health care expenditures associated with averted deaths were assumed to have been captured in the fist part of the analysis (averted health care expenditures). Additional savings

estimated included funeral costs (assumed to be LE 200 per funeral, based on expert opinion in Egypt), wages lost during funeral and grieving periods (assumed to be 5 days for a wage earner), and the value of a productive life lost. The value of each life lost was estimated at the expected annual income of a wage earner today (LE 500/month assumed at 10 months of wages earned per year), multiplied by the number of years of life lost for each child in which she or he might have been expected to earn wages.

5.3 Patterns of Health Care for Episodes of Illness

Based on analysis of EHHUES and DHS datasets, Tables 5.1 and 5.2 shows utilization rates and source choices for health care among people in Lower and Upper Egypt, respectively, who reported an episode of diarrhea.

Table 5.1 Patterns of Health Care Utilization
Urban Lower Egypt for Episodes of Diarrhea

Source of care	Children under 5	Children 5-15	Adults 16+
No care	46%	68%	64%
Public sector primary care provider	8%	4%	5%
Private clinics/doctors	34%	19%	21%
Pharmacies	10%	6%	6%
Hospital (as an inpatient)	3%	3%	3%
Other providers	3%	1%	2%

Table 5.2 Patterns of Health Care Utilization
Urban Upper Egypt for Episodes of Diarrhea

Source of care	Children under 5	Children 5-15	Adults 16+
No care	38%	56%	53%
Public sector primary care provider	15%	10%	11%
Private clinics/doctors	31%	21%	23%
Pharmacies	12%	8%	9%
Hospital (as an inpatient)	3%	3%	3%
Other providers	4%	2%	3%

Patients of all age groups in Upper Egypt are tend to seek health care outside the home for episodes of diarrhea illness and they also tend to use services or private sector providers. Based on this information, and compared to residents in Lower Egypt, residents in the project communities located in Upper Egypt would be expected to save more on health care expenditures due a decline in water-related illness.

As noted earlier, in the absence of information on patterns of health care seeking behavior for water borne illnesses other than diarrhea, the patterns shown above were assumed to be prevalent. One exception is for eye and skin infections, where data indicates that about 90 percent of urban Lower Egypt residents and 85 percent of urban Upper Egypt residents do not seek care for these episodes of illness.

5.4 Unit Costs for Health Care

The 2002 EHHUES was used to estimate unit costs for the different sources of care. Table 5.3 below shows the costs of consultations for the three major types of providers: (i) public sector, (ii) private sector and (iii) hospitals and for traditional healers. "Care" is defined generally as consultations, and includes registration fees, consultation fees, informal payments, payments for ancillary services such as lab tests, drugs, and supplies.

Table 5.3 Typical Costs of Health Care Consultations

Source of Care	Lower Egypt	Upper Egypt
Public sector primary care facility	LE 14.9	LE 14.7
Private sector primary care provider	LE 67.0	LE 52.0
Hospitalization	LE 52.9	LE 41.4
Other providers *	LE 8	
Transportation - to outpatient facility - to inpatient facility	 LE 1.0 LE 2.0	

* This includes traditional healers. No information was available from the EHHUES data set and the cost was estimated based on expert opinion.

In addition to these patient-paid costs of health care, the public health system incurs additional costs not covered by these payments. The MOHP recently estimated its average cost per outpatient consultation in its system to be LE 23.9. No estimate of the systems costs per inpatient day at a public hospital was provided; an estimate of LE 75 per day was used by the study team health specialists.

5.5 Incidence of Illness

The study team health specialists carefully reviewed all available data on the relevant diseases, literature covering international experience with their public health characteristics as well as the relevant data on the incidence of the diseases in Egypt. A discussion of each illness follows below, with a summary of trends in the incidence of the diseases provided at the conclusion of this sub-section.

Diarrhea - Calculations based on DHS and EHHUES datasets were used to establish baselines on the incidence of diarrhea type illnesses in urban Lower and Upper Egypt communities. These baselines were established for children under age 5, children between 5 and 15 years of age, and adults aged 16 and over. Project-related declines were projected from these baseline estimates. Improvements in both water and sanitation systems were made in Mansoura and Aswan and it has been assumed that a 27% decline in diarrhea illness would occur as a result of these improvements. In Luxor, improvements were restricted to sewerage systems and wastewater treatment, and an impact of 50% of the level of decline that was assumed for Mansoura and Aswan was assumed. A substantial increase in water system coverage was experienced in Nuweiba as a result of the project (nearly 0% to 80%) and a 27% decline in diarrhea incidence is assumed to have occurred.

Child deaths (under age 5) are another source of economic loss due to diarrheal illness and information from health departments in project areas was used to estimate economic benefits from prevented child deaths. Mansoura, Luxor, and Aswan provided information on the number of child deaths occurring from the late 1990s to 2003 and from among those deaths, the number that were due to diarrheal illness. The proportion of child deaths that were due to diarrhea was calculated for the years prior to completion of project water and sanitation systems improvements and for the year or two after completion of project interventions for which data was provided. A decline in the proportion of child deaths due to diarrhea was observed in the data. In Mansoura the estimated number of child lives saved per year is 5, in Luxor 7 fewer child deaths were estimated to have occurred per year due to water and sanitation systems improvements, and in Aswan 6 fewer deaths were estimated to have occurred. These averted deaths represent a decline of between 10 and 22 percent of the pre-project mortality burden in these communities, well within the estimated 50 percent decline due to water and sanitation systems improvements reported in the literature.

Schistosomiasis - Reports from the Mansoura Health Department of outpatient health care visits for schistosomiasis infection indicate that incidence was on a downward trend prior to completion of the project's systems improvements. Based on these reports, it appears that incidence declined between 1998 and 2001 and it fell more rapidly from 2001 to 2003 when results of project-related water and sanitation systems improvements began to be experienced at the household level. Using this trend data from 1998 to 2003, incidence was estimated through 2006 under the assumption that schistosomiasis incidence would continue to decline for a year after upgrading of the sewerage system was completed. (This upgrading is expected to be completed in 2005.) It was further assumed that the downward trend observed from 1998 to 2001 in the absence of any project-related improvements would have continued, but at the slower pace experienced over those three years, and this was also modeled through 2006. The difference between these two scenarios observed in 2006 was held constant for the remainder of the analysis period. In estimating savings on health care costs, it was further assumed that the primary population affected is children age 5 and above and that 15 percent of infections result in symptoms serious enough to motivate families to seek health care.

The literature reports lower schistosomiasis infection rates in Upper Egypt communities and health utilization reports from Luxor and Aswan communities also indicate that a declining trend was in progress prior to completion of project improvements in water and sanitation systems. In both cases, the decline appears to have reached a plateau by 2002. That was the year that additional households began to benefit from the project's water and sanitation system improvements and the impact on schistosomiasis infection was assumed to be experienced over a three year period from 2002. In Luxor, infection rates were assumed to decline by 15 percent over this three year period. (The proportion of households connected to the expanded sewerage system increased by 20%, and this expanded coverage rate was multiplied by the 77% decline reported in the literature in infection rates due to water and sanitation systems.) In Aswan, the decline over this three year, post-project period was assumed to be 38% (half of 77% because the sanitation system coverage rate increased by 50%). No information on schistosomiasis was available for the project's South Sinai communities, where environmental conditions were assumed not to be conducive to endemic schistosomiasis and no project-related benefits were assumed.

Bladder cancer is a longer term consequence of schistosomiasis infection and in Egypt, it is estimated that 16 percent of all bladder cancer cases result from such infections. Among the

estimated 65,000 new cases of cancer diagnosed per year in Egypt, 30 percent are bladder cancer. These two facts allow us to estimate that about 3,100 cases of bladder cancer occur in Egypt each year as a result of past schistosomiasis infection. Based on the population in the project areas, it is estimated that 40 schistosomiasis-related bladder cancer cases occur each year. Given a presumed long lag time between infection and development of cancer, it was assumed that a reduction in the incidence of bladder cancer due to project interventions would not be observed until 15 years after the project interventions were completed, or 2017. The reduction in the number of bladder cancer cases was estimated to be proportionally equivalent to the decline in infection rates assumed to result from project interventions, with up to a third of schistosomiasis-related cases being averted thereafter. Given that the incidence of schistosomiasis infection is considerably lower in Upper Egypt and the smaller population of project communities in Upper Egypt, the estimated number of bladder cancer cases averted was estimated to be less than one case per year and these were not included in the estimated health savings.

Hepatitis A, typhoid and paratyphoid - Only the Luxor Health Department provided information on these three water-related diseases. Like schistosomiasis, these diseases were on a declining trend prior to completion of project water and sanitation systems improvements. The declines appeared to reach a plateau by 2001, with about 2 per hundred population experiencing an episode of hepatitis A per year, 7 per hundred experiencing an episode of typhoid and 4 per hundred experiencing an episode of paratyphoid. Information about patterns of care was not available and the patterns of care observed for diarrhea were used as a conservative estimate of the proportion of people with episodes of these illnesses who sought care. It was further assumed that all project areas experienced the same burden of these diseases and that after completion of project water and sanitation systems improvements, each area experienced a further modest reduction in the number of episodes of illness related to these diseases of 5 percent.

Eye and skin infections - Respondents to the 2002 EHHUES were asked if they had experienced an episode of eye or skin infection in the two weeks prior to the survey. Based on those responses, 6 out of 10 children under age five in Lower and Upper Egypt experienced one episode of such an illness in the past year. Among children age 5 to 15, 6 out of 10 in Lower Egypt and 5 out of 10 experienced an episode in that year. The average adult in Lower Egypt experienced one such episode that year and in Upper Egypt, 8 out of 10 adults experienced an episode of an eye or skin infection. However, compared to diarrhea, considerably fewer of these illnesses resulted in a visit to a health care provider. On average, only between 10 and 20 percent of those experiencing such an episode sought care.

Table 5.4 shows a summary of the estimated project impacts on incidence of water-related illness in project communities.

Table 5.4 Changes in incidence of water-related illnesses in SCP areas

Disease	Decline in episodes of illness per year			
	Mansoura	S. Sinai (Nuweiba)	Luxor	Aswan
Diarrhea				
- Children	5.8 to 4.3	5.8 to 4.3	5.5 to 4.8	5.5 to 4.1
< 5	2.9 to 2.1	2.9 to 2.1	2.7 to 2.4	2.7 to 2.1
- Age 5-15	1.4 to 1.1	1.4 to 1.1	1.4 to 1.2	1.4 to 1.0

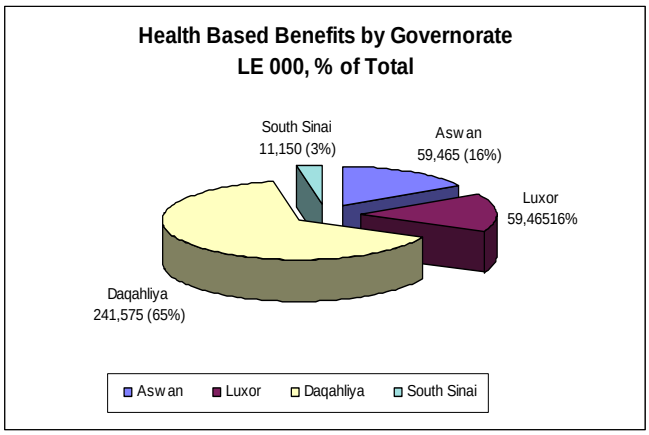
- Adults 16+				
Schistosomiasis	.104 to .044	NA	.06 to .054	.066 to .044
Hepatitis A	.0213 to .0202			
Typhoid	.0682 to .0645			
Paratyphoid	.0368 to .0350			
Eye and skin infections - Children < 5 - Age 5-15 - Adults 16+	.606 to .457 .653 to .492 1.042 to .785		.637 to .480 .508 to .382 .826 to .623	

5.6 Economic Benefits of Improved Health

Over the analysis period, 91 percent economic benefits will accrue in two of the three health care categories: (i) health care expenditures saved and (ii) averted wage loses due to illness. Benefits will be nearly evenly split between these two categories. An additional 9 percent in benefits will be realized due to child deaths prevented. Nearly two-thirds of the economic benefits due to the project's health impacts will accrue in the largest community, Mansoura. Sixteen percent of the benefits will accrue each to Luxor and Aswan project communities, and 3 percent will be realized in Nuweiba in South Sinai. Data on the distribution of benefits due to cost avoidance by disease and the health benefits gained by each governorate are shown in the two inset boxes.

Health Care Benefis Summary				
Item	Health Care	Lost Wages	Child Mortality	Total Health Based
NPVs - LE 000	167,086	170,343	34,225	371,654
% of Total Health	45%	46%	9%	100%
%of Overall Total	11.2%	11.5%	2.3%	25.0%

Benefits accruing to reduction in diarrheal episodes of illness accounted for three-quarters of all benefits in Mansoura, one-half in Luxor, and 85 percent in Aswan. Benefits from prevented eye and skin infections accounted for between 13 and 20 percent of total benefits, while prevented childhood deaths accounted for 6 percent of benefits in Mansoura and one-third of benefits in Luxor. Economic benefits due to reduced burden of the other water-related diseases (schistosomiasis, hepatitis A, typhoid and paratyphoid) accounted for only about one percent of total benefits in all project communities. Overall, benefits from averted costs of



heath care, lost wages and child mortality amount to 25% of all quantified benefits in this assessment. Detailed worksheets are presented in Annex II.

SECTION VI

COMPUTATION OF ECONOMIC INDICATORS

6.1 Methodology Used in Computing Economic Indicators

A series of spread sheets, presented in Annex II, were prepared as a basis for computing the net present values for each of the identified cost and benefit streams. A set of five spreadsheets cover each of the four governorates and the project as a whole. Supporting worksheets are also presented to show how the data was prepared for inclusion in the five main spreadsheets.

The discounting rate for economic analyses made by international development banks is typically in the range of 10% to 12%[13]. The 10% nominal rate has been used for this assessment, representing the real rate of 5.26% (the 10% discount rate adjusted to remove the estimated inflation component of 4.5%). Total benefits are compared with total costs to determine the B/C ratio for each governorate and for the overall project. In Aswan and Daqhaliya, overall B/C ratios have been computed that represent an aggregate figure for SCP projects in those governorates.

Sensitivity analyses have been made to illustrate the impact on the B/C ratio of increases in estimated costs and of decreases in estimated benefits. Since the initial construction projects are virtually complete and the costs are known, the only element of costs subject to uncertainty are operating costs and replacement costs. Another indicator, the switching value (SV) has also been computed. The SV is the point at which adverse factors reduce benefits or increase costs to the point at which the net present values of benefits and costs become equal (e.g. the B/C ratio becomes equal to one). An additional economic indicator, the EIRR, has also been computed for comparison with the EOCC.

6.2 B/C Ratios Representing the Economic Impact of the SCP

It is important to keep in mind that the approach used in the quantification and valuation of benefits was conservative in that the selection of values for benefits was consistently made toward the lower end of the range of possible values. In addition, many prospective benefits included on the long list that were not included in the short list because of practical problems in the quantification process, are known to have real and tangible benefits. In many cases, such benefits could have been quantified if more time and resources had been available for this assessment.[14] Finally, the category of intangibles includes many additional benefits that are not readily subject to quantification but are known to have beneficial impacts. The main

[13] This is the ADB's range of assumed rates for the economic opportunity cost of capital (EOCC) in developing countries.

[14] There is a point in the build-up of study costs however, beyond which it is not cost effective to attempt to quantify and value additional benefits.

point here is that the figures presented for the B/C ratio represent a very conservative estimate of the beneficial impact of the SCP.

The B/C ratio for the project as a whole, base case, is computed as 1.6. This is considered an excellent ratio, especially given the type of project and what is considered to be a substantial amount of unquantifiable benefits that, if quantified, would further increase this positive ratio. The B/C ratios for the individual governorates range from 1.1 in South Sinai to 2.2 in Daqhaliya; the ratio for Luxor is 1.5 and the ratio for Aswan is 1.2. The ratio for Daqahliyais most impressive in that it applies to a much larger economic base than is present in the other three governorates. Project impacts in the governorates with smaller B/C ratios are greater than one and the project can be considered economically beneficial in those communities as well as in those with the larger ratios. Further, it must be emphasized that the beneficial impacts will continue to accrue in these communities for many years to come.

EIRRs computed for the project as a whole and the individual governorates follow a similar pattern. The EIRR for the project as a whole is 9%, with a high of 14% in Daqahliyaand a low of 6% in South Sinai. EIRRs in Luxor and Aswan are recorded at 9% and 6% respectively. The overall EIRR of 9% seems in line with, if not slightly better than, expectations for a project with many social and other difficult to quantify benefits. With an assumed inflation rate of 4.5% added, the nominal EIRR would become 13.5% which would be comparable with the estimated EOCC in Egypt.[15] The table in the inset box provides a summary of B/C ratios and EIRRs for the project.

Economic Indicator	Base Case B/C Ratios and EIRRs				
	Total Project	Luxor	Aswan	Daqhliya	S. Sinai
B/C	1.6	1.5	1.2	2.2	1.1
EIRR	9%	9%	6%	14%	6%

6.3 Sensitivity of Computed Economic Indicators to Adverse Conditions

The beneficial impacts of the project appear to be relatively well insulated from the advent of adverse experiences in terms of costs and benefits. A sensitivity analysis was made to determine the impact of costs being 10% higher than expected and benefits being 15% lower than expected. These two adverse circumstances combine to reduce the B/C ratio to 1.3 and the EIRR to 8%. These are relatively small changes from the base case and increase the level of confidence in the findings that the project will produce highly positive impacts for many years in the future.

The switching value (SV) was also computed to provide a measure of the extent to which costs must increase and benefits must decrease in order for the B/C ratio to be reduced to 1.0. An SV of 1.46 was computed which indicates that costs would have to increase, and benefits would have to decrease, by nearly 50% each in order for the B/C ratio to be reduced to one. This again demonstrates that the project is well buffered from adverse conditions and strengthens the confidence level in the findings of solid positive and sustainable benefits for the SCP.

[15] Using the commercial lending rate of 13.5% in April 2004 as a proxy for the EOCC.

SECTION VII

CONCLUSIONS ON THE ECONOMIC IMPACT OF THE SCP

The findings described in Section VI clearly portray strong economic indicators that support the conclusion that the SCP will have a highly beneficial impact on the project communities and the economy of Egypt for many years. In addition to exhibiting strength in terms of economic measurements, sensitivity analysis show that the project can withstand substantial adverse experiences in the future in terms of increased costs and decreased benefits and still remain vibrant and continue to produce positive impacts for many years.

As indicated in Section VI, It is important to keep in mind that the approach used in the quantification and valuation of benefits was conservative. Benefits were consistently quantified and valued on the low side of possible values. Many prospective benefits included on the long list were not included in the short list because of practical problems in the quantification process and are known to have real and tangible benefits. In many cases, such benefits could have been quantified if more time and resources had been available for this assessment. Finally, the category of intangible benefits includes many that are not easily quantified but that are known to have beneficial impacts. The main point here is that the figures computed for the base case B/C ratios represent a very conservative estimate of the beneficial impacts of the SCP. These additional factors give positive reinforcement to the conclusions of strong and sustainable economic impacts for base case conditions which are well buffered from adverse circumstances that may be encountered in the years ahead.

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ANNEX I

THE LONG LIST OF PROSPECTIVE BENEFITS

Comprehensive List of Prospective Benefits for Inclusion in the Economic Impact Assessment of the Secondary Cities Project	
Description	**Comments & Initial Reaction**
Part A: Benefits Attributable to Improvements in Utility Services	
1. As a result of IDS/SCP' program to assist utilities in improving contract management procedures, utilities will obtain higher quality work at more competitive prices and will be less subject to costly change orders.	1. The stated benefit is thought to be valid, but deemed impractical, if not impossible, to quantify and value.
2. IDS/SCP' program for the provision of leak detection equipment, training in leak detection and for assisting utilities in reducing the other factors contributing to UFW, has produced substantial savings in operating costs. The savings attributable to the project extend throughout all of DaqahliyaGovernorate because the PEA has used the leak detection teams trained by the IDS/SCP in Mansoura to serve the other divisions in the PEA.	2. This is clearly a valid and substantial benefit in all utilities except South Sinai. Programs for reducing UFW have been in operation long enough to produce tangible evidence of their effectiveness. By 2004, UFW has been reduced by more than 50 million CuM in the three utilities and the savings is expected to increase to more than 100 million by 2010. The total savings is considerable even though the savings is limited to electricity and chemical costs and the cost per CuM is small (about 8 Piasters).
3. The reduction in leakage will reduce contamination in the water distribution system and the associated negative and costly impacts.	3. It is true that openings in pipes that allow leakage will also allow contamination under conditions of negative pressure. However the establishment of positive pressures throughout all water systems on a 24/7 basis is one of the objectives of the capital investment program and that would have to be given credit for the prevention of contamination of water in the distribution systems.
4. Efficiencies will be realized that will result in lower operating costs of the utilities, due to the merger of water and wastewater organizations into a single utility organization (e.g. PEA).	4. This could be a valid assertion, but difficult to quantify and value. Further, it could be argued that the decision to establish PEAs and provide for the merger of these functions had been made prior to the initiation of the IDS/SCP project.
5. It is thought that in general, customers of the SCP utilities have increased trust and confidence in the organizations providing the services.	5. Hopefully true, but would have to be proven through the conduct of a contingent valuation or a willingness to pay survey, which are beyond the scope of this project. Quantification and valuation would then be a major obstacle.

6. Improved system pressures brought about by water system improvements will result in savings to customers who no longer have to operate pumps for storage of water to use during times when system pressures are low.	6. This appears to be a valid assertion. Some information is available on the costs of operating an in-home water pump for Cairo, but not for the project utilities. The study team did not have information on the number of customers operating such pumps or the costs of pump operation and was unable to include this benefit in the analysis..
7. Provisions for the reuse of wastewater treatment plant effluent was incorporated into the capital improvement projects in Nuweiba, Aswan and Luxor. Thus practical and beneficial use may be made of a resource that would otherwise be discarded and possibly cause environmental degradation.	7. There are clearly beneficial impacts created by the reuse of treated wastewater. However in our situation, restrictions on the use of treated wastewater by the Ministry of Agriculture have diminished the feasibility of reuse projects to the point where such reuse is not likely to be implemented. We are left with a situation where the investment already made in the development of the reuse facilities may have been for naught.
8. The leak detection programs are systematically identifying leaks which are then repaired prior to the point where damage has been created. Without the project, leaks could ultimately cause damage to roadways and possibly to adjoining houses. Thus the leak reduction program provides another source of cost savings.	8. This difference between the cost of repairing a leak under the leak detection program and the cost of the same repair without the leak detection program which may have an added cost for repairing damage to adjacent areas may not be of significant magnitude and in any case is virtually impossible to estimate.
9. Improvements in mapping of water distribution and wastewater collection systems made by the utilities with IDS/SCP' guidance and assistance will improve the efficiency of maintenance crews by greatly reducing wasted effort in locating pipes, which previously was based largely on a "trial and error" basis due to a lack of up-to-date and reliable system maps.	9. A valid point, but this situation is considered to be a contributing factor, along with others, toward the realization of benefits under the category of staff rationalization.
10. Improvements to water systems made under the capital improvement program have expanded water service into new areas and provided for greater continuity of services in areas already served with connections to the water systems. This will result in considerable savings in time spent by women in carrying water.	10. This is a real and quantifiable benefit based on studies conducted in Cairo that indicated that on the average, women without water connections or with intermittent service spent 28 hours per month carrying water. An additional benefit is the avoidance of paying the costs of the water purchased in this manner or purchased from vendors. This benefit is applicable in all communities except Luxor and is the largest single benefit identified in this assessment.

11. The initiation of operations at the new Mit Khamis water treatment plant in Mansoura will allow service to be extended into a wide area and will permit the decommissioning of nearly 100 compact water treatment units that previously provided service in those areas. There will be a benefit in reduced operating costs of the larger plant (4,320 CuM/Hr.)vs. the costs of operating the compact units (100 Cum/Hr).	11. The savings do not appear to be uniform, in that it is said that if a compact unit is operated 15 hrs. per day or more, then it operates as efficiently as a larger plant. Also it is not certain as to how many plants will actually be shut down. Since the plants are operated largely by volunteer labor from the local communities, there would be a beneficial savings in labor for each plant that is actually closed. The project team however, was not able to obtain the level of detailed information on this matter needed for it to be included among project benefits.
12. As a result of the IDS/SCP advisory services, operating costs on a per CuM basis have declined generally among project utilities.	12. This is true but for a variety of specific reasons that will be considered individually as potential benefits attributable to the project.
13. As a result of IDS/SCP assistance, store management and inventory control has improved in the project utilities. Benefits will accrue in terms of reduction losses and waste.	13. Losses and waste should be reduced and the level of working capital needed by the utilities should also be reduced. The benefits however seem too difficult to quantify within the time constraints for this assessment.
14. Automation of the billing process in Dakhaliya with IDS/SCP assistance has resulted in the elimination of 1,800 clerical positions and a significant savings in staffing costs.	14. Operational efficiencies created in the utility organizations with IDS/SCP assistance are considered in the aggregate as contributing factors in the “staff rationalization” (e.g. more efficient use of staffing in terms of the numbers of staff employed for each 1,000 customers) that has occurred in the various utilities. The savings are one of the larger benefits identified in this assessment.
15. Improvements in collections efficiency attributable to IDS/SCP can result in improvements in the liquidity of a utility. If the utility is borrowing to meet its working capital requirements, say through an overdraft account, savings in terms of reduced interest expense can accrue.	15. This appears to have been the experience in Aswan where the utility’s interest expenses have decrease by approximately LE 2 million after collection rates were improved and accounts receivable reduced.
16. Introduction of maintenance management systems by IDS/SCP, including preventive maintenance and planned and scheduled maintenance in lieu of “break down” maintenance, in each utility will result in lower O&M costs, less down time, increased life of equipment and more effective operations.	16. Valid recognition of a real benefit, but one that is too difficult to quantify under the constraints of this assessment.

17. As a result of the capital investment projects, there has been a significant savings due to the reduced need for households to purchase water from vendors or to travel to vending sites to purchase water.	17. A valid point, and as mentioned in point no. 10 above, the combined savings in time spent in carrying water and in the expenditures for water purchased from vendors or at other locations is the largest single benefit category identified in this assessment.
18. As a result of assistance provided by IDS/SCP advisors to water treatment plant operators, water quality has improved dramatically. For example in Mansoura, 100% of samples taken twice daily meet water quality standards and 98% to 100% of daily and weekly samples taken throughout the distribution system meet the required standards. These improvements should result in improved health conditions.	18. Health benefits attributable to the SCP are believed to be the result, in aggregate, of improvements in both water and wastewater operating procedures and in capital improvements made in both areas. Prospective health benefits are considered separately in the next section of this table.
19. IDS/SCP team members assisted utilities in reducing electricity expenses by increasing power factors in pumping plants through the installation of capacitors. Electric utilities charge penalties for plants with unsatisfactory power factors (e.g. plants that have high peak demands) and the improved power factor represents a substantial savings, with a pay-back of the investment within a 9 month period.	19. The IDS/SCP team was able to convince the management of the Daqahliya utility to purchase and install the capacitors with an estimated savings of LE 5 million per year. In other locations, the utilities have not been paying their electric bills and thus have no incentive to incur the expense of installing the capacitors.
20. Households gaining connection to the centralized sewage collection and treatment systems as a result of the USAID capital investment program, realize benefits in terms of avoided expenses for septic tank cleaning. In areas with high water table conditions, tanks can require cleaning on a twice weekly basis.	20. Information on this benefit has been gathered with the assistance of the SCP project team for both Aswan (Kom Ombo Division) and Luxor. Estimated savings are considerable.
21. In the Aswan PEA, the Kom Ombo Divison has been providing septic tank cleaning services at below cost. As a result of the extension of sewer services to about 50% of the households, the PEA will experience considerable savings.	21. The PEA's losses have amounted to an estimated LE 700,000 per year. The savings is therefore estimated at LE 350,000 per year.
22. As a result of the IDS/SCP' chemical optimization program (involving the introduction of such matters as break-point chlorination), utilities have been able to reduce operational expenses for chemicals (and spare parts) by significant amounts and at the same time improve water quality.	22. Savings attributable to the project can be quantified for Luxor and Daqahliya(Mansoura), but not for Aswan or South Sinai. Savings are relatively small, but meaningful enough to be included in the benefit assessment.

23. Prior to the implementation of improvements in the wastewater system in Mansoura, sewers overflowed on a daily basis creating flooding conditions which required pumping out of flooded areas and removal and disposal of the wastewater and debris. Now that the improvements have been made, flooding has ceased and the PEA has benefited through reduced costs of dealing with the flooding situations.	23. This benefit has been quantified with the assistance of the project team and will be included in the B/C assessment. The benefit amount is not large, but is still worthy of inclusion.
24. For customers located in areas previously subjected to conditions of low water pressure or periods when water service was disrupted, it was common for them to install pumps and water tanks for the purpose of storing water for use during periods of low pressure or when water was not available in the system. With the improvement in service continuity and maintenance of system pressures at adequate levels on a 24/7 basis, customers not longer need to incur the cost of electricity for pumping, thus gaining a benefit.	24. This is another case where the point is valid, but as a practical matter the benefit cannot be quantified without conducting surveys or additional research that is outside the scope of the present study.
25. Installation of smart meters in Luxor and Nuweiba will provide benefits in terms of improved collections and reduction of costs for billing and collection.	25. Smart metering offers the potential for substantial benefits, but the Luxor pilot project platform is too small to make projections from. In Nuweiba, the total staff level is so small that it is unlikely that a substantial benefit can be achieved through reductions in billing and collection staffing. A small benefit has been given for a general staff rationalization in Nuwieba expected to occur by the year 2010 that will recognize this and other efficiencies gained through the efforts of the IDS/SCP.
26. The improvements in water and wastewater facilities and services in Luxor and South Sinai will have a beneficial impact on tourism. Overall community esthetics are being improved in both governorates and coral reefs in Nuweiba are being protected. These communities are increasingly attractive as tourism destinations due to no small measure to SCP sponsored improvements. The availability of adequate water and wastewater services also makes these areas more attractive to investors and developers in the tourism industry. The involved governorates and Egypt will gain significant benefits in the coming years.	26. It is intuitively true that improvements in water and wastewater utility services will have beneficial impacts on economic conditions in the more tourist oriented areas. Given a solid baseline assessment followed-up by a review of how tourism has changed over say, a ten year period, it might be possible to quantify the benefits. Contingent valuation surveys could be used in such studies as a tool for measuring how water and wastewater services impact decisions on tourism. The present study however does not have sufficient time or resources to undertake such analyses.

27. IDS/SCP was originally designed to provide institutional development assistance to specific operating units within the governorate level utilities, e.g. Kom Ombo Division within the Aswan PEA. However the benefits realized have extended far the limits of the originally specified units to provide substantial benefits to other communities. For example two other tourism sites in South Sinai, Dahab and Ras Sudr, are now more attractive as tourist destinations as a result of improvements in wastewater system management that can be attributed to the SCP.	27. Again, these are valid points. When possible, the study team is including such benefits in this assessment, as in the case of leakage reduction and other UFW improvements made in Mansoura, that have been extended throughout Daqahliyagovernorate. However with respect to the implementation of the billing system in Daqahliyabeyond Mansoura, it is more difficult to make a linkage between the benefits and the IDS/SCP project. Also, in matters such as benefits in tourism, the benefits cannot be readily quantified at the present time as discussed in point #26 above.
28. As a result of IDS/SCP' programs in operations and maintenance, the assets acquired through the USAID sponsored capital investments will have a longer useful life than they would have without the assistance provided under the project. This will provide tangible benefits in the years ahead.	28. The benefits are real and are represented by the length of time that the useful life of the assets are lengthened which allows the capital expenditure for their replacement to be postponed. One difficulty in quantifying the benefit is that the length of time that useful lives are extended will not be known until some distant time in the future. The benefit of a small extension say of 5% would not make a significant impact on the results of this assessment (e.g. about one-half of 1% of the NPV of total benefits).