Quantifying Replenish Benefits in Community Water Partnership Projects

Final Report for 2012
February, 2013

Prepared for:

The Coca-Cola Company

in collaboration with

The Nature Conservancy
Protecting nature. Preserving life.™

LimnoTech
Water | Environment | Scientists | Engineers

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1. INTRODUCTION

The Coca-Cola Company is quantifying the water-related “Replenish” benefits derived through its Community Water Partnership (CWP) projects. The work described in this report builds on previous efforts, and provides a current status of quantification results for three categories of CWP projects: Watershed Protection; Water for Productive Use; and Water Access and Sanitation.

1.1 PREVIOUS STUDIES

During previous phases of work, the types of activities that generate Replenish benefits were identified, and past and ongoing CWP projects were reviewed and categorized. Methodologies for quantifying Replenish benefits and associated data needs were identified, and the methods were applied to projects with sufficient data for the calculations. The quantification approach and results for Watershed Protection and Water for Productive Use projects are described in a January 2010 report (LimnoTech and TNC, 2010a) and updated results including water access benefits are provided in a December 2010 report (LimnoTech and TNC, 2010b) and a 2011 report (LimnoTech and TNC, 2012). The methods for Replenish benefits generated through Water Access projects are provided in a 2009 report (GETF and Wright, 2009).

The Coca-Cola Company’s “Water Stewardship and Replenish Report” (TCCC, 2012) provides details on the Company’s water stewardship goals and key partnerships, and includes summaries of ongoing CWP projects.

1.2 QUANTIFICATION APPROACH

The results provided in this report represent an update of previous quantification results. The updated results are the outcome the following steps:

1. New project activities that are generating Replenish benefits were identified;
2. Updated project information that may affect previous quantification results were identified;
3. Key data and information needed to quantify benefits were obtained and reviewed;
4. Replenish benefits were calculated for new activities, and updated where needed for activities that were evaluated previously.

2. QUANTIFICATION RESULTS

The quantification results for all Replenish activities are provided in Section 2.1. Specific results for Watershed Protection projects are shown in Section 2.2, results for Water for Productive Use projects are presented in Section 2.3, and results for Water Access and Sanitation projects are presented in Section 2.4.

For the purpose of this report, the term "project" refers to each of the almost 400 CWP projects described in the Replenish report. The term "activity" refers to the specific actions that are being implemented under each project.

2.1 COMBINED REPLENISH BENEFITS

The current estimate is that projects implemented by the end of 2012 provide a Replenish benefit of approximately 81.3 billion liters per year (BL/yr), representing 51.7% of the product volume generated by TCCC facilities (157.3 BL/yr). This estimate of benefits for 2012 represents current performance. The 2012 Replenish benefits are anticipated to continue to be generated through the year 2020 provided that the projects remain in productive service, but benefits will be verified before they are reported as actual benefits.

There are several projects that generate exceptionally high benefits that if unadjusted, would have a disproportionate effect on global progress that would be inconsistent with the goals of the program. In 2012, The Coca-Cola Company developed a formal policy on benefit capping. This policy sets a cap for exceptionally large projects in a way that supports TCCC's continued commitment to the credibility of Replenish benefits reported, yet still recognizes a fair accounting of Replenish benefits from the largest-benefit projects. Implementation of the capping policy adjusts benefits for four projects.

The pollution reduction benefits of Watershed Protection projects were also estimated. The primary focus of most of the CWP projects that address water quality problems is erosion control, so the reduction in sediment yield was estimated where relevant. The current estimate is that in 2012, 36 activities are reducing sediment loads by 3,505,913.5 metric tons/year. These reductions are significantly improving the quality of receiving waters in those watersheds.

2.2 BENEFITS OF WATERSHED PROTECTION ACTIVITIES

The information obtained through this phase of work was sufficient to quantify new and updated benefits from 39 watershed protection activities.

Water quantity and water quality benefits are presented separately below. Additional details are provided in Tables A1 and A2 in Appendix A. For each activity that was quantified, the tables present the total estimated benefit, Coca-Cola's percent contribution to the project, and the activity timeline. For projects that TCCC did not solely fund, the total benefit was adjusted based on the estimated cost share. The total benefit is also adjusted according to the timeline for implementation.

The supporting documentation for each Watershed Protection project that was quantified is provided in individual fact sheets, which are included in Appendix D. Each fact sheet includes a basic description of the activity with watershed restoration benefits, contact information, the water quantity and/or water quality benefit that was estimated, the approaches used to make the estimates, and the source of data and information used to compute the quantity/quality benefits.

2.2.1 Water Quantity Benefits

The current estimate is that the watershed protection projects implemented by the end of 2012 will provide a benefit of approximately 70.1 BL/yr. This reflects an adjustment for four large-scale projects, as described in Section 2.1.

2.2.2 Water Quality Benefits

The pollution reduction benefits of these activities were also estimated. The primary focus of almost every CWP project that addresses water quality was determined to be erosion control, so the reduction in sediment yield was estimated where relevant. The estimate is that the CWP activities evaluated will reduce sediment yield in 2012 by approximately 3,304,063 metric tons/year. These reductions are significantly improving the quality of receiving waters in those watersheds.

Many watershed protection activities are also reducing other pollutant loads, including nutrients and pathogens. The current estimate is that approximately 87.7 metric tons of other pollutants are no longer released to waterways as a result of the activities.

2.3 BENEFITS OF WATER FOR PRODUCTIVE USE PROJECTS

The information obtained through this phase of work was sufficient to quantify new and updated benefits from 6 Water for Productive Use activities. The current estimate is that projects implemented by the end of 2012 are providing a benefit of 6.2 BL/yr.

Additional details are provided in the table in Appendix B. For each activity that was quantified, the table presents the total estimated benefit, Coca-Cola's percent contribution to the project, and the activity timeline. For projects that TCCC did not solely fund, the total benefit was adjusted based on the estimated cost share. The total benefit is also adjusted according to the timeline for implementation. The supporting documentation for each Water for Productive Use project that was quantified is provided in individual fact sheets, which are included in Appendix E.

2.4 BENEFITS OF WATER ACCESS AND SANITATION ACTIVITIES

The benefits of 96 water access and sanitation projects have been quantified to date. A total of 1,818,722 beneficiaries are provided with full access to water through these projects. In addition, 5 wastewater treatment plants have been constructed. Replenish benefits by project are provided in Appendix C, and Appendix F provides project summaries.

The current estimate is that the water access and sanitation projects implemented by the end of 2012 are providing provide a benefit of 5.0 BL/yr.

3. REFERENCES

GETF and Dr. Albert Wright. 2009. Quantifying Water Access Benefits in Community Water Partnership Projects. Prepared for The Coca-Cola Company.

LimnoTech and The Nature Conservancy (TNC). 2010a. Quantifying Watershed Restoration Benefits in Community Water Partnership Projects. Prepared for The Coca-Cola Company in collaboration with The Nature Conservancy. January 25.

LimnoTech and The Nature Conservancy (TNC). 2010b. Quantifying Replenish Benefits in Community Water Partnership Projects. Prepared for The Coca-Cola Company in collaboration with The Nature Conservancy: Updated Results. December 31.

LimnoTech and The Nature Conservancy (TNC). 2012. Quantifying Replenish Benefits in Community Water Partnership Projects. Prepared for The Coca-Cola Company in collaboration with The Nature Conservancy. Final Report for 2011. January.

The Coca-Cola Company (TCCC). 2012. The Water Stewardship and Replenish Report. January.

Appendix A
Quantification Results:
Watershed Protection Projects

Table A1. Water quantity benefits for watershed protection projects

Table A2. Water quality benefits for watershed protection projects

Table A1. Water Quantity Benefits for Watershed Protection Projects

	End 2012
TCCC Product Volume (billion L/yr):	157.3
TCCC Quantity Benefits (billion L/yr):	70.1
% of Benefits Relative to Product Volume:	44.5%

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Type of Benefit Quantified	Quantity Change (million L/yr)			
1	153	U.S. MI	TNC	Paw Paw River Watershed Restoration	Cropland management (conservation tillage, filter strips, conservation cover - 477 ha)	R	2009 - ongoing	100%	Runoff (decrease)	254.90	240.40	160.50	Reduce runoff and sediment from agricultural lands; increase recharge / baseflow
2	154	U.S. TX	TNC	Tallgrass Prairie Watershed Restoration in North Texas	Conservation of prairie lands and wetlands (52.6 ha)		2008 - ongoing	100%	Runoff (decrease)	42.40	42.40	42.40	Maintain hydrologic condition of prairie lands
					Removal of invasive species and revegetation (1,125 ha)		2008 - ongoing	100%	Runoff (decrease)	35.50	35.50	35.50	Increase infiltration, reduce sediment erosion/runoff
3	155	U.S. GA	TNC	Flint River Watershed Restoration	Remote soil moisture monitoring for irrigation management	R	2012	100%	GW usage (decrease)	289.97	289.97	289.97	Provide demonstration projects for decreasing irrigation water usage
4	156	U.S. GA	TNC	Etowah River Watershed Conservation Partnership	Floodplain restoration	N	2012 - ongoing	31%	Floodplain inundation (increase)	5.90	1.84	0.66	Re-establish floodplain connectivity
5	42	Ghana, Ivory Coast	GETF	Transboundary Community Water Management	Conservation/reforestation of tropical rain forest (~13.5 ha)		2007 - 2009	50%	Runoff (decrease)	6.00	3.00	3.00	Protect biodiversity, reduce sediment & other pollutant loads
7	48	Tanzania	GETF	Improved Community Livelihoods and Sustainable Water Management	Reforestation (23 ha)		2009	50%	Runoff (decrease)	17.00	8.50	8.50	Reduce land degradation & sediment erosion
15	91	U.S. PA	Wildlands Conservancy	Wildlands Conservancy Lehigh River Restoration	Abandoned mine drainage treatment (Lausanne Tunnel)	R	2004 - 2009	1.5%	Volume Treated	3,979.00	61.20	61.20	Treat acid mine drainage
16	478	U.S. PA	ClearWater Conservancy	Clearwater Community Watershed Partnership: the Scotia Barrens Conservation Project's Halfmoon Wildlife Corridor	Conservation/protection of existing resources (106 ha)		2009 - 2010	1%	Runoff (decrease)	11.90	0.08	0.08	Conservation/protection of a corridor for wildlife passage

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LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits (ultimate): Type of Benefit Quantified	Water Quantity Benefits (ultimate): Quantity Change (million L/yr)	TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
21	18	U.S. / Mexico	WWF	Protecting the Rio Grande / Rio Bravo River	*Rio Conchos* - Delicias Irrigation District modernization		2002 - ongoing	0.03%	SW usage (decrease)	396,000.00	118.80	118.80	Reduce irrigation water usage
					Rio Conchos - Pandeno Springs (water efficiency improvements)		2007 - ongoing	51%	GW pumping (decrease)	2,370.00	1,208.70	1,208.70	Secure flows to re-establish population of endemic fish
					Rio Conchos - reforestation in headwaters (122.5 ha)		2007 - ongoing	35%	Runoff (decrease)	14.60	5.11	5.11	Reduce sediment erosion/runoff and sedimentation
					Pecos River - wetland restoration		2007 - 2011	1%	Floodplain inundation (increase)	123.35	1.23	1.23	Re-establish channel morphology
					Rio Grande (Caballo Dam to American Dam, New Mexico) - Reestablishment of channel morphology and floodplain connectivity		2007 - ongoing	30%	Direct streamflow	3,764.59	1,129.38	372.69	Re-establish channel morphology and floodplain connectivity
					Rio Grande (Big Bend, Texas) - Reestablishment of channel morphology and floodplain connectivity	R	2007 - ongoing	Variable	Infiltration (increase)	4,009.20	1,797.10	1,268.30	Re-establish channel morphology and floodplain connectivity
					Rio Grande (Rio Bosque Wetland Park) - Acquisition of water rights to support environmental flows		2007 - ongoing	50%	Direct streamflow	740.00	370.00	370.00	Secure water supply to sustain habitat
25	221	Honduras	WWF	Rio Chamelecon River Watershed Protection Initiative	Conversion of degraded open land to managed cropland		2008 - 2009	31%	Runoff (decrease)	18.00	5.49	5.49	Reduce sediment erosion/washoff
28	340	Vietnam / Thailand	WWF	Conserving the Mekong	*Chi River subcatchment:* Reforestation		2008 - ongoing	95%	Runoff (decrease)	128.00	121.60	121.60	Reduce sediment erosion/runoff; improve biodiversity
	195				*Plain of Reeds (Tram Chim N.P.):* Conservation/ protection of existing resources		2006 -2010	96%	Direct streamflow	11,400.00	7,865.87	7,865.87	Mitigate flood and drought impacts
31		Croatia / Serbia	WWF	Reconnecting the Lifeline	*Kopacki Rit:* wetland restoration	N	2010 - ongoing	100%	Increase in storage volume	8,550.00	7,865.87	4,800.00	Increase wetland storage volume
					Gornje Podunavlje: wetland restoration	N	2011 - 2012	95%	Increase in storage volume	110.00	104.50	104.50	Increase wetland storage volume
33	185	Pakistan	WWF	Environment Conservation & Watershed Management	Afforestation and conservation		2008 - 2010	100%	Runoff (decrease)	52.42	52.42	52.42	Reduce sedimentation due to land use changes
35	112	Brazil	SOS Mata Atlantica Foundation	Brazilian Rainforest Water Program	Reforestation (3,000 ha)		2006 - 2010	50%	Runoff (decrease)	2,029.00	1,014.50	1,014.50	Reduce sediment erosion/runoff
37	13	Mexico	TCCC	Reforestation of Nevado de Toluca Park	Reforestation (1,000 ha)		2005 - 2010	20%	Infiltration (increase)	540.00	108.00	108.00	Increase recharge of local aquifer
38	120	Mexico	TCCC	Mexico Restoration & Reforestation Program	Reforestation (47,969 ha)	R	2008 - 2012	40.74%	Runoff (decrease)	19,285.00	7,857.00	7,857.00	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
					Ground restoration (infiltration trenches) (250 ha)		2008	47%	Infiltration (increase)	1,252.00	590.19	590.19	Reduce runoff / increase infiltration; reduce sediment erosion/runoff

Table A1. Water Quantity Benefits for Watershed Protection Projects

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Type of Benefit Quantified	Quantity Change (million L/yr)			
39	130	Mexico	TCCC	Reforestation Efforts at the de Monarca Butterfly Bioreserve	Reforestation (2,000 ha)		2007 - 2009	100%	Infiltration (increase)	1,080.00	1,080.00	1,080.00	Rehabilitate degraded forest areas
40	247	Philippines	WWF	Ilagan Watershed Conservation Project in Isabela	Conversion of degraded grassland to agro-forestry (220 ha)		2009 - 2010	72%	Runoff (decrease)	136.00	98.33	98.33	Reduce sediment erosion/runoff from degraded grassland areas
43	261	Thailand	TCCC	Conservation and Rehabilitation of the Klong Yan Watershed in Surat Thani	Conservation of forest land		2008	100%	Runoff (decrease)	2,078.00	2,078.00	2,078.00	Conservation of existing forest land; decrease runoff
51	375	India	TCCC	India Rainwater Harvesting and Aquifer Recharge Projects	Rainwater harvesting and artificial aquifer recharge	R	2002 - ongoing	Variable (8%-100%)	Recharge (increase)	5,201.60	5,060.20	5,060.20	Recharge aquifer and enhance water supply
70	259	Spain	WWF	La Guadiana Sub Basin	Reforestation (195 ha)	R	2008 - ongoing	100%	Runoff (decrease)	37.25	37.25	35.42	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
73	227	Australia	WWF	Great Barrier Reef Project (Project Catalyst)	Improved agricultural practices		2009 - 2013	Variable (<=50%)	Runoff (decrease)	19,172.00	3,745.00	3,745.00	Reduction of runoff and nutrient, sediment and pesticide loadings to the Great Barrier Reef
74	323	Belarus	TCCC	Let's Save Yelnya Together!	Blockage of artificial drainage canals		2007 - 2009	100%	Infiltration (increase)	140,000.00	7,865.87	7,865.87	Reduce forest fires
75	313	Ecuador	TCCC	Protection of Water Sources in El Carmen	Reforestation (120 ha)		2008 - 2010	53%	Runoff (decrease)	116.00	61.10	61.10	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
76	21	Guatemala	WWF	Protecting the Mesoamerican Reef	*Communities of Pueblo Viejo, Cancoy:* Forest conservation (1,021 ha)		2007 - 2009	30%	Runoff (decrease)	151.00	45.30	45.30	Reduction of sediment loadings to the Polochic and Motagua Rivers and the Mesoamerican Reef (Carribean Sea).
77	190	Philippines	TCCC	Go Green! Go For the Real Thing!	Reforestation / revegetation (39.5 ha)		2009 - 2010	57%	Runoff (decrease)	19.20	10.94	10.94	Reduce sediment erosion/runoff
80	308	Philippines	TCCC	Caliraya Native Tree Nursery	Reforestation (10 ha)		2010 - 2012	100%	Runoff (decrease)	1.50	1.50	1.50	Improve biodiversity
85	410	Brazil	FAS	Bolsa Floresta Program	Conservation of tropical forests to maintain environmental services (124,538 hectares in 2013)		2010 - 2013	33%	Runoff (decrease)	199,585.00	11,306.34	11,306.34	Prevent loss of rainforests in the Amazon
86	367	Colombia	TCCC	Recovery of Endangered Species	Reforestation (32.8 ha)		2010	87%	Runoff (decrease)	9.10	7.92	7.92	Increase biodiversity
87	368	Colombia	Camara de Comercio de Bogota et al.	Planta tu huella	Reforestation (32.76 ha)		2010 - 2011	10%	Runoff (decrease)	9.10	0.87	0.87	Increase biodiversity
88	365	Costa Rica	EARTH University	Siembre de Arboles	Reforestation (1.0 ha)		2010	100%	Runoff (decrease)	0.60	0.60	0.60	Increase biodiversity
91	175	China	WWF	Improving River Management Practices in the Yangtze	Construction of treatment wetlands		2009 - 2011	100%	Volume Treated	15.20	15.20	15.20	Improve water quality
					Irrigation improvement for ecosystem (Anlong Village)	N	2010 - 2011	100%	Direct streamflow	286.16	286.16	286.16	Ecosystem improvement
					Wetland restoration (Yunqiao Village)	N	2011	100%	Increase in storage volume	504.90	504.90	504.90	Wetland restoration
					Reforestation - Nibashan (150 ha)	N	2011 - 2012	100%	Runoff (decrease)	66.00	66.00	66.00	Reduce sediment erosion/runoff

Table A1. Water Quantity Benefits for Watershed Protection Projects

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Type of Benefit Quantified	Quantity Change (million L/yr)			
95	492	France	Pennes Mirabeau, NFA	Massif de la Nerthe	Reforestation (2.0 ha)		2010 - 2013	100%	Runoff (decrease)	2.00	2.00	1.00	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
96	549	U.S. CA	TNC	Sacramento River Riparian Habitat Restoration at La Barranca	Riparian habitat restoration	R	2011 - 2012	11%	GW usage (decrease)	561.00	61.70	61.70	Improve biodiversity of riparian habitat
101	448	Mexico	TCCC	Rain Water Harvesting Program in Mexico for Artifical Aquifer Recharge	Rainwater harvesting and artificial aquifer recharge		2004 - 2010	100%	Recharge (increase)	54.80	54.80	54.80	Aquifer recharge
102	498	Japan	TCCC	Reforestation for Source Water Protection	Reforestation at 5 locations (15.9 ha)		2006 - ongoing	100%	Recharge (increase)	13.90	13.90	11.80	Source water protection
103	345	U.S.	TCCC	North America Rain Barrel Donation Program	Rain barrel distribution	R	2008 - ongoing	100%	Runoff (decrease)	303.70	303.70	303.70	Reduce stormwater runoff
105		Japan	TCCC	Protecting Forests from Land Development	Conservation of forest land (68 ha)	N	2006 - ongoing	100%	Runoff (decrease)	99.80	99.80	99.80	Prevent additional runoff & sediment erosion/runoff
106		Indonesia	TCCC	Restoration of Water Resources as an Adaptation to Climate Change	Infiltration wells for aquifer recharge	N	2012	88%	Recharge (increase)	490.20	431.40	431.40	Increase groundwater recharge
107		Argentina	AVINA	Conservation and Restoration of Ramsar Site Lagunas de Guanacache Desaguadero and del Bebedero	Wetland restoration (1000 ha)	N	2012 - 2015	70%	Increase in storage volume	5,000.00	3,500.00	1,050.00	Wetland restoration
108		Argentina	AVINA	Reserves in La Calera, Province of Cordoba: Management as a Tool for Basin Recovery	Fire suppression (13,500 ha)	N	2012 - 2015	90%	Infiltration (increase)	6,086.40	5,478.00	2,739.00	Prevent additional runoff & sediment erosion/runoff
109		Canada	WWF	St. Lawrence Restoration (St. Eugene Marsh)	Wetland restoration (34 ha)	N	2012	32%	Increase in storage volume	23.70	7.60	7.60	Wetland restoration
110		U.S. AZ	Bonneville Environmental Foundation	Verde River Program	Instream flow restoration	N	2012 - ongoing	100%	Direct streamflow	170.00	170.00	170.00	Increase instream flows
111		U.S. MT	Bonneville Environmental Foundation	Prickly Pear Creek Re-watering Project	Instream flow restoration	N	2011 - 2012	54.6%	Direct streamflow	3,390.00	1,850.00	1,850.00	Increase instream flows
112		U.S. OR	Bonneville Environmental Foundation	Middle Deschutes Instream Flow Restoration	Instream flow restoration	N	2012	12%	Direct streamflow	9,251.00	1,110.00	1,110.00	Increase instream flows
113		U.S. CA	U.S. Forest Service	Indian Valley High Mountain Meadow Restoration	Re-wetting high mountain meadows through hydrologic restoration	N	2012	100%	Infiltration (increase)	305.00	305.00	305.00	Increase aquifer infiltration/storage
114		U.S. CO	U.S. Forest Service	Trail Creek Restoration, Colorado	Construction of sediment detention basins and rehabilitation of alluvial fans	N	2012	100%	Runoff (decrease)	232.00	232.00	232.00	Reduce runoff & sediment erosion/runoff
115		U.S. GA	TNC	Dawson Forest Acquisition	Conservation of forest land (190 ha)	N	2008 - 2012	14%	Runoff (decrease)	212.20	29.70	29.70	Reduce runoff & sediment erosion
116		India	TCCC	Construction of Check Dams in Rajasthan and Himachal Pradesh	Check dam construction for aquifer recharge	N	2010 - 2012	100%	Infiltration (increase)	1,806.00	1,806.00	1,806.00	Increase groundwater recharge

Table A1. Water Quantity Benefits for Watershed Protection Projects

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Type of Benefit Quantified	Quantity Change (million L/yr)			
117		India	TCCC	Rehabilitation of Farm Ponds Across India	Desilting and rejuvenation of farm ponds	N	2010 - 2012	Variable (50-100%)	Infiltration (increase)	929.90	893.50	893.50	Restoration of farm ponds
118		U.S.	TCCC	Coca-Cola Rain Gardens	Construction of rain gardens	N	2012	Variable (11-100%)	Runoff (decrease)	50.68	44.42	44.42	Reduce stormwater runoff
119		Ecuador	TNC	Chongon-Colonche - Cerro Blanco Ecological Corridor	Reforestation (32.6 ha)	N	2011 - 2012	47.4%	Runoff (decrease)	11.78	5.60	5.60	Reduce runoff & sediment erosion
120		Japan	TCCC	Reforestation at Shiroishi	Reforestation (5 ha)	N	2006 - 2010	100%	Runoff (decrease)	2.60	2.60	2.60	Reduce runoff & sediment erosion
121		Japan	TCCC	Forest Maintenance in Japan	Forest maintenance (48.8 ha)	N	2003 - ongoing	59%	Runoff (decrease)	45.30	26.80	26.80	Reduce runoff & sediment erosion
122		U.S. MN	TNC	Mississippi River Basin Treatment Wetlands	Construction of treatment wetland	N	2012	100%	Volume Treated	53.28	53.28	53.28	Reduce pollutants in runoff from agricultural fields
124		Spain	TCCC	Wet Lagoon Conservation Cobega	Wastewater reuse for conservation	N	2008 - ongoing	100%	Wastewater reuse	29.20	29.20	29.20	Maintain ecological flows to Increase habitat & biodiversity
125		Argentina	AVINA	Reforestation in the San Roque Lake Watershed	Reforestation (5 ha)	N	2012	37%	Runoff (decrease)	4.00	1.48	1.48	Increase water infiltration; improve water quality and habitat
126		Argentina	AVINA	Reforestation in the Hills of Cordoba	Reforestation (21 ha)	N	2012 - ongoing	56.5%	Runoff (decrease)	16.80	9.49	3.13	Increase water infiltration; improve water quality and habitat
127		Chile	AVINA	Reforestation in the Quilimari River Basin	Reforestation (15 ha)	N	2012 - ongoing	80%	Runoff (decrease)	4.05	3.24	2.59	Increase water infiltration; improve water quality and habitat
128		Chile	AVINA	Infiltration Trenches in the Yali Salt Marsh Basin	Construction of infiltration trenches	N	2012 - ongoing	64.7%	Infiltration (increase)	1.64	1.06	0.53	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
129		Argentina	AVINA	Wet Meadow Conservation and Management Optimization in the Province of Jujuy	Wet meadow restoration	N	2012 - ongoing	65%	Increase in storage volume	47.30	30.70	21.50	Develop improve vegetation coverage and local water storage

[1] TCCCC cost contribution for years prior to 2012 may vary.

Table A2. Water Quality Benefits for Watershed Protection Projects

	End 2012
Sediment Reduction Benefits (MT/yr):	3,304,063.5
Other Pollutant Reduction Benefits (MT/yr):	87.7

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quality Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit (MT/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Target Pollutant	Loading Change (MT/yr)			
1	153	U.S. MI	TNC	Paw Paw River Watershed Restoration	Cropland management (conservation tillage, filter strips, conservation cover - 477 ha)	R	2009 - ongoing	100%	Sediment	1,186.00	1,097.0	896.0	Reduce runoff and sediment from agricultural lands; increase recharge / baseflow
2	154	U.S. TX	TNC	Tallgrass Prairie Watershed Restoration in North Texas	Conservation of prairie lands and wetlands (52.6 ha)		2008 - ongoing	100%	Sediment	163.70	163.7	163.7	Maintain hydrologic condition of prairie lands
					Removal of invasive species and revegetation (1,125 ha)		2008 - ongoing	100%	Sediment	141.90	141.9	141.9	Increase infiltration, reduce sediment erosion/runoff
4	156	U.S. GA	TNC	Etowah River Watershed Conservation Partnership	Riparian buffer (Raccoon Creek)		Apr 2009 - May 2012	100%	Sediment	100.00	100.0	75.0	Stabilize stream bank (reduce instream erosion)
					Stormwater management (tributary ditch improvements)		Apr 2009 - May 2012	100%	Sediment	32.60	32.6	24.5	Stabilize stream bank (reduce instream sediment erosion); increase infiltration
5	42	Ghana, Ivory Coast	GETF	Transboundary Community Water Management	Conservation/reforestation of tropical rain forest (~13.5 ha)		2007 - 2009	50%	Sediment	26.50	13.3	13.3	Protect biodiversity, reduce sediment & other pollutant loads
7	48	Tanzania	GETF	Improved Community Livelihoods and Sustainable Water Management	Reforestation (23 ha)		2009	50%	Sediment	30.20	15.1	15.1	Reduce land degradation & sediment erosion
15	91	U.S. PA	Wildlands Conservancy	Wildlands Conservancy Lehigh River Restoration	Abandoned mine drainage treatment (Lausanne Tunnel)	R	2004 - 2009	1.5%	Iron	20.00	0.3	0.3	Reduce sediment runoff to streams; stabilize stream bank
								1.5%	Aluminum	7.50	0.1	0.1	
								1.5%	Sulfates	1,324.00	19.9	19.9	
					Jordan Creek stream stabilization project		2009	50%	Sediment	207.00	103.5	103.5	Stabilize stream bank (reduce erosion)
					Little Lehigh stream bank stabilization project		2008	50%	Sediment	33.00	16.5	16.5	Stabilize stream bank (reduce erosion)
					Monocacy Creek stream restoration projects (Edgewood Valley Farm, Just Enuff Angus Farm)		2008	50%	Sediment	502.00	251.0	251.0	Reduce sediment runoff to streams; stabilize stream bank
16	478	U.S. PA	ClearWater Conservancy	Clearwater Community Watershed Partnership: the Scotia Barrens Conservation Project's Halfmoon Wildlife Corridor	Conservation/protection of existing resources (106 ha)		2009 - 2010	1%	Sediment	223.20	1.5	1.5	Conservation/protection of a corridor for wildlife passage
21	18	U.S. / Mexico	WWF	Protecting the Rio Grande / Rio Bravo River	*Rio Conchos* - reforestation in headwaters (122.5 ha)		2007 - ongoing	35%	Sediment	220.00	77.0	77.0	Reduce sediment erosion/runoff and sedimentation
25	221	Honduras	WWF	Rio Chamelecon River Watershed Protection Initiative	Conversion of degraded open land to managed cropland		2008 - 2009	31%	Sediment	14,571.00	4,444.2	4,444.2	Reduce sediment erosion/washoff

Table A2. Water Quality Benefits for Watershed Protection Projects

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quality Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit (MT/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Target Pollutant	Loading Change (MT/yr)			
28	340	Vietnam / Thailand	WWF	Conserving the Mekong	*Chi River subcatchment:* Reforestation		2008 - ongoing	95%	Sediment	170.70	162.2	162.2	Reduce sediment erosion/runoff; improve biodiversity
	195				*Chi River subcatchment:* Agricultural practices		2006 -2010	95%	Sediment	2,856.00	2,713.2	2,713.2	Demonstration project for improved agricultural practices to reduce sediment, nutrient, and chemical runoff.
33	185	Pakistan	WWF	Environment Conservation & Watershed Management	Afforestation and conservation		2008 - 2010	100%	Sediment	0.00	0.0	0.0	Reduce sedimentation due to land use changes
35	112	Brazil	SOS Mata Atlantica Foundation	Brazilian Rainforest Water Program	Reforestation (3,000 ha)		2006 - 2010	50%	Sediment	182,025.00	91,012.5	91,012.5	Reduce sediment erosion/runoff
37	13	Mexico	TCCC	Reforestation of Nevado de Toluca Park	Reforestation (1,000 ha)		2005 - 2010	20%	Sediment		0.0	0.0	Increase recharge of local aquifer
38	120	Mexico	TCCC	Mexico Restoration & Reforestation Program	Reforestation (47,969 ha)	R	2008 - 2012	40.7%	Sediment	1,123,675.00	457,785.0	457,785.0	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
39	130	Mexico	TCCC	Reforestation Efforts at the de Monarca Butterfly Bioreserve	Reforestation (2,000 ha)		2007 - 2009	100%	Sediment		0.0	0.0	Rehabilitate degraded forest areas
40	247	Philippines	WWF	Ilagan Watershed Conservation Project in Isabela	Conversion of degraded grassland to agro-forestry (220 ha)		2009 - 2010	72%	Sediment	11,200.00	8,097.6	8,097.6	Reduce sediment erosion/runoff from degraded grassland areas
43	261	Thailand	TCCC	Conservation and Rehabilitation of the Klong Yan Watershed in Surat Thani	Conservation of forest land		2008	100%	Sediment	2,679,600.00	2,679,600.0	2,679,600.0	Conservation of existing forest land; decrease runoff
73	227	Australia	WWF	Great Barrier Reef Project (Project Catalyst)	Improved agricultural practices		2009 - 2013	Variable (<=50%)	Nitrogen	121.00	25.8	25.8	Reduction of runoff and nutrient, sediment and pesticide loadings to the Great Barrier Reef
									Phosphorus	41.00	9.0	9.0	
									Pesticides	0.49	0.1	0.1	
75	313	Ecuador	TCCC	Protection of Water Sources in El Carmen	Reforestation (120 ha)		2008 - 2010	53%	Sediment	12,800.00	6,741.8	6,741.8	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
76	21	Guatemala	WWF	Protecting the Mesoamerican Reef	*Communities of Pueblo Viejo, Cancoy:* Improved agricultural practices (201 ha)		2007 - 2009	30%	Sediment	1,954.00	586.2	586.2	Reduction of sediment loadings to the Polochic and Motagua Rivers and the Mesoamerican Reef (Carribean Sea).
					Communities of Pueblo Viejo, Cancoy: Forest conservation (1,021 ha)		2007 - 2009	30%	Sediment	17,160.00	5,148.0	5,148.0	
77	190	Philippines	TCCC	Go Green! Go For the Real Thing!	Reforestation / revegetation (39.5 ha)		2009 - 2010	57%	Sediment	1,348.00	768.4	768.4	Reduce sediment erosion/runoff
80	308	Philippines	TCCC	Caliraya Native Tree Nursery	Reforestation (10 ha)		2010 - 2012	100%	Sediment	1,123.00	1,123.0	1,123.0	Improve biodiversity
82	134	Thailand	HAII	Village that Learns and Earns	Water supply for community use		2006 - 2008	95%	Sediment	308.00	292.6	292.6	Provide water for irrigation use

Table A2. Water Quality Benefits for Watershed Protection Projects

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quality Benefits (ultimate)		TCCC Ultimate Water Quantity Benefit (MT/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Target Pollutant	Loading Change (MT/yr)			
85	410	Brazil	FAS	Bolsa Floresta Program	Conservation of tropical forests to maintain environmental services (124,538 hectares in 2013)		2010 - 2013	33%	Sediment	173,535.00	57,266.6	42,156.6	Prevent loss of rainforests in the Amazon
86	367	Colombia	TCCC	Recovery of Endangered Species	Reforestation (32.8 ha)		2010	87%	Sediment	647.00	562.9	562.9	Increase biodiversity
87	368	Colombia	Camara de Comercio de Bogota et al.	Planta tu huella	Reforestation (32.76 ha)		2010 - 2011	10%	Sediment	14.40	1.4	1.4	Increase biodiversity
88	365	Costa Rica	EARTH University	Siembre de Arboles	Reforestation (1.0 ha)		2010	100%	Sediment	18.50	18.5	18.5	Increase biodiversity
91	175	China	WWF	Improving River Management Practices in the Yangtze	Construction of three biogas digesters		2009	100%	Phosphorus	0.03	0.0	0.0	Reduce nutrient loads
								100%	Nitrogen	0.08	0.1	0.1	
					Construction of treatment wetlands		2009 - 2010	100%	Phosphorus	0.26	0.3	0.3	Improve water quality
								100%	Nitrogen	2.64	2.6	2.6	
								100%	COD	23.57	23.6	23.6	
								100%	BOD	5.90	5.9	5.9	
95	492	France	Pennes Mirabeau, NFA	Massif de la Nerthe	Reforestation (2.0 ha)		2010 - 2013	100%	Sediment	3.56	3.6	1.8	Reduce runoff / increase infiltration; reduce sediment erosion/runoff
114		U.S. CO	U.S. Forest Service	Trail Creek Restoration, Colorado	Construction of sediment detention basins and rehabilitation of alluvial fans	N	2012	100%	Sediment	871.50	871.5	871.5	Reduce sediment runoff
115		U.S. GA	TNC	Dawson Forest Acquisition	Conservation of forest land (190 ha)	N	2008 - 2012	14%	Sediment	1,409.00	197.3	197.3	Reduce runoff / increase infiltration; reduce sediment erosion/runoff

[1] TCCCC cost contribution for years prior to 2012 may vary.

Appendix B
Quantification Results:
Water for Productive Use Projects

Table B1. Water quantity benefits for water for productive use projects

Table B1. Water Quantity Benefits for Water for Productive Use Projects

	End 2012
TCCC Product Volume (billion L/yr):	157.3
TCCC Quantity Benefits (billion L/yr):	6.2
% of Benefits Relative to Product Volume:	3.9%

LTI ID	TCCC ID	Country	Partner / Lead	Project Name	Description of Activity	New (N) or Revised (R) in 2012	Activity Timeline	% TCCC Contribution (2012)[1]	Water Quantity Benefits		TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)	TCCC Adjusted Benefit (End 2012)	Goals / Problems Addressed
									Type of Benefit Quantified	Quantity Change (million L/yr)			
6	7	Mali	GETF	Community Water Supply, Sanitation, and Wastewater Program	Irrigation system improvements (drip irrigation)		2005 - 2008	50%	Water supply for productive use	0.18	0.09	0.09	Reduce irrigation water usage
8	10	South Africa	GETF	<u>Two Projects:</u> 1.) Watergy Program - Fixing the Leaks and 2.) School Plumbing Repair and Energy Savings	Leak repair in schools & private households		1997 - 2009	50%	Water supply for productive use	407.52	203.76	203.76	Increase water use efficiency
9	34	Malawi	GETF	Mulanje Mountain Community Watershed Management	Irrigation system improvements (drip irrigation)		2008	50%	Water supply for productive use	0.18	0.09	0.09	Promote & demonstrate use of drip irrigation kits
10	45	Nigeria	GETF	Improved Health and Livelihoods in Nigeria's Rural Communities	Irrigation system improvements (drip irrigation)		2007 - 2008	50%	Water supply for productive use	1.26	0.63	0.63	Promote improved small-scale irrigation methods
14	71	U.S. PA	Borough of Bellefonte	Big Spring Watershed Protection	Repairing leaks in drinking water systems	R	2006 - ongoing	18%	Water supply for productive use	4,359.40	614.70	614.70	Increase water use efficiency
21	18	U.S. / Mexico	WWF	Protecting the Rio Grande / Rio Bravo River	*Rio Conchos* - Rainwater harvesting for drip irrigation		2007 - ongoing	35%	Water supply for productive use	0.01	0.00	0.00	Augment domestic & irrigation water supplies
41	358	Turkey	TCCC	Every Drop Matters - in Saraykoy and Beypazari	Leak repair: replacing water mains to reduce water loss		2007 - 2008	89%	Water supply for productive use	45.38	40.39	40.39	Increase water use efficiency
76	21	Guatemala	WWF	Protecting the Mesoamerican Reef	*Teculutan subwatershed:* Drip irrigation (9 ha)		2008 - 2009	30%	SW usage (decrease)	98.00	29.40	29.40	Reduction of sediment loadings to the Polochic and Motagua Rivers and the Mesoamerican Reef (Carribean Sea).
82	134	Thailand	HAII	Village that Learns and Earns	Water supply for community use		2006 - 2008	95%	Water supply for productive use	152.95	145.30	145.30	Provide water for irrigation use
90	435	Turkmenistan	TCCC	Turkemenistan'da Forest Irrigation Project	Irrigation of forest lands		2005 - ongoing	100%	Water supply for productive use	9.94	9.94	9.94	Provide water for irrigation use
92	409	Argentina	Comunidad Aborigen Cueva del Inca	Sustainable Management of Water Resources in Cueva Del Inca	Irrigation water for productive use		2010 - 2011	74%	Water supply for productive use	0.75	0.55	0.55	Provide water for irrigation use
94	427	China	UNDP	Guangxi Sustainable Sugarcane Initiative: Phases I and II	Irrigation system improvements via drip irrigation (Jiangzhou District)	R	2010 - 2011	50%	Water supply for productive use	1,016.00	508.00	508.00	Provide water for irrigation use
					Irrigation system improvements (Shangsi County)	R	2011 - 2012	50%	Water supply for productive use	1,299.90	650.00	650.00	Provide water for irrigation use
100	480	China	UNDP	Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim	Irrigation water for productive use	R	2007 - 2010	10%	Water supply for productive use	1,729.40	172.90	172.90	Provide water for irrigation use
					Irrigation system improvements (drip irrigation)	N	2007 - 2011	10%	Water supply for productive use	508.40	50.80	50.80	Provide water for irrigation use
104	456	India	TCCC	Conserving Water Usage through Improved Irrigation Techniques	Irrigation water for productive use	R	2005 - ongoing	100%	Water supply for productive use	3,763.00	3,763.00	3,763.00	Provide water for irrigation use

Appendix C
Quantification Results:
Water Access Projects

Table C1. Quantification of full access to water benefits

Table C1: Quantification of Full Access to Water Benefits

Total Full Access Beneficiaries:	1,818,722	TCCC Water Quantity Benefit (million L/yr):	5,049.20 (2012)

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries Full Access	Beneficiaries Liters/person/day	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	2012
39	Angola	CARE Angola	Water Supply Access for the Urban Poor	The project gave 27,600 people full access to water through construction of nine community water tap stands. It also provided sanitation and hygiene training and education to 120 people. 3,000 school children also received limited access to water. (updated 2012)	2008	50%	27,600	20	201.48	100.74	100.74
648	Angola	Development Worskhop (Angola)	Improvement of Drinking Water and Sanitation Services in the Angolan Communities of Bom Jesus and Funda	This project will focus on expanded service delivery and management in the comuna of Bom Jesus, but limit its intervention to a community water needs and management training assessment in the proposed Funda project area.	2014	50%	8,500	20	62.05	31.03	0.00
70	Argentina	INDES	Grant for Water Projects I – Chaco	The project gave 1,200 people full access to water through the construction of water wells.	2007	100%	1,200	20	8.76	8.76	8.76
650	Argentina	AVENA	Improvement of Conditions for Drinking Water Access at 3 Localities in the Province of Entre Rios	This initiative considers strategies to make an important improvement on water access at three localities in the Province of Entre Ríos: Oro Verde, Conscripto Bernardi and Colonia Elia benefiting 6,260 people.	2012	53%	6,260	20	45.70	23.99	0.00
651	Argentina	AVENA	Access to Water for Family Consumption and Production in the Household Environment, by Means of the Construction of Rain Water Catchment Modules in Cordoba	The objective of this project is to facilitate access to water to 30 families with the construction of rain water catchment modules and storage cisterns with a capacity of 15,000 liters.	2013	50%	150	20	1.10	0.55	0.00
652	Argentina	AVENA	Extension of the Drinking Water Natwork, at EFA Neighborhood, Villa Ocampo, Santa Fe.	This initiative entails the extension of the drinking water network for 40 families at the E.F.A. neighborhood.	2012	53%	200	20	1.46	0.77	0.00
204	Argentina	Environment and Sustainable Development Secretariat	Grant for Water Projects I – Jujuy	The project gave 44 families, or 158 people full access to water.	2009	100%	158	20	1.15	1.15	1.15
73	Argentina	ASEM, San Pablo's Cooperative, CONIN Foundation, ADIS	Provision of Clean Drinking Water: El Algarrobal – Barrios Solidarios	The project gave full access to water to 300 people through household water pumps.	2006	100%	300	20	2.19	2.19	2.19

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries Full Access	Beneficiaries Liters/person/day	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	2012
408	Argentina	Fundacion Vida Silvestre	Water and Life for the Alfarcito	This project gave full access to water to 237 people through the construction of a well point.	2010	100%	237	20	1.73	1.73	1.73
425	Azerbaijan	Save the Children	Seyidli Village Water Supply	This project will give 1,450 people full access to water through the construction of a well, water tower, and water tap stands.	2011	82%	1,450	20	10.59	8.68	8.68
653	Burundi	Betraco-Mesodi	Water Supply, Sanitation, and Hygiene Education in Peri-Urban Bujumbura (WADA)	The main goal of this project is to improve the health and well-being of 8,253 community members by providing sustained and improved access to safe water supply in the three targeted villages of rural Bujumbura Province.	2013	50%	8,253	20	60.25	30.12	0.00
654	Cambodia	Cambodian Women for Peace and Development	Community Clean Water Supply and Sanitation 2011	This project provides clean water to 2,800 people.	2012	97%	2,800	20	20.44	19.83	0.00
304	Cambodia	Cambodian Women for Peace and Development	Communities Clean Water Supply and Sanitation 2010	This project gave full access to water to 2,160 people through the installation of wells equipped with pumps and the distribution of water purifiers.	2010	100%	2,160	20	15.77	15.77	15.77
608	Cambodia and Vietnam	UN Habitat	Mekong Region Water and Sanitation Initiative	This project gave full access to water to 12,481 people.	2012	20%	12,481	20	91.11	17.86	0.00
406	Cameroon	Plan Cameroon	Water and Sanitation for Schools and Communities in Akonolinga and Gaschiga Councils	This project will give full access to water to 5,400 people through the construction of hand dug wells equipped with pumps. 6,000 additional community members including 1,500 students will receive limited access to water. (updated 2012)	2011	100%	5,400	20	39.42	39.42	39.42
658	Chile	AVENA	Loss Reduction and Network Connection to Contribute to Guarrntee Access Water at the San Pedro Commune	This initiative considers the reduction of losses and connection of networks, as well as the improvement of water use efficiency by means of joint work with the population of Las Loica locality at the San Pedro de Melipilla commune.	2013	38%	1,354	20	9.88	3.71	0.00
659	Chile	AVENA	Expansion and Connection of Networks to Guarantee Access to Quality Water at Guangualí, Coquimbo Region	This initiative addresses the networks' expansion and connectivity, water use efficiency improvement and losses reduction, by means of joint work to be done with the population of the Guangualí locality.	2013	65%	850	20	6.21	4.03	0.00
660	Chile	AVENA	Collection and Installation of Acessories for Water CONNECTION (use of fog collectiors and water care) at Quilimari. Coquimbo Region	This initiative addresses associative work for the technical feasibility assessment (pilot construction) to install "fog collectors" systems.	2013	45%	945	20	6.90	3.10	0.00
107	China	United Front Work Dept. of Miluo City	Coca-Cola New Village	The project gave full access to water to 9,240 people through the drilling of 100 water wells.	2008	50%	9,240	20	67.45	33.73	33.73

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
482	China	UNDP	Non-point Pollution Control and Drinking Water Safety in the Rural Areas	The sewage treatment plant is located in Shuangcheng City. Construction of this plant was completed in 2008, and it has a treatment capacity of 3×104 tons per day (30 ML per day). The project also involves rebuilding main drainage pipelines in towns and rural areas.	2008	20%		Benefits provided through monitoring of system	10,950.00	2,190.00	2190.00
483	China	UNDP	Water treatment and waterborne disease control	This project involved development of a sewage pipe network to collect and route sewage from rural areas of Chongzhou City to a wastewater treatment plant to improve water quality in the Jinma River.	2008	6%		Benefits provided through monitoring of system	432.50	25.52	25.52
29	China	China Soong Ching Ling Foundation	China Rainwater Harvesting Project	This project gave full access to water to 4,200 farmers through the construction of water storage facilities, water pump stations, and pipe systems. 600 school children also received limited access to water.	2009	100%	4,200	20	30.66	30.66	30.66
405	Colombia	Municipal Governments, FEMSA Foundation	Clean Water Program	This project gave full access to water to 14,000 people through the granting of mixed oxidants generation plants for water treatment.	2010	100%	14,000	20	102.20	102.20	102.20
657	Colombia	Colombia Humanitaria	Drinking Water Project	The Coca-Cola System with the FEMSA Foundation donated 10 modern water treatment plants to provide drinking water to 10 municipalities.	2012	50%		Benefits provided through monitoring of system	429.64	214.82	0.00
557	DRC	CARE	Kinshasa Bopeto	This project will provide 75,000 community members with access to clean water. (updated 2012)	2012	100%	75,000	20	547.50	547.50	0.00
77	Ecuador	CARE Ecuador	Improved Quality of Life though Water and Sanitation	This project gave full access to water to 250 people though the implementation of a water system.	2006	100%	250	20	1.83	1.83	1.83
403	Egypt	CARE Egypt	Community Water Connections and Health Improvement	This project will give full access to water to 7,500 people through household connections	2012	84%	7,500	20	54.75	45.99	0.00
656	Egypt	UNICEF	Raising Healthy Children with Safe Household Water Supply and Sanitation	This project aims to provide access to household water (and potentially waste water) connections for the most deprived 1,000 households or 4,700 children, men and women, thereby positively affecting hygiene and health results in the short and long term in Assiut governorate, one of the most deprived areas in Egypt.	2013	52%	4,700	20	34.31	17.84	0.00
40	Egypt	IRG	Environmental Services for Improving Water Quality Management	In the villages of Shobra Kas, Dhamanhour el Wahsh and El Toud, canals previously received untreated sewage. Between 2007 and 2010, wastewater treatment facilities were constructed in these villages, serving 54,000 people.	2010	33%		Benefits provided through monitoring of system	492.75	162.61	162.61

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
558	El Salvador, Guatemala, and Nicaragua	Millennium Water Alliance	Mi Escuela Saludable SWASH+	This project provided water for 23,730 people through the construction of 150 water access points	2011	50%	23,730	20	173.23	86.61	86.61
41	Ethiopia	Millennium Water Alliance	Amhara Community Water Supply, Sanitation, and Hygiene Project	46,258 people benefitted from full access to water.	2008	50%	46,258	20	337.68	168.84	168.84
5	French Polynesia	Ayrlie Partners, AFD, Brasserie de Tahiti	Partnering to Improve Water Access and Governance	This project will benefit 80,000 people with full access to water through provision and installation of water technology and support systems.	2009	2%	80,000	20	584.00	11.68	11.68
109	Ghana & Ivory Coast	CARE Gulf of Guinea	Trans boundary Community Water Management	This project gave full access to water to 10,049 people through the construction of boreholes, wells, and pumps. 2,600 students also benefited from limited access to sanitation, and 122 teachers benefited from training and education.	2009	50%	10,049	20	73.36	36.68	36.68
559	Ghana	Relief International, WaterHealth International, Beta Construction Engineers	Water Supply and Sanitation Project in Teshie, Greater Accra	This project will give full access to water to an estimated 16,250 people by constructing WaterHealth Centers in peri-urban communities.	2012	50%	16,250	20	118.63	59.31	0.00
560	Ghana, Niberia, Liberia	WaterHealth International	Safe Water for Africa	This project will give full access to at least 91,125 people across West Africa with current funding raised	2014	56%	91,125	20	665.21	372.52	0.00
100	Honduras	Fondo Hondureno de Inversion Social	Water from the River for Local Community	This project gave full access to water to 350 families or about 1,680 people by replacing a run down water supply system.	2009	100%	1,680	20	12.26	12.26	12.26
301	India	Jaipur Municipal Corp. and the Rajasthan State Ground Water Dept.	Baawdi Restoration (Revival of Old Water Bodies)	This project gave 5,000 people full access to water through the rehabilitation of community water step wells.	2008	100%	5,000	20	36.50	36.50	36.50
578	India	Atmakuru Village Panchayat	Creation of Protected Water Supply in Atmakuru, Andhra Pradesh	The incoming source water of inferior quality with turbidity and not potable is treated through appropriate designed water treatment technology and serves as safe drinking water source for the local population of about 8,900	2012	100%		Benefits provided through monitoring of system	328.50	328.50	0.00
235	India	Winrock International	Multiple Use Water Services Initiative in Andhra Pradesh	This project will give 5,250 people full access to water through domestic and priority productive activities.	2011	100%	5,250	20	38.33	38.33	38.33
116	Indonesia	National NGO	Jabotabek Community Water Project	This project will give 6,100 people full access to water through the construction of communal pumps.	2009	50%	6,100	20	44.53	22.27	22.27
238	Indonesia	Yayasan Nawakamal	Well Conservation and Water Distribution System in the Sombron Community	This project gave 400 people, full access to water through a well conservation and water distribution system. (Updated 2010)	2009	88%	400	20	2.92	2.57	2.57
372	Indonesia	Yayasan Bina Usaha Lingkungan	Water and Sanitation for a Sustainable Community	This project will give 1,900 people full access to water through the installation of an improved water system in the community.	2012	100%	1,900	20	13.87	13.87	0.00

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
493	Indonesia	Yayasan Bina Lingkungan	RW Siaga PLUS+	This project provided 1,000 households access to safe water benefiting 5,000 people	2011	100%	5,000	20	36.50	36.50	36.50
401	Indonesia	Local Bottler	Water for Life	This project provided 895,000 liters of water to the city of Karangasem through water delivery trucks.* (please note: 895,000 liters delivered in 2010 according to information provided by local Coca-Cola Contact)	2010	100%		Benefits provided through monitoring of system	0.90	0.90	0.90
9	Kenya	Local NGOs	Community Water, Sanitation, and Sustainable Agriculture	This project gave 2,000 people full access to water and sanitation as well as access to drip irrigation.	2007	100%	2,000	20	14.60	14.60	14.60
242	Kenya	Florida International University, World Vision	Mara River Basin Water & Development Alliance	This project gave 8,704 people full access to water through he construction of protected and shallow springs and boreholes. 677 students benefitted from limited access to water through tanks constructed in schools and 910 students received access to sanitation through the construction of VIP latrines. (Updated 2012)	2010	50%	8,704	20	63.54	31.77	31.77
243	Kenya	International NGO	Safe Water in Kenya	This project will provide 500,000 people with full access to water through the building and renovation of wells, extension of water pipelines, and provision of water storage tanks.	2010	10%	500,000	20	3,650.00	365.00	365.00
244	Kenya	Aga Khan Foundation	Water and Sanitation Improvement Program	This project will gave 16,000 people full access to water through construction of water storage facilities, and water points. An additional 18,000 people are benefitting from improved sanitation facilities and hygiene education. (Updated 2012)	2010	50%	16,000	20	116.80	58.40	58.40
399	Kenya	Maji na Ufanisi	Water and Sanitation Improvement in the Laini Saba Community of Kibera, Kenya	This project will give 9,000 residents of Kibera, Kenya access to clean, affordable, drinking water.	2011	100%	9,000	20	65.70	65.70	65.70
655	Madagascar	Water & Sanitation for the Urban Poor (WSUP)	Water & Sanitation for the Urban Poor (WSUP)	Providing effective, equitable and financially viable water and sanitation service delivery models for women, men and children living in low income areas of Antananarivo.	2014	92%	84,750	20	618.68	569.18	0.00
34	Malawi	DAI	Mulanje Mountain Community Watershed Management	This project gave full access to water to 28,000 people by constructing water taps and spring boxes. Piped water was also given to a clinic. In addition, 2,070 farmers benefited from watershed protection and 50 farmers benefited from drip irrigation.	2008	50%	28,000	20	204.40	102.20	102.20
397	Malawi	Total LandCare Malawi	Community Watershed Support Project (C-WASP)	This project will provide 100,000 people with full access to water through the construction of well points.	2013	50%	100,000	20	730.00	365.00	0.00
610	Malaysia	Yayasan Kemanusiaan Muslim Aid Malaysia	Water for Humanity	Instilation of 2 underground water supplies with 4-step filtration processes.	2012	100%		Benefits provided through monitoring of system	17.52	17.52	0.00

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
25	Malaysia	Raleigh International	Clean Water for Communities	This project gave full access to water to 10,000 people through a basic gravity water feed system. (Updated 2010)	2011	76%	10,000	20	73.00	55.48	55.48
63	Maldives	UNDP Maldives	Island Sanitation in the Maldives	This project includes the installation of a sustainable sanitation system for all 526 residents of the island.	2008	39%		Benefits provided through monitoring of system	11.52	4.49	4.49
7	Mali	Local and International NGOs	Community Water, Supply, Sanitation, and Small-Scale Agriculture	This project gave full access to water to 20,904 people through construction of boreholes, standpipes, and family wells. 6,264 people also received full access to sanitation facilities and 1,730 students received limited access to water.	2008	50%	20,904	20	152.60	76.30	76.30
18	Mexico	WWF	TCCC-WWF Partnership: Rio Grande/Rio Bravo River Basin	A pilot cost-effective wastewater bio-treatment plant with a capacity to serve approximately 200 people	2010	60%		Benefits provided through monitoring of system	1.97	1.18	1.18
666	Morocco	CARE	Potable Water Supply and Small-Scale Irrigation (WADA)	Provided access to water supply sources and improved water use practices by at least seven groups of small farmers in intensive agricultural production areas.	2011	47%	1,024	20	7.48	3.51	3.51
44	Mozambique	VITENS	Rehabilitating the TextAfrica Water Treatment System and expanding water supply to Bairro 4	This project gave 26,800 people full access to water through the renovation of a dilapidated water treatment system and by expanding piped water supply. (Updated 2010)	2010	50%	35,500	20	259.15	129.58	129.58
416	Mozambique	CARE Mozambique	Strengthening Communities through Integrated WASH Activities	This project will give 29,500 people full access to water through construction of well points and household connections.	2013	50%	29,500	20	215.35	107.68	0.00
415	Nicaragua	Local Municipality, Coca-Cola FEMSA	Water Treatment Plant Donation	This project gave 4,000 people access to potable water for the first time through the construction of a water treatment plant	2010	100%	4,000	20	29.20	29.20	29.20
287	Niger	Winrock International	Multiple Use Services and Point of Use Treatment	This project will give over 15,500 people full access to water through the construction of boreholes	2011	50%	15,704	20	114.64	57.32	57.32
45	Nigeria	WOFAN	Improved Health and Livelihoods in Rural Communities	This project gave 66,000 people full access to water and sanitation by constructing boreholes, tap stands, a well, and latrines. In addition, 13,200 people received full access to water only. 33,000 students also benefited from limited access to sanitation and 280 farmers benefited from sustainable smallholder agriculture.	2008	50%	66,000	20	481.80	240.90	240.90
22	Nigeria	NGOs	Water for Community Productive Use - Fish Farms	This project gave 200 people full access to clean drinking water.	2005	50%	200	20	1.46	0.73	0.73

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	**Beneficiaries**	**Beneficiaries**	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
289	Nigeria	Society for Family Health	Water and Sanitation in Nkanu East	Increased access to improved community water supplies, reduced diarrheal disease by distribution, promotion, and use of affordable household water disinfectant products, and increased schoolchildren's access to improved sanitation facilities by constructing school latrines and promoting hygiene in communities.	2011	50%	4,500	20	32.85	16.43	16.43
663	Peru	AVENA	Improvement of Waste Water Treatment Plants in Rural Communities at the Black and White Andean Mountain Range, Ancash Region	The project's main objective is to improve the waste water treatment plants, training of operations and maintenance staff and establishment of quality control systems for discharges.	2012	57%		Benefits provided through monitoring of system	49.00	27.69	0.00
664	Peru	AVENA	Improvement of Access to Safe Water in Rural Communities at the Black and White Andean Mountain Ranges, Ancash Region	The objective is to improve the water supply rural systems for nine (9) communities with poor socio-economic level, by means of spring's protection, rehabilitation of water distribution systems and water disinfection systems.	2012	47%	2,945	20	21.50	10.00	0.00
665	Peru	AVENA	Improvement of Water Quality at Three Populated Centers at Chincha Baja Disctrict, Ica Region	The Water Services Administration Boards of 3 Rural Populated Centers, with 1734 inhabitants, will have been provided with water disinfection to the operation of their systems.	2013	56%	1,734	20	12.66	7.09	0.00
552	Philippines	Nortehanon Access Center , Inc.	Community-based Potable Water System Management Project	A level -2 water system will be installed in Barangays Caburihan and Sabang Tabok, Lavezares, Northern Samar.	2012	100%	3,875	20	28.29	28.29	0.00
553	Philippines	SUNGCOD, Inc.	Community Managed Potable Water Supply through Creek Development and Rain Harvesting in Barangays San Fernando and Dumuyog, Del Carmen, Surigao del Norte	The primary focus of the project is the installation of a Rainwater Harvesting Facility and the rehabilitation / improvement of a creek-based water source towards operationalization of a Level II Potable Water System in each of the two barangays.	2012	67%	1,173	20	8.56	5.74	0.00
555	Philippines	Earth Day Network Philippines, Inc.	AGOS Hydraulic Ram Pump Project	The project provides poor upland communities with accessible and reliable community water systems using hydraulic ram pumps and ferrocement storage tanks.	2014	100%	8,595	20	62.74	62.74	0.00
517	Philippines	Winrock AMORE	Sarangani and Sultan Kudarat Community Water Access Project	This project provided 7,583 people with improved access to potable water & sanitation through the construction of spring boxes and rainwater harvesting	2011	73%	7,583	20	55.36	40.20	40.20
47	Rwanda	Blood:Water Mission	Community Development through Sustainable Water Supply	This project gave 86,237 people full access to water.	2008	10%	86,237	20	629.53	62.95	62.95
561	Rwanda	Water For People	Water and Sanitation in Gahanga and Masaka	This project will provide 17,000 people with access to clean water.	2013	55%	17,000	20	124.10	68.44	0.00

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
288	Senegal	IRG	Potable Water Supply to Rural Communities	This project will give 4,050 people full access to water through the construction of 20 wells	2012	50%	4,050	20	29.57	14.78	0.00
411	Senegal	Millennium Promise	Millennium Water and Sanitation Program in Senegal	The project's goal is to expand the success of the revolving fund established previously to benefit more than 3,000 farmers.	2014	29%	19,050	20	139.07	40.33	0.00
562	Senegal	Research Triangle Institute	Community Water, Sanitation, and Hygiene	This project will give 19,050 people full access to water though installation and rehabilitation of water access infrastructure in villages.	2013	50%	19,050	20	139.07	69.53	0.00
64	Sri Lanka	UNDP Sri Lanka	Community Empowerment through Water and Sanitation	This project gave 5,000 people full access to water through the installation of a pipeline built to reconnect residents to the Greater Galle Water Project.	2010	50%	5,000	20	36.50	18.25	18.25
285	South Africa	The Mvula Trust	Water Supply, Watergy Intervention and Education	This project gave 4,802 people full access to water through the refurbishment of a water treatment facility and the construction of pipeline and tapstands.	2011	33%	4,802	25	43.82	14.46	14.46
422	South Africa	Re-Solve Consulting, The Mvula Trust, FHI	Bophelo ka Metsi "Health through Water"	This project will give 10,000 community members full access to water through the construction of a water reticulation network.	2013	50%	10,000	25	91.25	45.63	0.00
144	Swaziland	Local NGO	Emlonyeni Water Project - Providing Water to the People	This project gave full access to water to 85 families, or approximately 544 people through the installation of taps, piping, and water tanks.	2009	50%	544	20	3.97	1.99	1.99
393	Swaziland	NCMI	Water for a Generation	This project will give full access to water to 37,500 people through the construction and rehabilitation of 50 wells and boreholes.	2012	81%	37,500	20	273.75	221.74	0.00
390	Tanzania	Florida International University	Tanzania Water and Development Alliance II	This project will give full access to water to 9,501 people through the construction of wells. In addition 7,101 people will receive access to improved sanitation through latrine construction.	2013	50%	9,501	20	69.36	34.68	0.00
119	Thailand	Regional Medical Sciences Center Kohn Kaen	Clean Water for Communities	This project will give full access to water to 48,000 people. (updated 2010)	2010	50%	48,000	20	350.40	175.20	175.20
65	Thailand	UNDP	Expanding Community Water Access on Lanta Island - Post Tsunami Reconstruction	This project gave 2,800 people full access to water through the construction of check dams, gravity-fed water systems, and drilling of artesian wells.	2006	50%	2,800	20	20.44	10.22	10.22
134	Thailand	HAII	Village that Learns and Earns	This project will give 1,500 households, or approximately 5,250 people, full access to water and education on integrated water resource management	2010	50%	5,250	20	38.33	19.16	19.16
127	Thailand	HAII, Royal Irrigation Dept., Population & Community Development Association	Water Supply for Community - The Celebrations on the Auspicious Occasion of His Majesty the King's 80th Birthday	This project gave 500 households, or approximately 1,750 people, full access to water through construction of water storage facilities, water filtration treatments, piping systems, and distribution canals.	2008	50%	1,750	20	12.78	6.39	6.39

Table C1: Quantification of Full Access to Water Benefits

ID	Country	Partner/Lead	Project Name	Description of Activity	Completion	% TCCC Contribution	Beneficiaries	Beneficiaries	Total Quantity Provided (million L/yr)	TCCC Water Quantity Benefit (million L/yr)	
							Full Access	Liters/person/day			2012
662	Tunisia	United Nations Development Programme	Local Governance of Drinking Water in Rural Areas in Tunisia	This project is rehabilitating at least 12 drinking water supply systems, training at least 12 local water management associations, and producing documents on best practices in drinking water management in rural areas of Tunisia.	2014	52%	11,249	20	82.12	0.00	0.00
49	Uganda	Christian Children's Fund	Northern Uganda Watersprings Initiative	This project gave 30,090 people full access to water through borehole construction and an additional 4,410 people full access to both water and sanitation through boreholes and latrines.	2008	50%	35,090	20	256.16	128.08	128.08
389	Uganda	Water and Sanitation for the Urban Poor	Bwaise Urban Water Access Program	This project will give 15,000 people full access to safe, affordable water through the rehabilitation of the water distribution network.	2012	96%	15,000	20	109.50	105.12	0.00
661	Vietnam	CEFACOM	Clean Water for School and Communities 2012	This project will give 1,986 people full access to water through construction of wells	2012	100%	1,986	20	14.50	14.50	0.00
315	Vietnam	East Meets West Foundation	Clean Water for Communities Program	This project will give full access to water and sanitation to 26,500 people through the extension of water pipes to households outside of the municipal network, water facilities in schools, and latrines.	2009	50%	26,500	20	193.45	96.73	96.73
2	Vietnam	UNDP	Clean Water for Communities - Vietnam	This project gave 500 households, or approximately 2,200 people, full access to water.	2005	50%	2,200	20	16.06	8.03	8.03
472	Vietnam	People's Committee of Lien Chieu District	Clean Water for Communities in Lien Chieu District	This project gave 200 households, or 880 people, full access to water.	2008	50%	880	20	6.42	3.21	3.21
473	Vietnam	CEFACOM	Clean Water for Communities in Thuong Tin and Thu Duc districts	This project will provide 3,500 people by extending water provision facilities to rural areas	2011	100%	3,500	20	25.55	25.55	25.55
474	Vietnam	People's Committee of Thu Duc District	Clean Water for Communities in Thu Duc District	This project gave 2,162 people full access to water through the construction of a well and water filter system and the extension of water pipes.	2007	50%	2,162	20	15.78	7.89	7.89

Appendix D

Fact Sheets for Watershed Protection Projects

Fact sheets for updated and new activities quantified

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PROJECT NAME: Paw Paw River Watershed Restoration
PROJECT ID #: 01

DESCRIPTION OF ACTIVITY: Implement best management practices for cropland in the Paw Paw River watershed, including: 1) conservation tillage practices for up to 2,000 acres, 2) conservation cover for 30 acres, and 3) filter strips for 9 acres.

LOCATION: Paw Paw River watershed (located near the city of Paw Paw in southwest lower Michigan)

PRIMARY CONTACT:

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OBJECTIVES:

- Reduce runoff and increase infiltration/baseflow
- Reduce sediment erosion / runoff

BACKGROUND & ACTIVITY DESCRIPTION: Implementing conservation tillage (e.g., no till) practices for agricultural fields (up to 2,000 acres) that are currently subject to conventional tillage is expected to: 1) reduce runoff quantities and enhance groundwater baseflow, and 2) reduce sediment erosion and runoff from agricultural fields. The implementation of conservation cover (30 acres) and filter strips (8 acres) are expected to have similar benefits on a smaller scale.

Conservation tillage and a riparian buffer in the Paw Paw River watershed

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 160.5 ML/YR

ACTIVITY TIMELINE:

- Project was originally intended to be implemented during roughly a 3-year period extending from September 2009 to 2012. However, implementation of additional tillage and other best management practices are now planned for 2013.
- The conservation tillage activities associated with TCCC funding are expected to be 100% implemented by the end of 2013.
- The conservation cover was implemented in 2011, and filter strips were implemented in 2012 with an additional filter strip activity planned for 2013.

COCA-COLA CONTRIBUTION: 76.9% to 100% (depending on implementation year)

- Project would not have occurred without TCCC funding.
- Through year 2010, Coca-Cola had contributed grant money totaling $133,000 for studies and planning, and USDA and The Nature Conservancy had contributed a total of $40,035.
- For activities implemented in 2010 and 2011, the TCCC cost share is estimated to be 76.9%.
- For activities implemented in 2012 and projected to be implemented in 2013, the TCCC cost share is 100% because TCCC funding is serving as direct payment to the farmers involved.

WATERSHED BENEFITS CALCULATED:

1. Increase in groundwater recharge
2. Decrease in sediment erosion/runoff

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1. INCREASE IN GROUNDWATER RECHARGE

<u>Approach & Results:</u>

The Institute for Water Resources (IWR) at Michigan State University has developed a Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) to simulate the hydrology of the Paw Paw River watershed in southwest Michigan. The goals of this watershed modeling study included: 1) estimating the water balance of the watershed under current land uses, and 2) developing an estimate of the change in groundwater recharge under potential land use scenarios and management practices. The model utilizes typical watershed datasets, including the National Hydrography Dataset (NHD), a digital elevation model (DEM), county-based SSURGO soil datasets, and the 2001 National Land Cover Dataset (NLCD) for defining land use/cover conditions. More detailed documentation of the SWAT model is provided in the IWR (2010) modeling report.

The calibrated SWAT model for the Paw Paw River watershed was used to estimate the increase in groundwater recharge resulting from three different management practices implemented in the watershed:

- <u>Conservation tillage</u> – reduced-till and no-till practices for 1,140 acres:
    - Water quantity benefit: 237.1 ML/yr
- <u>Filter strips</u> – implemented on 9 acres:
    - Water quantity benefit: 6.4 ML/yr
- <u>Conservation cover</u> – implemented for 30 acres:

- Water quantity benefit: 11.8 ML/yr

- The maximum project water quantity benefit for the tillage, filter strips, and conservation cover activities, without schedule adjustment, is 255.3 ML/yr. After this benefit is scaled for implementation schedule, the total maximum benefit is 254.9 ML/yr.

The total (maximum) benefit is: 254.9 ML/yr

TCCC total (maximum) benefit taken as a function of cost share is: 240.4 ML/yr

The current (2012) benefit and projected benefits are based on the total maximum benefit for the tillage management practice area (1,140 acres), adjusted to account for implementation schedule and TCCC cost share.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 175.1 ML/yr and TCCC's benefit (adjusted for cost share) is 160.5 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service and additional activities planned for 2013 are conducted. While not shown in the table, benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column (including an expected reduction in benefit after a 3-year funding cycle has ended), and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	254.9	240.4
2014	242.5	230.8
2015	215.6	204.0
2016	196.1	184.4
2017	196.1	184.4

Data Sources & Assumptions:

- See detailed discussion in the IWR modeling report (IWR 2010).
- Key assumptions regarding implementation schedule include:
  - Tillage and other management practices will be carried forward by farmers for 75% of the implementation area after the 3-year funding cycle is completed for a given area (Van Buren County Conservation District, personal communication); and
  - Although the original objective of the project was to place 2,000 acres of land into reduced-till or no-till, the current projected total area through 2013 is only 1,140 acres. Therefore, it is likely that the original 2,000 acre goal for the project will not be fully met.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

To complement the SWAT model described above, IWR is also developing a "High-Impact Targeting" (HIT) tool that is designed to focus conservation resources on the most significant erosion problems in the Paw Paw River watershed. This tool is based on two underlying models, the Revised Universal Soil Loss Equation (RUSLE) and the Spatially Explicit Delivery Model (SEDMOD). The data used to drive these models includes digital elevation models (DEMs), land cover, soil surveys, climate data, and crop/tillage practices. Ultimately, the HIT tool will be used to estimate sediment erosion/runoff reduction benefits for the management practices implemented in the Paw Paw River watershed. However, this tool was still under development as of September 2011, and thus could not be used immediately to develop these estimates.

In lieu of estimates from the HIT tool, the calculations included in the original (January 2010) fact sheet are used as placeholder estimates. The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting conventionally tilled cropland to conservation tillage or "no-till". The Curve Number Runoff method was used to estimate daily runoff volume for the pre-project (conventionally-tilled straight row cropland) and post-project (conservation tillage) conditions. Hourly meteorological data for local weather stations were obtained from the database provided as part of USEPA's BASINS 4 watershed modeling software package. Hourly data were used to compute total daily precipitation, maximum hourly rainfall intensity, daily average and maximum air temperature, and daily total potential evapotranspiration (PET).

Curve numbers and processed meteorological data were used to compute daily runoff for the pre- and post-project cases for a 29-year period (1970-1998), including the effects of seasonal snow accumulation and melt. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated based on hourly precipitation data for the 1970-1998 time period.

The Cover/Management Factors (C_{usle}) for the MUSLE were estimated as 0.20 and 0.062 for pre-project and post-project conditions, respectively, based on information provided in Haith (1992). Total annual sediment yields for the cropland were estimated as follows:

- Pre-project (conventional tillage): 1,671 MT/yr (3.62 MT/ha/yr)
- Post-project (conservation tillage or "no-till"): 479 MT/yr (1.04 MT/ha/yr)

The total water quality benefit for the tillage management area, without schedule adjustment, is estimated as the difference in the pre-project and post-project load, and equals 1,192 MT/yr. After this benefit is scaled for implementation schedule, the total maximum water quality benefit is 1,186 MT/yr.

- The total (maximum) benefit (reduced sediment yield) is: 1,186 MT/yr
- TCCC total (maximum) benefit taken as a function of cost share is: 1,097 MT/yr

2012 Water Quality Benefit

The 2012 water quality benefit (reduced sediment yield) is 986 MT/yr. The 2012 water quality benefit taken as a function of cost share is 896 MT/yr.

Data Sources:

- Size of area targeted for conservation tillage: up to 2,000 acres (809.4 Ha), but currently expected to reach 1,140 acres by the end of 2013. Additional water quality benefits are expected to be generated by filter strip and conservation cover activities. There is insufficient information to estimate benefits for those activities at present; however, the HIT tool results will ultimately include estimates of these benefits.
- Slope: 1% (estimated based on local topographic datasets)
- Soil type: predominantly hydrologic soil group (HSG) "B"
    - Characterized by moderate to high infiltration rates
    - Based on STATSGO soils database available through BASINS
- Meteorological data:
    - All meteorological data obtained via USEPA's BASINS version 4 software
    - Hourly precipitation data were obtained for Coloma, MI for the 1970-1998 period.
    - Hourly air temperature and evapotranspiration rates were obtained for Berrien Springs, MI for the 1970-2006 period.
- STATSGO soils data obtained from USEPA BASINS 4 were used to estimate a soil erodibility factor (K) of 0.17 for use in MUSLE equation.

Assumptions:

- Land slope was assumed to be 1% on average for the agricultural areas of interest.
- The Cover Factor (C_{usle}) was assumed to remain constant through time (both seasonally and among years).
- The USLE "Practice Factor" (P) was assumed to be 1.0, corresponding to no contouring or terracing of the land surface.

Key assumptions regarding implementation schedule include:

- Tillage and other management practices will be carried forward by farmers for 75% of the implementation area after the 3-year funding cycle is completed for a given area (Van Buren County Conservation District, personal communication); and

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OTHER BENEFITS NOT QUANTIFIED

- None

NOTES

- This fact sheet is an update of the November 2011 fact sheet and reflects current information on the status of the program. It includes preliminary estimates of water quantity/quality benefits resulting from reductions in runoff/sediment. Monitoring and modeling continue to be conducted as part of the project and will be used to report final estimates of benefits.

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Williams J.R. 1975. “Sediment yield prediction with USLE using runoff energy factor.” In: *ARS-S-40.* Agr. Res. Serv., USDA. Washington DC. pp. 244-252.

PROJECT NAME: Lower Flint River Watershed Restoration
PROJECT ID #: 03

DESCRIPTION OF ACTIVITY: Variable Rate Irrigation and Remote Soil Moisture Monitoring

LOCATION: Flint River Watershed, Georgia

PRIMARY CONTACT:

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OBJECTIVE:

- Provide demonstration project for decreasing irrigation water use

BACKGROUND & DESCRIPTION OF ACTIVITY: This project is focused on improved irrigation practices through variable rate irrigation (VRI) and remote soil moisture monitoring (RSMM). Water savings through VRI are generated by using upgraded GPS technology to remove non-crop areas (e.g., ditches, rocks, wetlands) from irrigation, coordinating application amounts with variations in soil type and field topography, and eliminating double application due to pivot overlap. VRI reduces water use by an average of 15% (Reckford, et al., 2010). Remote soil moisture monitoring relies on GPS technology and low-cost sensors that gather real-time temperature and soil moisture data from different soil depths and at multiple locations. Antennae fitted to the pipe then relay the soil conditions to the internet, where the data is reviewed and analyzed to inform optimal application of irrigation water. Research shows that use of RSMM results in the reduction of 1-2 irrigation applications per season. The technology was developed at the University of Georgia, and rolled out in a partnership between the Flint River Soil and Water Conservation District and The Nature Conservancy.

Figure 1. VRI optimizes irrigation application with center pivot irrigation systems

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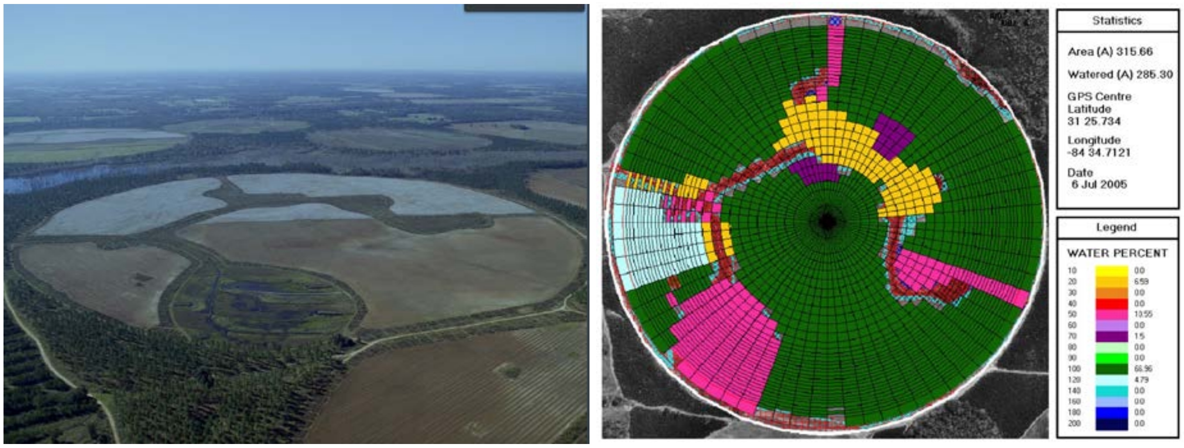

Figure 2. VRI applies GPS technology to remove non-crop areas from irrigation

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 289.97 ML/YR

ACTIVITY TIMELINE:

- Project initiation: January 2012
- Project completion: October 2012

COKE CONTRIBUTION: 100%

- Total cost: $88,250 USD
- TCCC cost contribution: $88,250 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in groundwater withdrawal

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1. DECREASE IN GROUNDWATER WITHDRAWAL

<u>Approach and Results</u>

Water savings were calculated using different methods for VRI and RSMM because VRI reduces the volume of water applied per irrigation cycle and RSMM reduces the total number of irrigations.

Variable Rate Irrigation

The volume of water savings was calculated as the volume of water that is not withdrawn during an average year as a result of the use of VRI. This is a conservative estimate and savings are larger during drought years when more irrigation water is required. The pivot irrigation systems used are already the most efficient available for the particular crops and land conditions (Evans, 1998), so losses through runoff and leaching are minimal and were not explicitly accounted for in the calculations.

In the Lower Flint River Watershed, the average volume of irrigation applied to supplement rainfall per season during an average precipitation year is approximately 10 acre-inches, or 10 irrigations to apply 1 acre-inch of water. This value is derived from both in-field and remote meter readings on a subset of center pivots in the Flint River Basin from 2007-2010.

One acre-inch is equal to 27,154 gallons. Therefore the total water conserved (i.e., not withdrawn) during an average year is based on the number of acres removed from irrigation as follows:

Water savings = # acres removed from irrigation x 27,154 gallons/acre x 10 irrigations

<u>GPS Upgrade for 10 VRIs</u>**:** 171 acres removed from irrigation

Water savings = 171 acres x 27,154 gallons x 10 applications = 46,433,340 gallons = 175,769,230 liters = 175.77 ML/yr

<u>VRI Demonstration CP1</u>: 19.6 acres removed from irrigation

Water savings = 19.6 acres x 27,154 gallons x 10 irrigations = 5,322,184 gallons = 20,146,649 liters = 20.15 ML/yr

<u>VRI Demonstration CP2</u>: 71.5 acres removed from irrigation

Water savings = 71.5 acres x 27,154 gallons x 10 applications = 19,415,110 gallons = 73,494,152 liters = 73.49 ML

Remote Soil Moisture Monitoring

The water savings is calculated differently because the goal of RSMM is to reduce the total number of irrigations. Research shows that use of RSMM results in the reduction of up to 2 irrigation applications per season.

<u>AG Expo RSMM:</u> Reduced irrigation by 1 out of 10 applications on 200 acres

Water savings = 200 acres x 27,154 gallons x 1 application = 5,430,800 gallons = 20,557,805 liters = 20.56 ML/yr

The **total water savings** from all projects is calculated as the sum of the water savings from VRI and RSMM demonstration projects:

Water savings = 175.77 + 20.15 + 73.49 + 20.56 = 289.97 million L/yr

<u>The total (ultimate) water quantity benefit is:</u> 289.97 ML/yr.

<u>TCCC total (ultimate) benefit taken as a function of cost share is:</u> 289.97 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

<u>2012 Replenish Benefit</u>

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 289.97 ML/yr and TCCC's benefit (adjusted for cost share) is 289.97 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	289.97	289.97
2014	289.97	289.97
2015	289.97	289.97
2016	289.97	289.97
2017	289.97	289.97
Ultimate Benefit:	289.97	289.97

Data sources

- Acreage and supporting materials provided by David Reckford, Flint River Basin Partnership

Assumptions

- 2012 was a drought year but average conditions were assumed, resulting in conservative assumptions of water savings. Some years will have smaller or larger savings depending on the amount of rainfall during the growing season.

OTHER BENEFITS NOT QUANTIFIED

- Energy savings and associated cost savings

NOTES

- This is an update of the November 2011 fact sheet and accounts for new activities conducted in 2012.

REFERENCES

Evans, Robert, et al. 1998. Irrigation Conservation Practices Appropriate for the Southeastern United States. Edited by: Daniel L. Thomas. Project Report 32.

Reckford, David (Flint River Basin Partnership), C. Perry, R. Yager, J. Marois and D. Wright, R. Barrett, and M. McLendon. 2010. Agricultural Water Conservation in the Lower Flint River Basin of Georgia.

PROJECT NAME: Etowah River Watershed Conservation Partnership
PROJECT ID #: 04

DESCRIPTION OF ACTIVITY: Raccoon Creek floodplain restoration

LOCATION: Paulding County, Georgia

PRIMARY CONTACTS:

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OBJECTIVES:

- Increase floodplain connectivity
- Restore floodplain habitat
- Control flooding

BACKGROUND & ACTIVITY DESCRIPTION: Raccoon Creek is a tributary of the Etowah River, Georgia. An approximately 1 mile stretch of this creek was previously channelized in an area located in an existing power line easement. The creek flows through former agricultural lands. Impacts from the power line easement and agricultural practices led to conditions where the stream became channelized, was lacking a riparian buffer and the banks were instable. Identified instability issues included but were not limited to down valley migration of many meanders, reach wide erosion, and incision of the stream. There are areas within the channel with substantial amounts of bedrock. These areas have provided a nick point to stop further stream incision and in places have helped to stop further erosion on the banks. Restoration of this portion of the creek has involved work to restore a pool and riffle system, reintroduce meanders and protect outside banks from erosion, and construct floodplain benches to facilitate cutting a new floodplain and reconnecting to the historic floodplain during 1 to 1.5 year rain events.

Site 3 before (left) and after (right) photos

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 0.66 ML/YR

ACTIVITY TIMELINE:

- 2011 and 2012 – Floodplain benches completed at sites 2, 3 and 4
- 2013 – Floodplain benches completed at sites 5 and 6

COCA-COLA CONTRIBUTION: 31%

- Total cost (USD) for floodplain restoration: $260,000 USD
  - TCCC contribution: $80,000 USD
  - Contribution from other partners: $180,000 USD
    (Partners include US Fish and Wildlife Service, the Upper Coosa Riverkeeper and Georgia Power)

WATERSHED BENEFITS CALCULATED:

1. Increase in floodplain inundation volume

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1. INCREASE IN FLOODPLAIN INUNDATION VOLUME

Approach and Results

The approach taken for the Raccoon Creek restoration project was to estimate the annual average increase in floodplain inundation volume (i.e., the volume of water that would have otherwise flowed downstream without serving important floodplain functions) established by the project. The water quantity benefit estimate is based on floodplain inundation areas and depths associated with a "bankfull" event, which occurs every 1 to 1.5 years in Raccoon Creek, according to TNC staff. For simplicity, it is assumed that a "bankfull" event occurs approximately once per calendar year for the purpose of this benefit estimate.

Following the initial installation of floodplain bench areas in 2011-12, TNC and its contractors have observed one "bankfull" event in Raccoon Creek and were able to collect measurements of inundation areas and depths associated with the various bench areas constructed for this project. These area and depth estimates were used to compute inundation volumes associated with each of the bench areas. Table 1 below summarizes the data and the estimated inundation volume for each bench area that was fully constructed in 2011and before November 2012.

Table 1. "Bankfull" Event Data and Inundation Volume Estimates for Bench Areas (2011 and 2012 only)

Site ID	Area (acre)	Depth (ft)	Volume (ft^3/yr)	Volume (ML/yr)
2 Left Bank	0.10	2.80	12,196.8	0.35
3-4 right bank	0.11	3.75	17,968.5	0.51
3-4 left bank	0.16	4.00	27,878.4	0.79
Darter Creek	0.40	1.00	17,424.0	0.49
			Total Volume (ML/yr):	**2.14**

The bench areas constructed in 2012 and described above are assumed to provide a constant water quantity benefit (via additional floodplain inundation volume) in future years beyond 2012. However, there are additional bench areas that are currently under construction and will be completed in February 2013, according to the TNC contact. Area and depth measurements were also collected for these bench sites during the last "bankfull" event. The data and estimated floodplain inundation volumes for the 2013 bench areas are provided in Table 2 below.

Table 2. Projected "Bankfull" Event Data and Inundation Volume Estimates for Bench Areas Constructed by February 2013

Site ID	Area (acre)	Depth (ft)	Volume (ft^3/yr)	Volume (ML/yr)
5 Left Bank	0.35	3.6	54885.6	1.55
5 right bank	0.20	2.0	17424	0.49
6 left bank	0.60	1.7	44431.2	1.26
6 right bank	0.40	1.0	17424	0.49
			Total Volume (ML/yr):	**3.79**

Based on these calculations, the **total water quantity benefit (additional floodplain inundation volume) for Raccoon Creek is: (2.14 + 3.79) = 5.93 million liters per year (ML/yr).**

The total (ultimate) benefit: 5.93 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 1.84 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 2.14 ML/yr and TCCC's benefit (adjusted for cost share) is 0.66 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)*	Adjusted for TCCC Cost Share (ML/yr)
2013	5.93	1.84
2014	5.93	1.84
2015	5.93	1.84
2016	5.93	1.84
2017	5.93	1.84
Ultimate Benefit:	5.93	1.84

*Based on the addition of four bench areas in 2013, the total water quality benefit for 2013 and beyond will be 5.93 ML/yr. If additional projects are added or projects are expanded (beyond the additional bench areas for 2013 described above), the future benefits will increase.

Data Sources:

- Estimates of acreage and water depth for floodplain inundation were collected by TNC and its contractors and provided by the TNC contact.

Assumptions:

- A “bankfull” event in Raccoon Creek occurs approximately once per calendar year.

OTHER BENEFITS NOT QUANTIFIED

- Reduced erosion and sediment load

NOTES

- Companion activities on Raccoon Creek are described in a separate fact sheet.

REFERENCES

Glickauf, S. 2010. Raccoon Creek Stream Design and Build, Phase I. Wildlands Concept Design Memo, May 24.

PROJECT NAME: Wildlands Conservancy Lehigh River Restoration
PROJECT ID #: 15

DESCRIPTION OF ACTIVITY: Wetland system for treatment of abandoned mine drainage from Lausanne Tunnel

LOCATION: Lehigh Gorge State Park, Borough of Jim Thorpe, Carbon County, PA

PRIMARY CONTACT:

Kristie Fach	Rena Ann Stricker	Jon Radtke
Biologist	Contract Ecologist	Manager, Water Resources
Wildlands Conservancy	CCR Environment & Sustainability	CCR Environment & Sustainability
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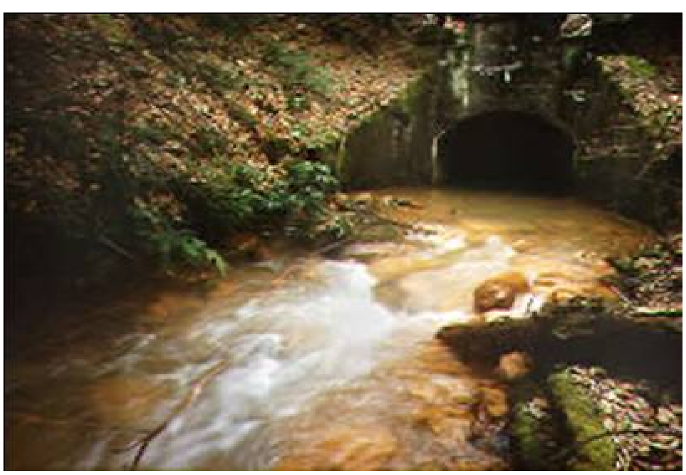
OBJECTIVE:

- Reduce loads of acid mine drainage constituents into Nesquehoning Creek

BACKGROUND & ACTIVITY DESCRIPTION: Abandoned mine drainage (AMD) contributes to the largest negative impact to water quality in the Lehigh River watershed. Each day the Lehigh River receives approximately 75,000 lbs of AMD-related heavy metals. The Lehigh River watershed contains numerous strip mines, pits, and underground workings being drained by eight discharges that enter four major Lehigh tributaries. Treatment of AMD is not required by law in Pennsylvania.

The Lausanne Tunnel Abandoned Mine Drainage Restoration Project involves a 1.5-acre constructed passive wetland treatment system to treat AMD from the Lausanne Tunnel discharge into Nesquehoning Creek, a tributary of the Lehigh River. The design and construction activities were completed in June 2004. Beginning in 2004, Wildlands Conservancy, along with Pennsylvania Department of Environmental Protection (PA DEP) Bureau of Abandoned Mine Reclamation, conducted visual site inspections, water flow and water quality sampling and analysis, and vegetation inspections to determine the effectiveness of the passive wetland treatment system and to address any issues. Invasive/exotic plant species were identified and removed before they spread to an extent that could impair the functionality of the system.



Lausanne Tunnel Discharge (Photo: Wildlands Conservancy)

The ability to increase retention time is critical because the longer that water is allowed to remain in the system the more opportunity there is for the heavy metals to be removed and absorbed by aquatic plants of the wetland. In 2006 a dye tracer was used to study water flow through the system, resulting in the installation of hay bales between the wetland segments to retard water flow. In 2009 a new weir was installed to further increase water retention time in the wetland system and facilitate collection of more accurate water quality and flow data.

Passive Wetland Treatment System: Lausanne Tunnel water flows through pipes (forefront) into Wetland A (Photo: Wildlands Conservancy)

Wetland A water flowing over hay bales into Wetland B (Photo: Wildlands Conservancy)

Water quality sampling has been conducted for several years at the Lausanne Tunnel, within the wetlands, and in Nesquehoning Creek. Flows through the system have also been measured. The treatment system has been demonstrated to remove significant quantities of heavy metals from the discharge. Upon analysis of annual data gathered from 2004 to 2007, the removal of metals from the water increased significantly. In 2007, more than 48% of the total iron concentration was removed compared to 2006 when 26% was removed from the Lausanne Tunnel discharge. In 2007, 56% of the aluminum concentration was removed compared to 29% in 2006. Sulfate, aluminum and iron removal rates have all improved since the treatment system was completed in 2004 (Figure 1).

SUMMARY OF REPLENISH BENEFIT:

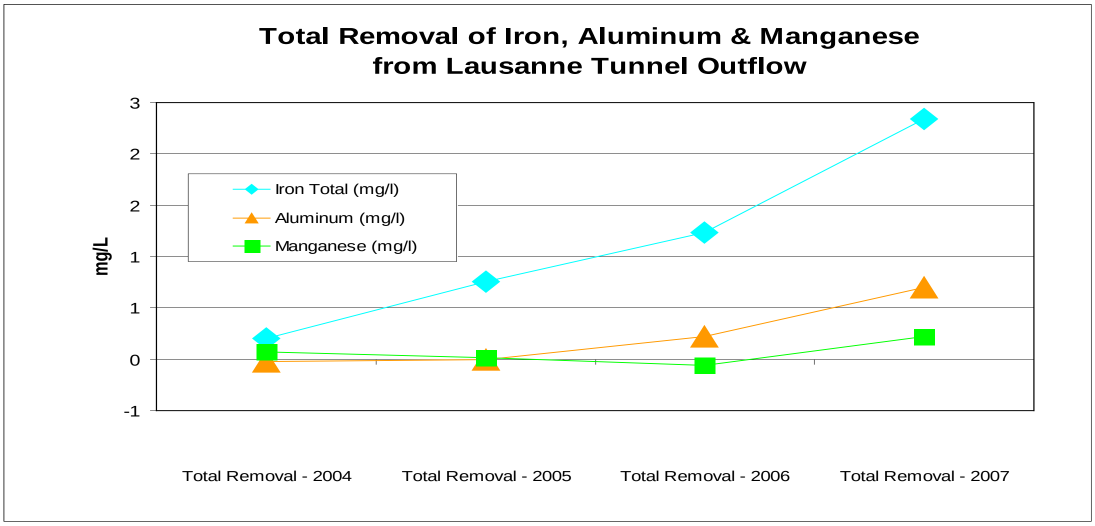
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 61.2 ML/YR

ACTIVITY TIMELINE:

- June 2004 – completion of treatment system design and construction activities
- 2004-Present – water quality and flow monitoring (most recent reported data is from 2012)
- 2006 – water flow dye study and installation of hay bales between wetland segments to increase water retention time in wetlands
- 2009 –installation of weir to increase water retention time in wetlands and provide for more accurate flow measurements

COCA-COLA CONTRIBUTION: 1.5%

- Total cost: $650,000
- Coca-Cola: $10,000



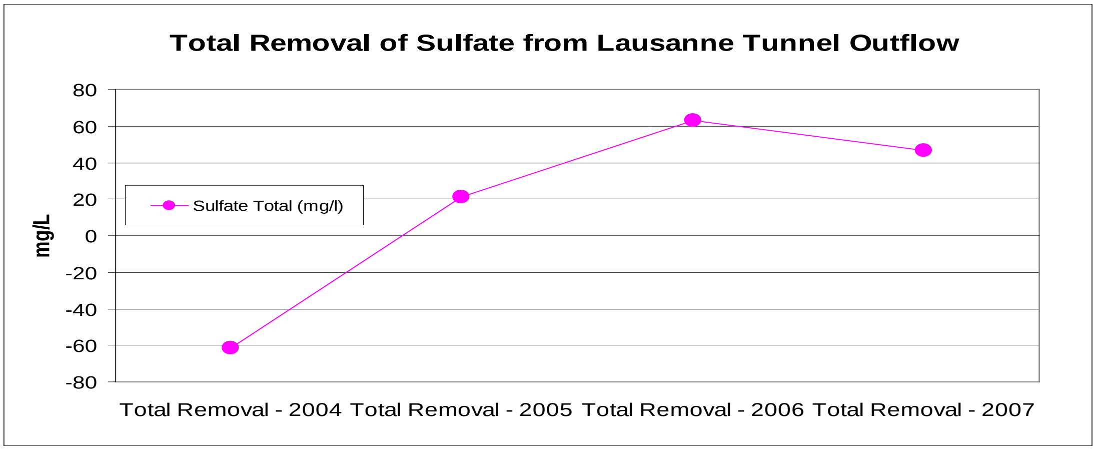


Figure 1. Data collected from 2004-2007 demonstrate the effectiveness of the treatment system

WATERSHED BENEFITS CALCULATED:

1. Volume of water treated
2. Decreased pollutant load

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1. VOLUME OF WATER TREATED

<u>Approach & Results</u>

The water quantity benefit was calculated as the volume of contaminated water treated to standards. Data collected at the outlet of Wetland B in 2011 and 2012 (PA DEP, 2011 and 2012) demonstrate that the treated water is meeting Pennsylvania's standard effluent limits for treatment pond effluent (PA DEP, 2009) as shown in Table 1. Metals concentrations in untreated water flowing from the tunnel have exceeded standards at times. A downward trend over time reflects improvements due to ongoing remediation activities upstream.

Table 1. Water Quality Data Collected in Untreated Water and Outlet of Wetland System

Constituent	Standard for Treatment Pond Effluent	Lausanne Tunnel Discharge (untreated water; 2004-2012)	Treatment Wetland B Outlet (2011)	Treatment Wetland B Outlet (2012)
Aluminum (mg/l)	<0.75	0.46 – 1.24	0.48	0.38
Iron, Fe (mg/l)	<3.0	2.8 – 4.8	2.8	2.4
Manganese, Mn (mg/l)	<2.0	1.9 – 2.6	2.0	1.9
pH	6.0 <= pH <= 9.0	6.6 – 7.0	6.9	7.1

The flow through the treatment wetland system is highly variable because it is driven by precipitation. The long-term average flow through the system is estimated conservatively by Wildlands Conservancy to be 2,000 gallons per minute. Maximum flows through the system can be as high as 4,000 gallons per minute. The long-term average flow was used in the benefit calculation as follows:
Benefit = 2,000 gal/minute = 10,902,000 liters/day = 3,979 ML/yr

Total (ultimate) benefit is: 3,979 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 61.2 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 61.2 ML/yr and TCCC's benefit (adjusted for cost share) is 61.2 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide it the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	3,979	61.2
2014	3,979	61.2
2015	3,979	61.2
2016	3,979	61.2
2017	3,979	61.2
Ultimate Benefit	3,979	61.2

2. DECREASED POLLUTANT LOAD

Daily load reductions were reported in the LTI CWP survey for iron, aluminum and sulfates. Based on data collected between 2004 and 2007, the effectiveness of the system improved as plants grew and improvements were made (Figure 1). These data indicate that the system is preventing approximately 120 lbs of iron, 45 lbs of aluminum, and 8,000 lbs of sulfates from entering Nesquehoning Creek and Lehigh River each day.

Additional monitoring data for alkalinity, pH, total suspended solids, manganese and hot acidity were reported in units of concentration, but flow data and/or loads associated with these parameters was not reported; therefore reduced loads for these additional parameters could not be quantified.

The total water quality benefits are estimated as follows:

- The total benefit (total iron decrease) is: 20 MT/yr and TCCC's benefit (adjusted for cost share) is 0.3 MT/yr.
- The total benefit (aluminum decrease) is: 7.5 MT/yr and TCCC's benefit (adjusted for cost share) is 0.1 MT/yr.
- The total benefit (sulfate decrease) is: 1,324 MT/yr and TCCC's benefit (adjusted for cost share) is 19.9 MT/yr.

The 2012 benefits are as follows:

- The 2012 benefit (total iron decrease) is: 20 MT/yr and TCCC's benefit (adjusted for cost share) is 0.3 MT/yr.
- The 2012 benefit (aluminum decrease) is: 7.5 MT/yr and TCCC's benefit (adjusted for cost share) is 0.1 MT/yr.
- The 2012 benefit (sulfate decrease) is: 1,324 MT/yr and TCCC's benefit (adjusted for cost share) is 19.9 MT/yr.

Data sources

- Average flow through treatment system provided by Wildlands Conservancy
- Water quality data provided in references as cited.

Assumptions

- It is assumed that the treatment system is operating as designed, based on information provided by Wildlands Conservancy.

OTHER BENEFITS NOT QUANTIFIED

- Improvements to quality of downstream waters

NOTES:

- This is an update of a fact sheet prepared in 2009 when only water quality benefits were estimated.

REFERENCES

Pennsylvania Department of Environmental Protection (PA DEP). 2009. Lehigh River Watershed TMDL (Final). March 27.

PA DEP Bureau of Laboratories - Harrisburg. 2011 and 2012. Analytical Reports for Abandoned Mine Reclamation.

Wildlands Conservancy, 2007. Lausanne Tunnel Abandoned Mine Drainage Restoration Project, Project Completed 2004. Wildlands Conservancy, 2007 Update Report, July.

Wildlands Conservancy, 2008. Community Water Partnerships Project of Coca-Cola Foundation & Wildlands Conservancy within the Lehigh Valley and Lehigh River Watershed of Eastern Pennsylvania. Project Update Report, November 10.

PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Reestablishment of channel morphology and floodplain connectivity

LOCATION: Rio Grande, Texas (Big Bend)

PRIMARY CONTACT:

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OBJECTIVES

- Reestablish channel morphology and river-floodplain connectivity
- Enhance replenishment rates by providing greater active channel surface area contact with flow
- Improve quality of habitat for a variety of native aquatic and terrestrial species, including the threatened Rio Grande silvery minnow
- Decrease frequency that riverside towns and infrastructure are flooded

BACKGROUND & DESCRIPTION OF ACTIVITY: WWF is working along the Big Bend reach of the Rio Grande to reestablish the floodplain. The main objective of the current treatments is to reestablish wide and shallow channel morphologic conditions that will provide significant active floodplain areas for replenishment under the current hydrologic regime of the river. This is being accomplished by working with Mexican water management agencies on developing channel maintenance flows, and removing dense stands of non-native species in selected locations, which is seen as important for increasing the vulnerability of underlying sediments to mobilization and evacuation (i.e., removing non-native stands reduces channel narrowing processes, increases widening, thus leading to enhanced replenishment).

Work is ongoing to maintain the floodplain and prevent reestablishment of invasive species in the floodplain areas that have been restored. The treated areas are being monitored through establishment and measurement of vegetation plots, allowing a solid before-and-after data base as well as the means to routinely identify areas requiring re-treatment. Additionally, sites where giant cane (Arundo donax) has resprouted are being retreated. Finally, the saltcedar leaf beetle has been released and has greatly reduced the likelihood of saltcedar invading sites formerly occupied by giant cane.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1,268.3 ML/YR

ACTIVITY TIMELINE:

- Implementation through 2020, with annual increased area of newly established floodplain surfaces conducive to replenishment (see attached spreadsheet).
- 2012: 30 km treated on US side; 26 km treated on Mexico side.
- 2013-2020: an additional 5 km/yr planned for treatment.

COKE CONTRIBUTION: Variable, see below

- 2009 through 2011 - Coca-Cola cost share was 30%
  - 30% TCCC -70% NOAA, National Park Service, BOR, and private foundations
- 2012
  - Coca-Cola cost share = 100% US side of the river
  - Coca-Cola cost share = 53% Mexico side of the river (53% TCCC, 47% CEC)
- 2013 through 2020 – Coca-Cola cost share projected to be 30%, but will be confirmed for future calculations

WATERSHED BENEFITS CALCULATED:

1. Increased floodplain inundation

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1. INCREASED FLOODPLAIN INUNDATION

Approach and Results

The benefit was calculated as an estimate of transmission rates through floodplain surfaces that have been hydrologically reconnected to the river via conservation activities.

Based on experience and due to access and channel morphologic conditions, WWF and its partners in Big Bend will be able to directly treat over one-third of the river channel length along the Big Bend reach of the Rio Grande. The total length of the Big Bend reach from Presido through Boquillas Canyon is approximately 216 km. To date, WWF has treated just over 51 km of river channel, including 30 km on the US side and 26 km on the Mexico side in 2012. High flows of magnitudes equal to or greater than a statistical recurrence interval of two to three years are required to take advantage of eradication activities and evacuate newly exposed alluvium. Depending on the magnitude and duration of future high flow events, the eradiation is expected to reestablish active floodplain surfaces along the treated reach that average 8 meters wide on both sides of the channel.

WWF anticipates in the foreseeable future that they will be able to treat on average about 5 km of river channel per year (both sides). In the current hydrologic regime, the newly reestablished active floodplain surfaces will be inundated on average about three days per year.

Floodplain alluvium along the Big Bend reach is sandy loam to sandy, which equates to a seepage rate (or replenishment rate) of about 1.01 m^3 per m^2 per day of inundation for the newly established active floodplain surfaces.

The water quantity benefit for 2012 is calculated as the sum of the increased floodplain inundation to date and equals 2246.9 ML/yr.

The total (ultimate) benefit is: 2246.9 ML/yr
TCCC total (ultimate) benefit is: 1268.3 ML/yr

Table 1. Estimated Annual and Cumulative Replenishment to Date

Year	Length Treated in Specified Year (km)	Annual Increased Floodplain Inundation (ML/yr)	Cumulative Increased Floodplain Inundation (ML/yr)
2009	7	308.4	308.4
2010	5	220.3	528.7
2011	11	484.6	1013.3
2012	28*	1233.6	2246.9

**30 km on US side and 26 km on Mexican side of the river, averaged to equal 28 km.*

Table 2 shows how the variable cost share is considered in the calculation of the TCCC benefit for work completed through 2012.

Table 2. Cost Share and Calculation of TCCC Benefit per Year

Time period	Replenishment during period indicated (ML/yr)	TCCC cost share (%)	TCCC benefit taken as a function of cost share (ML/yr)
2009-2011	1,013.3	30%	304
2012 (US side)	660.8	100%	660.8
2012 (Mexican side)	572.7	53%	303.5
Total	**2,246.9**		**1,268.3**

Numbers may not sum exactly due to rounding.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit (cumulative over the 2009 -2012 period) is 2,246.9 ML/yr and TCCC's benefit (adjusted for cost share) is 1,268.3 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	2,467.2	1,334.5
2014	2,687.5	1,400.6
2015	2,907.7	1,466.6
2016	3,128.0	1,532.7
2017	3,348.3	1,598.8
Ultimate Benefit:	4,009.2	1,797.1

**Projections assume 8 km treatment width on each side of the river.*

Data sources

- Data and calculations provided by M. Briggs, WWF (see attached spreadsheet)

Assumptions (see attached spreadsheet)

- Eradication of dense stands of non-native salt cedar and Arundo enhances channel widening processes, leading to enhance replenishment opportunities (impact of eradicating near-channel non-native plants is being evaluated)
- Rating curves for floodplain surfaces are under development, so the recurrence interval of the discharge required to inundate active floodplain surfaces that have been reestablished due to treatments is currently unknown. It was assumed (conservatively) that newly created floodplain surfaces will be inundated on average three days per year under the current hydrological regime.
- Projections assume 8 km treatment width on both the US and Mexican side of the river and 30% TCCC cost share for treatments on both sides of the river.

OTHER BENEFITS NOT QUANTIFIED

- Removal of invasive plants and revegetation with native species will expand habitat availability and quality, and lead to increased abundance of native birds, mammals, reptiles, and fish.
- Reduction of fire risk associated with dense salt cedar stands.
- Reduced flood frequency and flood hazard to streamside towns and infrastructure.

NOTES

- This fact sheet updates the 2009 fact sheet to include additional floodplain treatments from 2010 through 2012.
- As currently calculated, replenishment estimates are based on a variety of assumptions (summarized above) whose validity will be assessed as additional monitoring data are collected and model refinements are completed.
- Agreements with Comisión Nacional del Agua (CONAGUA) on channel maintenance flow releases (as part of treaty obligations) are in development. If successful, agreements could enhance replenishment rates thus far put forward.

REFERENCES

WWF. 2007. Restoring a Desert Jewel – The Chihuahuan Desert's Big Bend and the WWF/Coca Cola Partnership. August.

Calculations found in file: 21_Mexico_RioGrande_BigBend_floodplain_v2_2012_Nov.xlsx

PROJECT NAME: Reconnecting the Lifeline
PROJECT ID #: 31

DESCRIPTION OF ACTIVITY: Wetland restoration

LOCATION: Podunavlje fish ponds in Kopacki Rit Nature Park
Mura-Drava Danube Area, near the village of Kopacevo in the Baranja region of Croatia
(covers area from N 45^{o} 32’ to 45^{o} 47’ and E 18^{o} 45’to 18^{o} 59’)

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OBJECTIVES

- Restore open water ponds to increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: Kopacki Rit Nature Park is a Ramsar Site, an Important Bird Area, and part of the newly designated UNESCO Transboundary Biosphere Reserve “Mura-Drava-Danube.” The park is part of an extensive floodplain area of global significance, where fluctuating water levels create a mosaic of habitats (floodplain forests, open water ponds, river islands, sand banks and oxbows) that support high biodiversity. The region’s waterways provide refuge for fish spawning and support numerous species of rare and threatened waterfowl and other birds and plant species. The park is home to the highest density of breeding pairs of rare white-tailed eagles in Europe (WWF, 2012a).

When the Podunavlje fish ponds were abandoned approximately 7 years ago, they dried out and became overgrown with woody vegetation, leading to loss of ecological functions and values. A gradual lowering of the groundwater table in the region due to regulations and dredging of the Danube River for navigation has compounded the problem. The fish pond restoration project involves removal of vegetation to allow flood waters and precipitation to fill the ponds once again and restore open water habitat. The main vegetation removed was White and Purple willow (*Salix alba* and *S. purpurea*) stands that developed in the pond areas in island-like formations.

A plan is in place to use the ponds in the future for commercial fish production, a use that has been demonstrated to be compatible with other ecosystem uses. The project brings economic benefits to the region through jobs (e.g., tree removal, fish production) and ecotourism.

Figure 1 shows an educational sign that was recently installed along new trails built in the project area.

Figure 1. Trails and observation towers provide access for visitors and signs demonstrate the benefits of wetland habitat and restoration

Figure 2 depicts an aerial photo of the ponds showing key features.

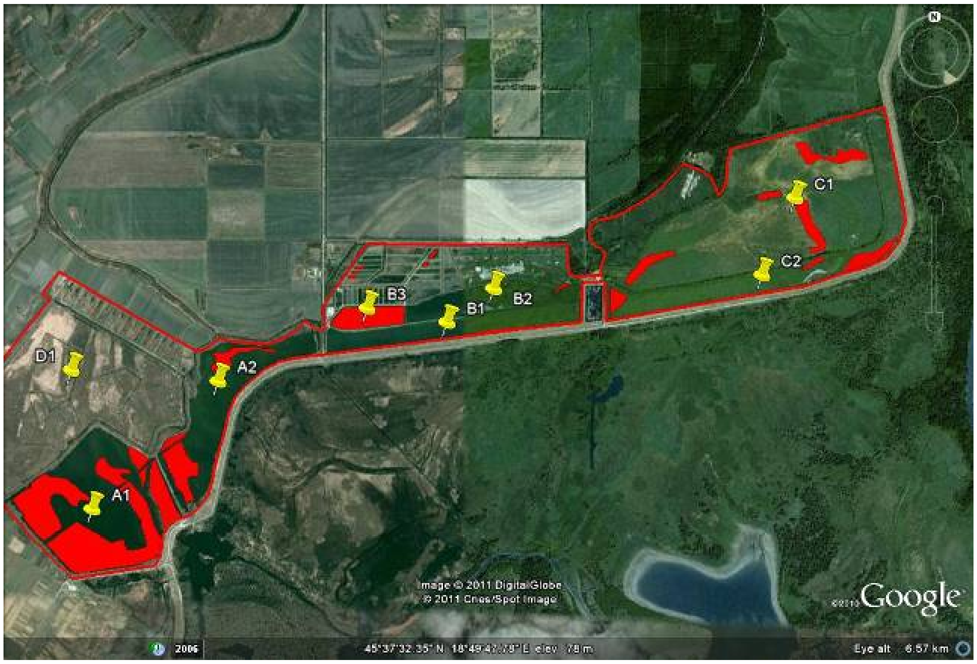

Figure 2. The three fishponds (A, B and C) are partly divided by small dykes, so the subdivisions are named A1, A2, etc. Highlighted in red are the areas where woody vegetation has been removed through the project.

Removal of vegetation allows water from flood waters and precipitation to fill the ponds (Figure 3). When the ponds are used for a commercial fishery again, pumps will be installed that can be used to pump water out during fish harvest and provide supplemental water when needed. The pumps have not yet been purchased so the replenish benefits calculated below account only for the water that fills the ponds naturally from flood water and precipitation.

Biological monitoring has indicated that the project is already demonstrating success. Numerous water birds including breeding pairs of Greylag Geese, ducks, eagles, cormorants and wading birds such as black-winged stilts have been observed using the ponds (WWF, 2012b).

Figure 3. Open water in ponds after restoration

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 4,800 ML/YR

ACTIVITY TIMELINE:

- 2010: Stakeholder alignment and analyses conducted
- Early 2011: Documents signed, restoration initiated
- October and November 2011: 105.589 m^2 (10.55 ha) of shrubby and wooded vegetation were removed in ponds A2, Bl, Cl and C2.
- January through June 2012: 424,431 m^2 (42.44 ha) of vegetation was removed and by June 2012, vegetation was removed from all ponds except pond A1.
- June 2012: Filling of ponds in B area began and about 897,000 m^3 water filled the ponds
- By November 2012: 2 ha of vegetation removed and 320 hectares of pond area have been fully restored.
- December 2012: All vegetation removal in pond A1 will be completed
- 2013 and beyond: Commercial fish production will be initiated

COCA-COLA CONTRIBUTION: 100%

- $137,000 USD provided by Coca-Cola Foundation

WATERSHED BENEFITS CALCULATED:

1. Increase in storage volume

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1. INCREASE IN STORAGE VOLUME

Approach and Results

The replenish benefit was calculated as the average annual storage volume restored in the fish ponds due to restoration measures. Water storage is a function of the volume of water from precipitation and flood water that can be stored in the ponds after vegetation has been removed. The ponds were dry prior to restoration.

The depth of the ponds is variable across the surface and throughout the year and they periodically dry out. An average and conservative depth of 1.5 meter was used to represent the average annual depth across all the ponds and across all seasons. Using this depth, the volume of water storage over 570 ha of the fishpond's surface area translates to a total water quantity benefit of 8,550 ML/yr.

The total (ultimate) benefit: 8,550 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 8,550 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is based on 320 ha of pond area restored by November 2012 and is estimated to be 4,800 ML/yr and TCCC's benefit (adjusted for cost share) is 4,800 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	8,550	8,550
2014	8,550	8,550
2015	8,550	8,550
2016	8,550	8,550
2017	8,550	8,550
Ultimate Benefit:	8,550	8,550

Data Sources

- Area flooded by November 2012: 320 ha (WWF, 2012b)
- Ultimate area flooded: 570 ha (WWF, 2012b)

Assumptions

- An average pond depth of 1.5 meter in the floodplain was conservatively assumed based on observations provided by the project contact. The ponds are deeper around the edges (up to 2.5 m) in the areas that serve as fish harvest ditches, and 1.0 to 1.5 m deep in the center.
- It was assumed that all restoration will be completed in December 2012. This will be verified in 2013.

OTHER BENEFITS NOT QUANTIFIED

- Habitat for migrating birds, spawning fish and other high-value flora and fauna
- Benefits to local economy when ponds are used as commercial fish ponds
- Recreational benefits (e.g., bird watching) and ecotourism
- Increased incomes due to jobs (e.g., tree removal) and ecotourism
- Flood protection benefits

NOTES

- An additional 250 hectares of ponds will be restored by the end of December 2012. This work will be accounted for in 2013.

REFERENCES

WWF, 2012a. Fact Sheet: Kopacki Rit Nature Park.
WWF, 2012b. WWF-TCCC Intermediate Report Wetland Restoration June 2012.

PROJECT NAME: Reconnecting the Lifeline
PROJECT ID #: 31

DESCRIPTION OF ACTIVITY: Wetland restoration (11 ha)

LOCATION: Strbac Area of the Special Nature Reserve (SNR) Gornje Podunavlje Mura-Drava Danube Area, near the village of Backi Monostor in Serbia

PRIMARY CONTACTS:

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OBJECTIVES

- Restore open water ponds to increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: Gornje Podunavlje is 200 km^2 in size and part of an extensive floodplain area located in the Mura-Drava-Danube Vojvodina Province of Serbia. The reserve contains high valuable habitats including natural willow, poplar and oak forests, wet meadows and oxbows and swamps (WWF, undated). Gornje Podunavlje is designated as a Special Nature Reserve, Ramsar Site, Important Plant Area, Prime Butterfly Area, Emerald site and Important Bird Area.

Despite its protected status, numerous factors including drainage, irrigation and forestry have adversely impacted ecosystems in the reserve. The Strbac restoration project is part of a larger initiative focused on reestablishment of a mosaic of wet meadows and shallow ponds throughout the landscape. The ponds have dried out and filled in with woody vegetation, leading to loss of ecological functions and values.

The project area is shown in Figure 1. To date, shrubby and woody vegetation has been removed from 5 hectares of wet meadow and shallow pond. The main vegetation removed was Purple willow (*Salix purpurea*) and Goat willow (*Salix caprea*). Restoration was implemented by the Public Enterprise Vojvodinašume, the managing authority of Gornje Podunavlje SNR.

Figure 1. Three wet meadows/ponds of project area

This project has piloted a new technology in removing shrubby and woody vegetation. Tested in other wetlands in Europe, this methodology has been applied for the first time in Serbia. The project team has undertaken comprehensive consultations with the project partners in finding the most effective way to remove vegetation. This has taken some time but the result is that the new technology has proven effective with a number of trained experts capable of applying it in the future.

Since the restoration of open water habitat (Figure 2), the number of migrating waterbirds has increased from a maximum of 100 (before restoration) to 890 (recorded in April 2012). Among these, Wigeon, Shoveler, Ferruginous Duck, Pochard were dominantly represented. Starting in April 2012, the pond has been frequently visited by breeding herons and it was most likely one of few key feeding sites for herons from a nearby colony including Night Herons, Little Egret, Squaco Heron and Grey Heron. The newly open water has remained free of the vegetation in 2012 and the pond is expected to attract more key indicator species in Autumn/Winter 2012.

Figure 2. Aerial photo showing partially restored area in summer 2011

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 104.5 ML/YR

ACTIVITY TIMELINE:

- Spring 2011: Project initiation
- Spring 2012: Project completion (11 ha restored)

COCA-COLA CONTRIBUTION: 95%

- $ 153,000 USD provided by Coca-Cola Foundation
- $ 8,000 USD provided by Provincial Secretariat of Urbanisam, Construction and Environmental Protection

WATERSHED BENEFITS CALCULATED:

1. Increase in storage volume

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1. INCREASE IN STORAGE VOLUME

Approach and Results

The replenish benefit was calculated as the average annual storage volume restored in the pond due to restoration measures. Water storage is a function of the volume of water from precipitation and groundwater that can be stored in the pond after vegetation has been removed. The area was dry prior to restoration.

The depth of the ponds is variable across the surface and throughout the year, and an average and conservative depth of 1 meter was used to calculate storage volume. The volume of water storage over 11 ha of the ponds' surface area translates to a total water quantity benefit of 110 ML/yr.

The total (ultimate) benefit: 110 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 104.5 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is based on 11 ha of pond area restored by October 2012 and is estimated to be 110 ML/yr and TCCC's benefit (adjusted for cost share) is 104.5 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	110	104.5
2014	110	104.5
2015	110	104.5
2016	110	104.5
2017	110	104.5
Ultimate Benefit:	110	104.5

Data Sources

- Size of restored area: 11 ha (WWF, 2012)

Assumptions

- An average pond depth of 1 meter in the floodplain was conservatively assumed based on WWF's observations (WWF, 2012)

OTHER BENEFITS NOT QUANTIFIED

- Habitat for migrating birds, spawning fish and other high-value flora and fauna
- Recreational benefits (e.g., bird watching)
- Increased incomes due to jobs (e.g., tree removal) and ecotourism
- Flood protection benefits

NOTES

- None

REFERENCES

WWF, Undated. WWF Fact Sheet: Gornje Podunavlje Special Nature Reserve.

WWF, 2012. Intermediate WWF-TCCC Report Wetland Restoration June 2012. Wetland restoration in the Mura-Drava-Danube area.

PROJECT NAME: Mexico Restoration and Reforestation Program
PROJECT ID #: 38

DESCRIPTION OF ACTIVITY: Reforestation of 47,969 hectares of deforested land in Mexico

LOCATION: 29 States in Mexico (various locations, including Coahuila, Durango, Hidalgo, Tlaxcala, and Veracruz, etc.)

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OBJECTIVES:
- Reduce runoff / increase infiltration
- Reduce sediment erosion/runoff
- Restore forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola, the Comision Nacional Forestal (CONAFOR), Pronatura Mexico, A.C., and Natural Protected Areas National Commission (CONANP) have reforested approximately 48,000 hectares of lands across Mexico to sustain water supplies and priority ecosystems. More than 40 million trees have been planted in deforested lands to mitigate climate effects, restore habitat and biodiversity, rehabilitate aquifers and watersheds, and promote economic and community growth.

Before (left) and after (right) photos showing reforestation in Veracruz

 

Before (left) and after (right) photos showing reforestation in Veracruz

SUMMARY OF REPLENISH ACTIVITY

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 7,857 ML/YR

ACTIVITY TIMELINE:

A total of 47,969 hectares have been reforested between 2008 and 2012, representing 92% more than the original planned reforestation area of 25,000 hectares. Table 1 below summarizes the reforestation areas by year for the project.

Table 1. Reforestation Schedule

Year	Area Reforested (ha)	% of Total Reforestation Area (47,969 ha)
2008	1,688[1]	3.5%
2009	7,697	16.0%
2010	10,890	22.7%
2011	12,408	25.9%
2012	15,287	31.9%
Total:	47,969	100%

[1] Includes 250 ha of area where "infiltration ditches" were constructed. This 250-ha area is treated as a separate activity and was not included in the water quantity reforestation calculations here to avoid double-counting of quantity benefits.

COCA-COLA CONTRIBUTION (2008-2012)**:** 40.74%

- Total cost: $19,392,180 USD
- TCCC cost contribution: $7,900,000 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment erosion/runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- Pre-project:
  - Hydrologic soil group (HSG) "B"
  - Herbaceous – grass/weeds/brush mixture in "fair" to "good" condition (CN = 67)
- Post-project:
  - Hydrologic soil group (HSG) "B"
  - Woodland in "good" condition (CN = 55)

Daily precipitation and air temperature data were obtained from the TuTiempo.net online meteorological database for various locations during the 2000-2008 time period. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963). A concerted effort was made to ensure that the precipitation data used for each reforestation location were representative of long-term annual average climate patterns for the region.

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases based on the areas reforested during 2008-2012. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows for work completed to date:

- Pre-project (open space): 87,976 ML/yr
- Post-project (reforested land): 68,691 ML/yr
- **Benefit (runoff reduction): 19,285 ML/yr**

The total (ultimate) benefit is calculated as the sum of benefits for all areas reforested to date.

The total (ultimate) benefit is: 19,285 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 7,857 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 19,285 ML/yr, and TCCC's benefit (adjusted for cost share) is 7,857 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	19,285	7,857
2014	19,285	7,857
2015	19,285	7,857
2016	19,285	7,857
2017	19,285	7,857
Ultimate Benefit:	19,285	7,857

Data Sources:

- Size of reforested land area: 47,969 ha (provided by contact)
- Slope: highly variable and site-dependent (0-40%) (provided by contact)
- Soil type: highly variable, but generally characterized by "available water content" (AWC) of 7 to 8 mm per meter of soil depth (Batjes, 1996).
- Daily precipitation and air temperature data were obtained from the online "TuTiempo.net" meteorological database (http://www.tutiempo.net/en/) for representative locations throughout Mexico, including Jalapa, Cuernavaca, Chihuahua, Queretaro, Puebla, and Saltillo (Table 4).
- A table summarizing the reforestation surface area by Mexico State for 2008-2012 is provided below (Table 5).

Table 4. Meteorological Stations for Water Runoff Analysis

Station Location	Station ID	Selected Years[1]	Average Rainfall for Selected Years (mm)
Jalapa	766870	2000-02	1,402
Cuernavaca	767260	2003-08	1,018
Chihuahua	762250	2000, 2006-08	335
Queretaro	766250	2003-04, 2007	601
Puebla	766850	2000-01, 2004-05	718
Saltillo	763900	2007-10	437
Sonora[2]	762250	2000, 2006-08	180

[1] Years selected based on recent data availability, completeness, and representativeness.

[2] The long-term annual precipitation at Sonora reforestation locations is 180 mm. The meteorological station with the next lowest rainfall, Chihuahua, was selected as representative of Sonora. The daily precipitation values for Chihuahua were proportionally scaled by a factor of 0.537 (180/335) to obtain daily values for Sonora.

Table 5. Summary of Reforestation Locations for 2008-2012

Location	Area Fraction[1]	Assigned Met. Station	Assumed Slope
Aguascalientes	0.4%	Saltillo	10%
Baja California Sur	1.8%	Chihuahua	8%
Campeche	0.1%	Jalapa	20%
Chihuahua	3.5%	Chihuahua	8%
Coahuila	3.3%	Saltillo	10%
Colima	1.1%	Puebla (high)	10%
Distrito Federal	0.2%	Puebla	10%
Durango	7.6%	Saltillo	10%
Estado de México	7.4%	Puebla	10%
Guanajuato	9.6%	Queretaro	10%
Guerrero	2.4%	Puebla (high)	10%
Hidalgo	3.2%	Puebla	10%
Jalisco	3.5%	Cuernavaca	15%
Michoacán	14.9%	Puebla (high)	10%
Morelos	0.8%	Puebla	15%
Nayarit	0.6%	Puebla (high)	10%
Nuevo Leon	3.9%	Saltillo	10%
Oaxaca	0.1%	Cuernavaca	15%
Puebla	9.0%	Puebla	15%
Queretaro	2.0%	Queretaro	10%
Quitana Roo	0.5%	Cuernavaca	15%
San Luis Potosí	6.3%	Saltillo	10%
Sinaloa	0.2%	Saltillo	10%

Location	Area Fraction[1]	Assigned Met. Station	Assumed Slope
Sonora	0.1%	Sonora	8%
Tamaulipas	1.3%	Queretaro	10%
Tlaxcala	3.8%	Puebla	15%
Veracruz	9.6%	Jalapa	20%
Yucatán	2.4%	Jalapa	20%
Zacatecas	0.3%	Chihuahua	8%

[1]Based on "LAND AREAS and TREES REFORESTED FROM 2008 TO 2012.docx" document and "Poligonos Nacional 2012.shp" shapefile provided by Pronatura.

Assumptions:

- The distribution of reforested land among the various states in Mexico (shown in Table 5) was based on the "LAND AREAS and TREES REFORESTED FROM 2008 TO 2012.docx" document (provided by Pronatura in early December 2012) and the "Poligonos Nacional 2012.shp" shapefile (provided by Pronatura in early December 2012).
- Precipitation patterns for meteorological stations are representative of conditions for reforested areas. In reality, we expect that the precipitation data are biased low and the air temperature data biased high relative to actual conditions at reforestation sites occurring on mountain slopes at higher elevations. Therefore, it is reasonable to expect that the current estimates are somewhat conservative relative to actual runoff reduction benefits for the reforested areas. Collection of daily precipitation data for specific reforestation locations would allow for a refined estimate of runoff reduction.
- The pre-project land cover can be appropriately characterized by herbaceous (grass/weeds/brush) with approximately 30-80% vegetative cover. (Note that this provides a conservative estimate of Curve Number for areas that have been utilized as crop land.)
- Land slopes were conservatively assumed to be ~10% unless otherwise determined based on available latitude/longitude locations and global slope datasets. Slope estimates (e.g., 10%) are likely conservative relative to actual slope conditions for some sites; specific latitude/longitude coordinates for all reforestation locations would be required to refine slope estimates.
- The SWAT model parameter "CNCOEF" is used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates. This parameter was set to 0.5 for all sites with the exception of those based on the Chihuahua or Saltillo meteorological stations (CNCOEF was to 2.0 for these locations).
- According to the contact, the survival rate for trees planted through 2011 was 61%. Approximately 1200 trees per hectare are planted, and about 400 to 500 trees are expected to grow to maturity and the intended tree cover at each site will still be reached.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 2000.

The Cover/Management Factors (C_{usle}) used in the MUSLE were estimated as follows based on Haith (1992):

- Pre-project: grass/weeds, 60-80% cover (C_{usle} = 0.02)
- Post-project: woodland with 75-100% tree canopy (C_{usle} = 0.001)

Annual sediment yields for the unforested and forested land areas were estimated as follows for work completed to date:

- Pre-project (pasture/rangeland): 1,173,288 MT/yr
- Post-project (forested): 49,613 MT/yr
- **Benefit (reduced sediment yield): 1,123,675 MT/yr**

Therefore, the total water quality benefit associated with reforestation of 47,969 hectares is estimated as:

The total benefit (reduced sediment yield) for 2008-2012 is: 1,123,675 MT/yr and TCCC's benefit (adjusted for cost share) is 457,785 MT/yr.

The 2012 benefit is: 1,123,675 MT/yr and TCCC's benefit (adjusted for cost share) is 457,785 MT/yr.

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER BENEFITS NOT QUANTIFIED

- Corresponding increases in infiltration and groundwater baseflow to local stream networks
- Habitat improvements benefiting terrestrial wildlife

NOTES

- Collection of daily precipitation data for specific reforestation locations would allow for a more accurate estimate of runoff reductions and sediment erosion/yield.
- Specific latitude/longitude coordinates could be used to better estimate local slope conditions.
- Model calculations resulted in zero runoff and sediment benefits for reforestation locations at Sonora. The extreme arid conditions reflected by low annual rainfall (180 mm), did not result in any runoff being generated in the model for either pre-project or post-project conditions. Reforestation locations at Sonora accounted for only 0.4% of the total areas reforested during 2012.
- This fact sheet updates a 2011 fact sheet to include new information related to expanded reforestation work and updated cost share information.
- The contact indicated the trees planted prior to 2011 have a 61% survival rate; however they noted that a sufficient number of trees are planted to offset the loss.

REFERENCES

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USDA-NRCS. 1986. “Urban Hydrology for Small Watersheds – Technical Release 55 (TR-55).” 2nd Edition.

Williams J.R. 1975. “Sediment yield prediction with USLE using runoff energy factor.” In: *ARS-S-40.* Agr. Res. Serv., USDA. Washington DC. pp. 244-252.

PROJECT NAME: Restoration Project Guadiana River Basin
PROJECT ID #: 70

DESCRIPTION OF ACTIVITY: Reforestation of forest areas impacted by fire (Phase 1); Reforestation of agricultural crop fields (Phase 2)

LOCATION: The Guadiana River Basin located in Spain and Portugal

PRIMARY CONTACT:

Diana Colomina Pérez	Clorinda Maldonado	Susana Pliago
World Wildlife Fund, Spain	World Wildlife Fund, Spain	Environment and Safety Manager, Coca-Cola Iberia
Gran Vía de San Francisco, 8-D. 28005 Madrid, Spain	Gran Vía de San Francisco 8-D; 28005 Madrid, Spain	Ribera de Loria 20-22 28042 Madrid, Spain
Tel. +34 91 354 0578	Tel. +34 91 354 0578	Tel. +34 91 396 9334
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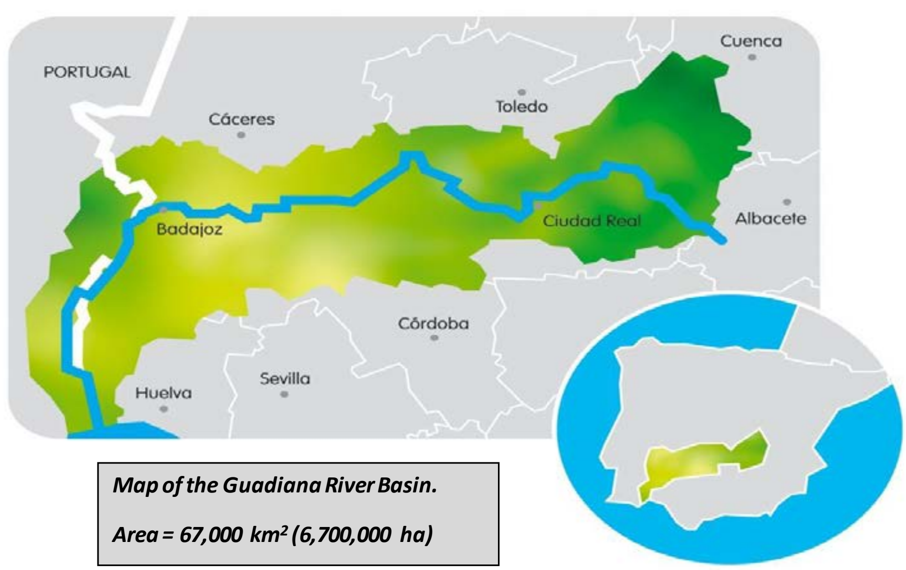
OBJECTIVES:

- Reduce runoff and associated sedimentation
- Improve habitat and increase biodiversity
- Recover native vegetation
- Improve the scientific and technical knowledge regarding ecosystems restoration within the Guadiana River Basin
- Involve the local population and key stakeholders in the project, while also improving the knowledge of the importance of rivers

BACKGROUND & ACTIVITY DESCRIPTION: The Guadiana River Basin is located in Spain and Portugal. The basin covers an area of 67,000 km^2, which is approximately 12% of the Iberian Peninsula (Hernandez, 2012). The Guadiana River Basin serves as a source of water supply to some of the most biodiverse regions of Spain and provides habitat for numerous species of fauna and flora. Portions of the basin are highly impacted by intensive flow regulation, groundwater extraction, water contamination, loss of biodiversity and territory fragmentation (Coca Cola España, 2009).



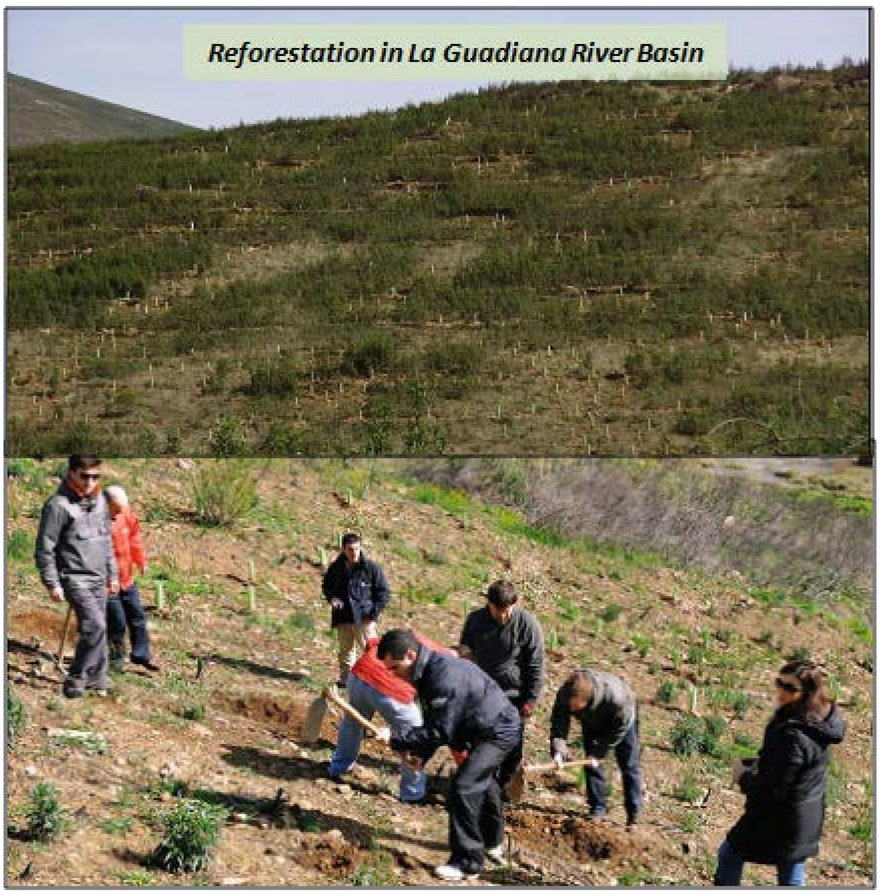
Map of the Guadiana River Basin.

Area = 67,000 km^2 (6,700,000 ha)

Coca-Cola Spain and WWF Spain have been working together to restore areas in the Guadiana River Basin. During the first phase of the project, Coca-Cola Spain and WWF Spain worked together for three years (2008-2010) in the "Bajo


Area of the Guadiana with a high biodiversity index

Guadina” and ”Medio Guadiana” to restore four different areas impacted by fire (Table 1). For the second phase of the project, Coca-Cola Spain and WWF Spain are working for another three years (2011-2013) in the Alto Guadiana to restore areas impacted by agriculture. The second phase of the project is focused on restoring Mediterranean forests around the protected "Las Tablas de Daimiel" wetland and reducing water demand from surrounding irrigated lands. The restoration activities have and will continue to improve water infiltration and runoff processes, improve soil conditions, restore native vegetation, and promote creation of ecological corridors in the basin.


Reforestation in La Guadiana River Basin

Reforestation activities were conducted at five locations in the Guadiana River Basin as shown in Table 1 below.

Table 1. Reforestation Activities at Five Locations in the Guadiana Basin

Location	Phase	Pre-Project Impact	Area Reforested (hectares)	# Plants/ha
Cerro Belén (Cáñamero, Cáceres, Spain)	1	Fire	8	800
Higueruelas y valles (Cañamero, Cáceres, Spain)	1	Fire	5	650
Ruecas river (Cañamero, Cáceres, Spain)	1	Fire	2.63	400
Ribera do Vascao, Vale do Guadiana National Park (Moinho de Alferes, Portugal)	1	Fire	12	
Tablas de Daimiel National Park (Ciudad Real, Castilla la Mancha, Spain)	2	Agriculture	167	400
Total area reforested (Phase 1 + Phase 2) >>			**194.63**	

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 35.42 ML/YR

ACTIVITY TIMELINE:

Phase 1 (2008-2011)

- Cerro Belén (reforestation of 8 ha): 2008-2010
- Higueruelas y valles (reforestation of 5 ha): 2008-2010
- Ruecas river (reforestation of 2.63 ha): 2008-2010
- Ribera do Vascao, Vale do Guadiana National Park (reforestation of 12 ha): 2008-2010

Phase 2 (2011-2013)

- Tablas de Daimiel National Park
  - 2011: 15 ha reforested
  - 2012: 142 ha reforested
  - 2013: 10 ha reforested

COCA-COLA CONTRIBUTION: 100%

- Overall Project Funding: 742,751.85 USD
- Coca-Cola Cost Contribution: 742,751.85 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)]

"Pre-project" is defined as the deforested condition of the land that existed prior to reforestation, while "post-project" is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for ΔK.

Calculated water quantity benefits are provided in Table 2 below.

The total ultimate benefit (runoff reduction) for the five projects is: 37.25 million liters per year (ML/yr).

Table 2. Summary of Water Quantity Benefits

Location	Description of Activity	Time Period	Annual Precipitation (m/yr)	Surface Area (m^2)	Ultimate Water Quantity Benefit (ML/yr)
Cerro Belén	Reforestation	2008-2010	0.689	80,000	2.20
Higueruelas y valles	Reforestation	2008-2010	0.723	50,000	1.45
Ruecas river	Reforestation	2008-2010	0.648	26,300	0.68
Ribera do Vascao, Vale do Guadiana National Park	Reforestation	2008-2010	0.500	120,000	2.40
Tablas de Daimiel National Park[1]	Reforestation	2011-2012	0.457	1,570,000	28.69
		2013	0.457	100,000	1.83
			Totals >>	**1,946,300**	**37.25**

The total (ultimate) benefit is: 37.25 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 37.25 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 35.42 ML/yr and TCCC's benefit (adjusted for cost share) is 35.42 ML/yr.

Projected Replenish Benefits

Table 3 that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share and percent complete in the second column.

Table 3. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	37.25	37.25
2014	37.25	37.25
2015	37.25	37.25
2016	37.25	37.25
2017	37.25	37.25
Ultimate Benefit:	37.25	37.25

Data Sources:

- Size of reforested land areas provided by contact
- Schedule for reforestation provided by contact
- Average annual precipitation provided by contact

Assumptions:

- A conservative value of 0.04 was selected for ΔK, consistent with the recommendations made in the "Alternative Annual Method" memorandum (Redder and Larson 2012)."

OTHER BENEFITS NOT QUANTIFIED

- Improved water quality, including sedimentation
- Improve habitat and increase biodiversity
- Recuperation of native vegetation
- Education of local stakeholders on conservation of the Guadiana River Basin

NOTES

- This fact sheet updates the 2010 fact sheet to revise the Phase 1 reforestation work to reflect work completed, and to include additional Phase 2 reforestation. Updated information on reforestation areas at the Tablas de Daimiel National Park location are reflected in the calculations.

REFERENCES

Coca Cola España. 2009. Restoration Project Guadiana River Basin. May 13, 2009.

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Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

PROJECT NAME: Rainwater Harvesting and Aquifer Recharge in India
PROJECT ID #: 51

DESCRIPTION OF ACTIVITY: Rainwater harvesting structures and recharge shafts

LOCATION: Locations throughout India

PRIMARY CONTACT:
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Senior Manager, Hydrogeology
Coca-Cola India
Gurgaon, India
dmurthy@coca-cola.com

OBJECTIVE:

- Improve groundwater supply reliability for community use

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola India and its partners are installing and maintaining rainwater harvesting and aquifer recharge structures to improve groundwater supply reliability for local communities. Currently rainwater harvesting structures have been constructed and are fully operational at hundreds of locations in communities throughout India. Rooftop structures, check dams and farm ponds collect water for infiltration to recharge aquifers and/or for storage and distribution. Some structures are located inside bottling plants and others are located at schools and other external locations in the local communities. Maintenance activities are conducted by TCCC, communities and NGOs to promote efficient operation and prolonged lifespan.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 5,060.2 ML/YR

ACTIVITY TIMELINE:

- Construction, restoration and maintenance activities were initiated in 2002
- All projects were completed and were fully operational in 2012

COCA-COLA CONTRIBUTION:

- RWH projects inside the plant premises are fully funded by Coca-Cola
- Most of the projects in the community are fully funded by Coca-Cola. For a small number of outside projects, the community/NGO contribution cost share ranges from 23% to 49%.

WATERSHED BENEFITS CALCULATED:

1. Increase in recharge

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1. INCREASE IN RECHARGE

Approach & Results:

The Coca-Cola India Division has estimated the rainwater harvesting potential and estimated recharge of RWH and AAR projects using the following equation and coefficients:

Supply (m3) = Catchment Surface Area (m2) X Annual Precipitation (m) X Catchment Coefficient

These are defined as follows:

Catchment Area – The area of the catchment(s) used to harvest precipitation for a given project, measured in square meters. The Division uses three categories of catchments within calculations: Roof; Paved; and Open.

Annual Precipitation – The best available annual average rainfall data for a given location, measured in meters (m).

Catchment Coefficient – A coefficient representing the estimated efficiency for each catchment type. The Division utilizes the following coefficients for projects involving rooftop structures:

- Roof: 0.80
- Paved*: 0.60*
- Open: 0.30

For projects involving check dams and farm ponds, the supply from the catchment is compared to the storage potential of the storage structures. Storage potential is estimated by calculating the number of times the storage structures will fill to maximum volume. The available "supply" from the catchment is then compared to the storage potential of the structures. The volume of water available for recharge is estimated as the minimum of supply and storage potential. India Division suggested that for catchments in their natural states, a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations to account for any evaporation or usage loss during storage of water in the structures. Therefore, when the supply is less than the available storage potential, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of "supply" is in excess of the available storage potential, evaporation and usage losses are accounted explicitly by assuming a fraction of stored water is lost. The remaining volume is considered to be the benefit.

Replenishment benefits for 2012 were calculated for RWH projects that have been fully implemented on the plant premises and in the local community. The 2012 benefit is also the total (ultimate) benefit, because until data become available for future years, it is assumed that the projected benefits will remain the same as 2012 in each future year. For projects in the local community, the estimates are adjusted for any cost share by the community.

Of the 2012 total TCCC benefits, 15% (768.1 ML/yr) account for RWH projects within the plant premises and the remaining 85% (4,433.5 ML/yr) account for projects in the local community. The water collected on plant premises is for aquifer recharge only and it is not used inside the plant. A breakdown of the benefit from different categories is provided below.

- Rooftop (within plant premises): 768.1 ML/yr
- Rooftop (in the community): 2,871.2 ML/yr
- Check dam (in the community): 900.7 ML/yr
- Farm ponds (in the community): 661.6 ML/yr

Total (ultimate) benefit: 5,201.6 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 5,060.2 ML/yr.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 5,201.6 ML/yr and TCCC's benefit (adjusted for cost share) is 5,060.2 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	5,201.6	5,060.2
2014	5,201.6	5,060.2
2015	5,201.6	5,060.2
2016	5,201.6	5,060.2
2017	5,201.6	5,060.2
Ultimate Benefit:	5,201.6	5,060.2

Data Sources:

All calculations were performed by Coca-Cola India Division. For projects inside the bottling plants, Coca-Cola India provided data on catchment areas and rainfall. For projects outside the bottling plants, input data were not available and Coca-Cola provided the estimated benefits to LimnoTech.

The following information on validation was provided by Coca-Cola India:
"Coca-Cola India has developed comprehensive requirements and guidelines for approaching the abovementioned water replenishment (WR) initiatives, technically pre-validating the proposed intervention, maintaining the developed structures/projects and establishing efficiency of the developed WR initiatives. These guidelines are applicable to all operations present in India South West Asia Business Unit (INSWA BU) including manufacturing/bottling entities. A brief summary of guidelines and requirements setup by Coca-Cola, India to approach water replenishment initiatives is provided in Water Replenish Requirements (WRR) document (2011). The document contains appendices that provide sample template of data needed to develop various WR initiatives. The existing WR initiatives are required to undergo field validation. The elements of field validation include documentation status review; design record sufficiency review; ownership record status review; maintenance record status review; and field level physical verification. The field validation involves a score based Data Quality Assessment (DQA) process. If the overall DQA score resulted in less than 60% for any particular project

location, then the replenish benefits are not accounted. An example DQA calculation is provided by Coca-Cola, India as an appendix to WRR (2011)."

Assumptions:

- It is assumed that projects have been field validated in India as described above.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in stormwater runoff and associated pollutant load

NOTES

- All calculations were performed by Coca-Cola India according to the methodology described above, and Coca-Cola India reports that they were independently validated by a third party in India. LimnoTech has verified the calculations for rooftop collection systems inside the bottling plants. Detailed inputs for outside projects are not available to LimnoTech at this time.
- None of the projects would have been implemented without TCCC funding. TCCC has also provided appropriate technology, community mobilization, communication and (for most projects) post-project maintenance.
- This fact sheet updates a 2011 fact sheet to include new projects and cost information and new information on data validation. Previously, check dams and farm ponds were included with RWH/AAR projects in one fact sheet. A subset of these projects is now described in separate fact sheets where detailed information about the projects was provided.

REFERENCES

Water Replenish Requirements (2011). Document provided by Dr. Murthy on November 02, 2011, describing the requirements of approaching developing, maintaining and understanding efficiency of the WR interventions initiated by INSWA BU. This includes a DQA example in the following appendix *annexure_7_DQA_worked_out_example.xlsx.*

Excel file named: *final_list_of_projects_types_classification_revised_PS-v2.xlsx* was provided by Dr. Murthy on November 22, 2012. The file India Division's estimates of rainwater harvesting potential and estimated recharge for all RWH and AAR projects.

PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Irrigation system and habitat improvements

LOCATION: Anlong Village, Pi County, Sichuan Province, China

PRIMARY CONTACT:

Lindsay Bass
WWF – US
(202) 495-4334
Lindsay.Bass@wwfus.org

OBJECTIVES:

- River and wetland restoration and enhancement
- Improve availability of irrigation water
- Improve habitat/increase biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: This project area is part of the vast Dujiangyan Irrigation System of the Chengdu Plain, which has operated for more 2200 years. The irrigation system is made up of thousands of small interconnected rivers. These "fan-shaped river nets" irrigate the entire Chengdu Plain, and sustain a rich agricultural landscape and provide habitat for numerous plant and animal species. Rapid development in the Chengdu Plain has contributed to physical alterations, agricultural and domestic pollution, degradation of the waterways and riparian areas and loss of wetland function.

In Anlong Village, sluice gates control water that flows via gravity from the Zouma River into the Power Station Canal (Figure 1). Water flows through the canal and some water is used to irrigate local fields. The canal flows through the Unnamed Lake and back into the Zouma River.

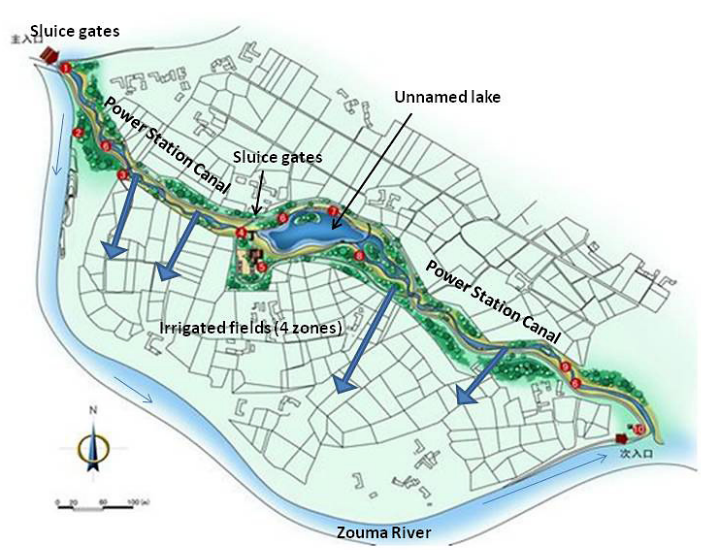

Figure 1. Anlong Village Project Area

The canal was originally wide and deep but it has silted up as agricultural activities have increased in the region over the past half-century. Sluice gates were also not functioning properly and farmers were not getting enough water during the dry season and fields were flooded during the wet season. The lake was silted up and degraded. The local government had planned to address these issues by dredging and solidifying the canals with cement.

This WWF project was designed to demonstrate an alternate approach to irrigation improvements that also improves ecosystem function. Restoration activities focused on cleaning out the sediment, widening and deepening the riverbed, sluice gate improvements, dredging the lake, along with other restoration activities such as riparian plantings (Figure 2). As a result, there have been significant improvements to the ecosystem, less water wasted, and improved and more reliable water supply for farmers.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 286.16 ML/YR

ACTIVITY TIMELINE:

- June 2010: Project initiation
- 2011: Project completion

COCA-COLA CONTRIBUTION: 100%

- Project is fully funded by Coca-Cola ($556,547USD)

WATERSHED BENEFITS CALCULATED

1. Increased flow

Figure 2. Riparian restoration activities

1. INCREASE IN FLOW

Approach & Results:

The increased volume of irrigation water provided to nature and farmers due to sluice gate repair and channel improvements was calculated based on the difference in pre and post-project monitoring data (WWF, 2012).

Pre-project Irrigation water volume:

Zone A1: 132710.4 m3/year= 132.7104 ML/yr

Zone A2: 106168.3m3/year=106.1683 ML/yr

Zone A3: 212336.6m3/year=212.3366 ML/yr

Zone A4: 159252.5 m3/year= 159.2525 ML/yr

Subtotal: 610467.8 m3/year= 610.4678 ML/yr

Post-project irrigation water volume:

Zone A1: 194918.4 m3/year= 194.9184 ML/yr

Zone A2: 155934.7m3/year=155.9347 ML/yr

Zone A3: 311869.4m3/year=311.8694 ML/yr

Zone A4: 233902.1m3/year= 233.9021 ML/yr

Subtotal: 896624.6m3/year=896.6246 ML/yr

Total increased volume: (896.6246 ML/yr - 610.4678 ML/yr) = 286.1568 ML/yr

The total (ultimate) benefit is: 286.16 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 286.16 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 286.16 ML/yr and TCCC's benefit (adjusted for cost share) is 286.16 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	286.16	286.16
2014	286.16	286.16
2015	286.16	286.16
2016	286.16	286.16
2017	286.16	286.16
Ultimate Benefit:	286.16	286.16

Data Sources:

- Pre and post-project volumes: WWF 2012

Assumptions:

- It is assumed that the system continues to be maintained. This will be verified on an annual basis.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat/increase biodiversity
- Education and awareness

NOTES

- Increased flow through the system combined with habitat enhancements provides more water for farmers and ecosystem benefits.

REFERENCES

World Wildlife Fund for Nature (WWF) and Chengdu Urban Rivers Association. 2011. Community Based Integrated Water Resource Conservation Model: Management Plan for Anlong Water Environmental Education Base. October.

WWF. 2012. Calculation report -Natur River Restoration and Wetland restoration in Anlong Village 2012-2-28.doc

PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Wetland restoration in Yunqiao Village

LOCATION: Yunqiao Village in Chengdu City, China (Latitude/Longitude: 30.8751, 103.89)

PRIMARY CONTACTS:

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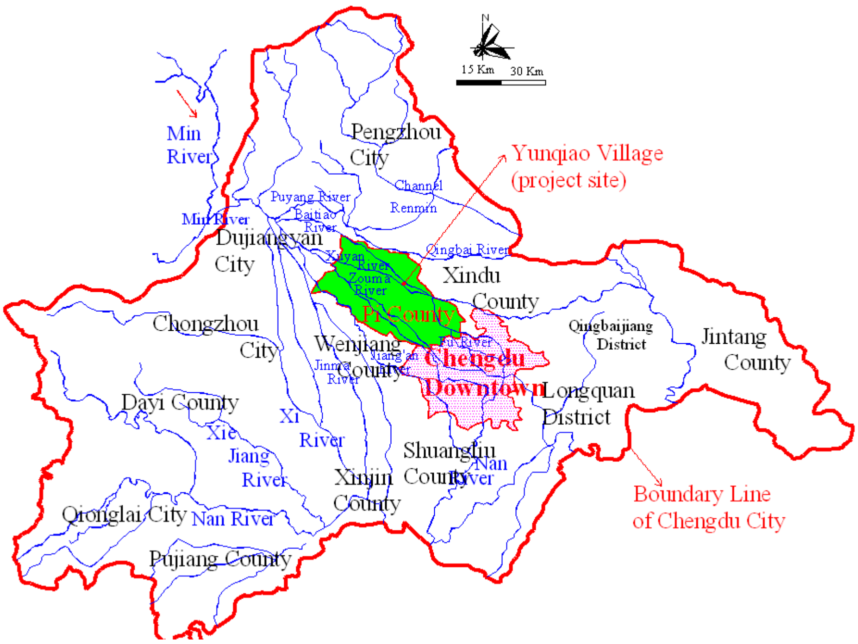
OBJECTIVES

- Protect drinking water source from agricultural non-point source pollution
- Improve wetland habitat/increase biodiversity
- Help recharge a groundwater aquifer for local village use

BACKGROUND & DESCRIPTION OF ACTIVITY: The project site, Yunqiao Village, is shown below and is part of the Dujiangyan Irrigation Systems, an ancient irrigation system that has been in operation for more than 2,200 years. Fed by the Min River in the Upper Yangtze basin, the Dujiangyan System creates a network of small rivers and irrigation channels that irrigate the Chengdu Plain and support abundant agriculture activity. The water that flows through Yunqiao Village provides about 80 percent of the drinking water for Chengdu City, and are a government priority for source water protection.



Project Site

Development activities across the Chengdu Plain have degraded wetland and riparian habitats, increased agricultural and domestic wastewater pollution, and increased sedimentation of rivers and ancient irrigation channels.

Since 2007, WWF has been implementing conservation projects to protect water source areas in Chengdu City. These activities have helped preserve the natural functioning of small rivers and irrigation channels, while also providing examples of rural pollution control through the implementation of biogas digesters, constructed wetlands, environmental-friendly farming and community-based environmental management in Yuantian and Yunqiao villages.

Yunqiao Wetland: View of project site & wetland core area

Starting in 2011, WWF implemented several additional activities in Yunqiao village to address non-point source pollution, create wetland habitat, and recharge the local groundwater aquifer in a sensitive source water area. Project work focused on: 1) the conversion of five hectares from rice paddy farming to natural habitat, 2) the creation of a 1.33 hectare wetland within the project site to restore habitat for local wildlife and remove nutrient pollution from existing soils and overland flow from surrounding farms, 3) removal of invasive plants (such as Alternanthera philoxeroides) and establishment of native wetland species across more than three hectares of the project site, and 4) diversion of irrigation channel water into the wetland area to support healthy functioning of the system.

Yunqiao Wetland: Irrigation channel

Yunqiao Wetland: Diversion into project site

Transitioning the area near the water plant's intake pipe from farming to natural habitat is expected to reduce the amount of non-point source pollution in the immediate vicinity, create a natural wetland landscape, and help recharge the groundwater aquifer used by local villagers. The project team has, in collaboration with the Chinese Academy of Sciences (CAS), established a monitoring plan that will track wetland health through transect assessments of wetland plant distribution and composition changes. The team is also working with CAS to assess water quantity and quality changes over time. With government support, the team has been able to enlist the assistance of local villagers in monitoring the project site through trainings and use of simple, yet effective monitoring techniques.

Yunqiao Wetland: Another view of the broader project site.

The recent launch of the TCCC Volunteer Program brought employees from one of Coca-Cola Greater China's largest bottlers, the Bottlers Investment Group (BIG) and representatives from the company's business unit to Yunqiao to assist with continued restoration of the wetland area.



SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 504.9 ML/YR

ACTIVITY TIMELINE:

- 2011: 100 % complete

COCA-COLA CONTRIBUTION: 100%

- Total Cost of Project: $80,645 USD
    - Coca-Cola: $80,645 USD (500,000 Chinese Yuan)

WATERSHED BENEFITS CALCULATED:

1. Added water quantity

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1. ADDED WATER QUANTITY

Approach & Results:

To supplement the influx of water to the wetland via overland flow from nearby farms in the watershed, the team negotiated the diversion of a small portion of flow from an adjacent irrigation channel to supplement the water levels of the secondary wetland area. The additional water flows into the core wetland area, which is approximately 1.33 hectares in area. To support better wetland health, the team also increased the storage capacity of the core zone by increasing the depth by 1.0 meter. At the inlet of core wetland area, the influent volume is 0.2 meters per second – a volume necessary to maintain healthy water levels in the wetland's core zone.

The establishment of the secondary wetland creates water quantity benefits through the addition of water into the wetland that was absent previously and improving the storage capacity of the core wetland area.

The replenish benefit is estimated as the total volume of water diverted from the irrigation channel annually to the wetland area to promote ecological functioning and groundwater recharge. The water quantity benefit is calculated as follows:

Influent water volume (m3/s) = channel width (m) x channel depth (m) x velocity (m/s)
= 0.4 m x 0.2 m x 0.2 m/s = 0.016 m^3/s

0.016 m^3/s x 3.15569 x 10^7 seconds/year = 504,910,000 L/year = 504.9 ML/yr.

It is expected that the water will flow into the wetland throughout the year. The flow rate of 0.016 m^3/s was measured during the dry season. Therefore, the replenish benefit is a conservative estimate.

Total (ultimate) benefit is: 504.9 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 504.9 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 504.9 ML/yr and TCCC's benefit (adjusted for cost share) is 504.9 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	504.9	504.9
2014	504.9	504.9
2015	504.9	504.9
2016	504.9	504.9
2017	504.9	504.9
Ultimate Benefit:	504.9	504.9

Data sources

- Calculations were provided by WWF.
- The flow rate of 0.016 cubic meters/second was measured during the dry season.

Assumptions

- Wetland water levels will be maintained each year through steady water flows from the adjacent irrigation channel that reflect WWF's calculated average flow cited above (0.016 cubic meters/sec).

OTHER BENEFITS NOT QUANTIFIED

- None

NOTES

- None

REFERENCES

Haith, D.A., R. Mandel, and R.S. Wu. 1992. "Generalized Watershed Loading Functions – Version 2.0 User's Manual." December. Cornell University. Ithaca, NY.

Williams J.R. 1975. "Sediment yield prediction with USLE using runoff energy factor." In: ARS-S-40. Agr. Res. Serv., USDA. Washington DC. pp. 244-252.

PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Reforestation in 150 ha of the Nibashan Panda Corridor

LOCATION: Nibashan Mountain in Siping Town, Yingjing County, Ya'an City, Sichuan Province

PRIMARY CONTACT:
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WWF –US
(202) 495-4334
Lindsay.Bass@wwfus.org

OBJECTIVES:
- Restore important Panda corridor connection
- Reduce runoff / increase infiltration
- Reduce flooding and drought impacts
- Reduce local climate change

BACKGROUND & ACTIVITY DESCRIPTION: Reforestation has been completed on about 150 ha of the Nibashan Panda corridor. The area is a vital landscape for giant Panda migration. The project area is currently affected due to deforestation and the disturbance of No 108 National Highway. Reforestation involved growing Cathay poplar (P. cathayana) trees, which are native to this area.

SUMMARY OF REPLENISH ACTIVITY
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 66 ML/YR

ACTIVITY TIMELINE:
- Project initiation: June 2011
- 2012: 100% complete

COCA-COLA CONTRIBUTION: 100 %
- Project is fully funded by Coca-Cola

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land (unmanaged grassland) to forested land. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for hydrologic improvements (e.g., enhanced baseflow); and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- Pre-project:
    - Hydrologic soil group (HSG) "B"
    - Pasture, grasslands or range in "poor" condition (CN = 79)
- Post-project:
    - Hydrologic soil group (HSG) "B"
    - Woodland in "good" condition (CN = 55)

Daily precipitation and air temperature data for climate station located in the city of Ya'an was obtained from the TuTiempo.net online meteorological database for the 1958-2008 time period. The data for this station were incomplete for many of the available years; however, climate data for 10 years within the 1958 – 2008 period provided a reasonably complete time series of precipitation and air temperature. The long-term annual average precipitation, based on 10 years of data, is 1,723 mm. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. The total water quantity benefit was estimated as the difference between the annual pre-project and post-project runoff volumes.

- Pre-project (unmanaged land): 1,389 ML/yr
- Post-project (reforested land): 1,323 ML/yr
- **Benefit (runoff reduction for 2012): 66 ML/yr**

The total (ultimate) benefit is: 66 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 66 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2011 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 66 ML/yr, and TCCC's benefit (adjusted for cost share) is 66 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	66	66
2014	66	66
2015	66	66
2016	66	66
2017	66	66
Ultimate Benefit:	66	66

Data Sources:

- Size of reforested land area: 150 ha (provided by contact)
- Slope: typically less than 30 degrees or 57.7% (provided by contact)
- Daily precipitation and air temperature data were obtained from the online "TuTiempo.net" meteorological database for climate station located at the City of Ya'an (http://www.tutiempo.net/en/Climate/YAAN/562870.htm).

Assumptions:

- The pre-project land cover can be characterized as open grassland/pasture/rangeland with approximately less than 50% vegetative cover.
- The slope conditions for the reforested area are approximately 30% on average.
- SWAT model parameter "CNCOEF" was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

OTHER BENEFITS NOT QUANTIFIED

- Corresponding increases in infiltration and groundwater baseflow to local stream networks
- Habitat improvements benefiting terrestrial wildlife
- Decrease in sediment erosion

NOTES

- None

REFERENCES

Hamon, W.R., 1963. "Computation of Direct Runoff Amounts From Storm Rainfall." Int. Assoc. Sci, Hydrol. Pub. 63:52-62.

Neitsch, S.L., J.G. Arnold, J.R. Kiniry, and J.R. Williams. 2005. "Soil and Water Assessment Tool Theoretical Documentation: Version 2005." January.

USDA-NRCS. 1986. "Urban Hydrology for Small Watersheds – Technical Release 55 (TR-55)." 2nd Edition.

PROJECT NAME: Sacramento River Riparian Habitat Restoration at La Barranca
PROJECT ID #: 96

DESCRIPTION OF ACTIVITY: Riparian habitat restoration

LOCATION: Red Bluff, California

PRIMARY CONTACT:

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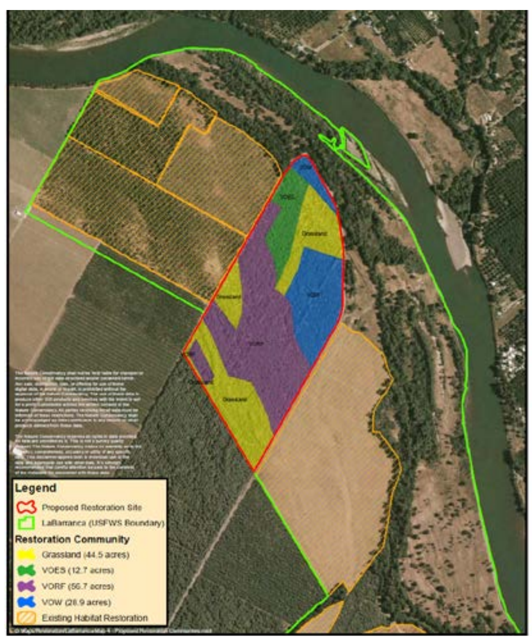
OBJECTIVES:

- Reduce water consumption
- Improve ecological health and long-term viability of at-risk species and riparian communities
- Improve water quality

BACKGROUND & DESCRIPTION OF ACTIVITY: Healthy riparian zones provide both water quality benefits and habitats for riparian communities. Much of the riparian habitat along the Sacramento River has been lost due to selective logging, agriculture, urban development, flood control and power generation projects. Although severely degraded, the Sacramento River is still the most diverse and extensive river ecosystem in California (TNC, 2011), and a number of organizations have begun implementing ecosystem restoration programs along the river.

Large portions of the La Barranca Unit were developed for orchards between 1978 and 1984 and this unit is comprised of a walnut orchard surrounded by existing remnant habitat. In 1991, this unit was purchased for conservation ownership.

This project has restored roughly 143 acres of riparian habitat on the U.S. Fish and Wildlife-owned La Barranca unit of the Sacramento River National Wildlife Refuge in California. In total, the following communities have been established in the project area: 56.7 acres of valley oak riparian forest, 28.9 acres of valley oak woodland, 12.7 acres valley oak elderberry savanna and 44.5 acres of grassland. This project involved removal of the walnut orchard, reforestation/revegetation, maintenance and monitoring. Flood irrigation (volume estimated to equal approximately 429 ac-ft or 529.16 ML annually) was previously used for the walnut orchard.



Proposed restoration communities

La Barranca walnut orchard

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 61.7 ML/YR

ACTIVITY TIMELINE:

- Project start: November 2011 (removed walnut orchard)
- June 2012: Planted native riparian vegetation
- 2012 –2014: Maintain site to ensure survival of planted vegetation

COCA-COLA CONTRIBUTION: 11%

Total Cost of Project: $636,000 USD

- Coca-Cola Foundation: $70,000 USD
- Wildlife Conservation Board of California: $566,000 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in groundwater consumption

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1. DECREASE IN GROUNDWATER CONSUMPTION

Approach & Results

The Water Footprint Network's water footprint method was followed to estimate the decrease in water consumption resulting from the conversion of the walnut orchard to native vegetation (forested land and grassland). Water quantity calculations were based on estimating the change in the blue component of crop water use, which is the consumptive loss of irrigation water through crop evapotranspiration. The volume of water conserved is estimated by calculating the change in the volume of blue component of crop water use (i.e., irrigation water consumed) during the production of the walnuts and after the conversion to native vegetation at this location.

The blue crop water use for walnut cultivation is estimated by considering the local climate including effective rainfall and the reference evapotranspiration, and crop coefficient. The consumptive loss of irrigation water for growing walnuts was calculated based on the crop water use and the size of the orchard. It was assumed that the restoration activity will not require irrigation after the initial establishment of the native vegetation.

- Pre-project:

  Crop water use from flood irrigation: 9,693 m3/ha

  Orchard area: 143 acres (58 ha)

  Crop water consumption from flood Irrigation = 9, 693 m3/ha x 58 ha = 560,905 m3 = 561 ML/yr

- Post-project:

  Crop water requirement from flood irrigation: 0 m3/ha

  Revegetated area: 143 acres (58 ha)

  Crop water consumption from flood Irrigation = 0 ML/yr

The total annual water quantity benefit resulting from the elimination of flood irrigation was calculated as the difference in the pre-project and post-project water consumption.

- Pre-project (walnut orchard): 561 ML/yr
- Post-project (re-vegetated land): 0 ML/yr

Total (ultimate) benefit is: 561 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share: 61.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 561 ML/yr and TCCC's benefit (adjusted for cost share) is 61.7 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	561	61.7
2014	561	61.7
2015	561	61.7
2016	561	61.7
2017	561	61.7
Ultimate Benefit:	561	61.7

Data Sources/Site-specific characteristics:

- Crop coefficient (Kc) and reference crop evapotranspiration (ET_o) values are based on walnut cultivation in the San Joaquin Valley.
- Rainfall is based on the long term monthly precipitation for a climate station in the Sacramento Valley.

Assumptions:

- Kc and ET_o values for walnut cultivation in San Joaquin Valley and Sacramento Valley are similar
- Assumed minimal irrigation (microdrip system) necessary to establish native vegetation

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OTHER BENEFITS NOT QUANTIFIED

- Promote the recovery of neotropical migrant and resident birds and other terrestrial species
- Improve floodplain and in-channel conditions for anadromous fish
- Improve water quality and aesthetics
- Flood damage reduction
- Increased recreational opportunities

NOTES

- This fact sheet updates the November 2011 fact sheet to reflect that this project is now generating benefits.

REFERENCES

The Nature Conservancy, 2011. La Barranca 4.1 Sacramento River National Wildlife Refuge Riparian Habitat Restoration and Management Plan. Prepared for The U.S. Fish and Wildlife Service Sacramento National Wildlife Refuge Complex. April 2011.

PROJECT NAME: North America Rain Barrel Donation Program
PROJECT ID #: 103

DESCRIPTION OF ACTIVITY: Rain barrel distribution for community household and school/business use

LOCATION: Locations throughout North America

PRIMARY CONTACT:

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OBJECTIVE

- Reduction in storm water runoff

BACKGROUND & DESCRIPTION OF ACTIVITY: The Coca-Cola Company is partnering with watershed conservation organizations, municipalities, universities, and community groups throughout North America to distribute 55-gallon syrup drums for reuse as rain barrels. The partner organizations are primarily supporting rain barrel use for residential properties. The use of collected water ranges from use for light gardening work to exterior household cleaning needs (vehicle washing). By collecting rainwater that normally flows off a property, rain barrels save money on water bills, conserve water during dry periods and prevent polluted runoff. The reuse of these 55-gallon barrels will not only help in watershed protection, but also eliminate the energy Coca-Cola would expend recycling the plastic barrels. Since 2008, a total of 36,120 rain barrels were donated from 74 Coca-Cola facilities to local communities throughout North America.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 303.7 ML/YR

ACTIVITY TIMELINE:

- 2008 through 2011: 25,304 rain barrels were donated.
- 2012: an additional 10,816 rain barrels were donated

COCA-COLA CONTRIBUTION: 100%

- Project is fully funded by Coca-Cola

WATERSHED BENEFITS CALCULATED:

1. Decrease in stormwater runoff

1. DECREASE IN STORMWATER RUNOFF

Approach & Results

A Microsoft Excel-based rain barrel calculator developed by Antea Group (formerly Delta Consultants) was used to estimate the water benefit from the use of donated rain barrels. The calculator is based on a supply and demand methodology and includes geography-specific input data, as follows:

Supply Calculations:

To calculate the potential rainwater available for harvest, the calculator utilizes the following formula and variables:

Catchment Size X Number of Barrels X Total Precipitation X Catchment Efficiency Coefficient

Catchment Size – Based upon an assigned percentage of the average single family home and school. For example, the average single family roof size is 1,200 square feet with most houses having a peaked roof. Therefore, the calculator utilizes 600 square feet as the catchment site.

Number of Barrels – An estimate of the number of donated barrels actually distributed and in use

Total Precipitation – Combined monthly rainfall and snowfall. Snowfall is converted to Snow Water Equivalent using a 0.20 density coefficient. Precipitation data is pre-loaded for select geographic locations.

Catchment Efficiency Coefficient - An 85% runoff coefficient was selected; meaning 85% of the rain falling on the catchment will run off to the gutter and rain barrel. The other 15% will be lost to evaporation, wind, leaks, infiltration into the catchment surface, etc.

Demand Calculations:

To calculate the demand or estimated barrel water use, the calculator utilizes the following formula and variables for both households and schools/businesses.

(Evapotranspiration X Landscape Coefficient X Landscape Area) + Estimated Other Use X Overflow Loss

Evapotranspiration - Data is pre-loaded for select geographic locations.

Landscape Coefficient - Also commonly referred to as the "Plant Factor" and the functional equivalent of the "Crop Coefficient." A factor of 0.55 was selected, which is an average value for moderate watering needs. Turf grasses are commonly 0.6-0.8, whereas gardens and shrubs are closer to 0.40 on average.

Landscape Area – The estimated square footage of the landscape are serviced by the rain barrel. The household average is 300 square feet and the school/business is 700 square feet. The larger landscape area for schools/businesses accounts for designated grounds personnel.

Estimated Other Use – Estimates for the amount of water utilized in each given month for purposes other than landscaping or gardening (e.g., washing a vehicle).

Overflow Loss – A percentage reduction based upon the month-to-month probability of receiving more than 0.30" precipitation in a single day. This represents the approximate amount to fill a rain barrel.

Total (ultimate) benefit: 303.7 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 303.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 303.7 ML/yr and TCCC's benefit (adjusted for cost share) is 303.7 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	303.7	303.7
2014	303.7	303.7
2015	303.7	303.7
2016	303.7	303.7
2017	303.7	303.7
Ultimate Benefit:	303.7	303.7

Data Sources/Site-specific characteristics:

The various data sources used are listed in the "Assumptions and References" tab of the rain barrel calculator excel spreadsheet.

Assumptions:

- Homeowners and school/business representatives that attend a workshop and receive a rain barrel through the donation program will use it consistently to collect rainwater from roofed areas and use the collected water for gardening, cleaning, and other outdoor uses.
- Additional assumptions are incorporated into the calculator formulas and coefficients.
- For plant locations not listed in the rain barrel calculator, an EPA estimated value of 1,300 gallons/drum over the peak summer months was used.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in municipal water usage due to use of water collected in rain barrels for gardening, and other activities

NOTES

- This fact sheet provides benefits for all rain barrel projects in North America, and it replaces fact sheets in previous reports for individual regions (i.e., Baltimore, Charlottesville, Nashville and Atlanta). This fact sheet updates the November 2011 fact sheet to provide benefits through 2012.

REFERENCES

The various references related to the rain barrel calculator are listed in the "Assumptions and References" tab of the rain barrel calculator excel spreadsheet.

U.S. Environmental Protection Agency (Region 3). Estimates that one barrel can save the average household approximately 1,300 gallons over the three peak summer months. http://www.epa.gov/region3/p2/what-is-rainbarrel.pdf

PROJECT NAME: Protecting Forests from Land Development
PROJECT ID #: 105

DESCRIPTION OF ACTIVITY: Protection of 68 ha forest at 5 locations from development

LOCATIONS: Mt. Shirahata, Kyoto, Hongo, Tosu and Daisen, Japan

PRIMARY CONTACT:
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Coca-Cola Japan
Technical Stewardship, Supply Chain & Commercialization, EOSH Governance
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mitshibata@coca-cola.com

OBJECTIVE:

- Source water protection

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola West and Hokkaido Coca-Cola Bottling have entered into long-term agreements with local governments to protect a total of 68 hectares of forest from development at five different locations. These locations are Mt. Shirahata, Kyoto, Hongo, Tosu, and Daisen.

The length of the protection agreements varies from 10 to 50 years and local partners also vary for the different sites. In addition to being protected from development, these areas are also being maintained through thinning, mowing and reforestation. The photos below show one of the forested areas being protected and some of the expected future development (in this example, for the Daisen site) if the land were not protected from development.

Example current forested condition

Anticipated future condition if forest were not protected

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 99.8 ML/YR

ACTIVITY TIMELINE:

- Agreements for protection and maintenance were signed and expire on varying dates. These are described below by site.
    - Mt. Shirahata: 2011 – 2060 (50 years)
    - Kyoto: 2007 – 2016 (10 years)
    - Hongo: 2009-2018 (10 years)
    - Tosu: 2006-2035 (30 years)
    - Daisen: 2007-2016 (10 years)

COCA-COLA CONTRIBUTION: 100%

- Total cost (USD): $1,274,860 USD, as detailed below by location.

Location	Funding provided by	Cost (USD/yr)	Length of agreement (yrs)	Total Cost (USD)
Mt. Shirahata	Hokkaido Coca-Cola Bottling	$12,500	50	$625,000
Kyoto	Coca-Cola West	$15,000	10	$150,000
Hongo	Coca-Cola West	$13,750	10	$137,500
Tosu	Coca-Cola West	$ 7,912	30	$237,360
Daisen	Coca-Cola West	$12,500	10	$125,000
	Total			$1,274,860

Other partners contributing support to this project are listed below by location:

- Mt. Shirahata: Sapporo Municipal Government and Sapporo Fureai no Mori Tomonokai
- Kyoto: Kyoto Municipal Govenrment and Kyoto Model Forest Association
- Hongo: Hiroshima Local Government and Local Forestry Association
- Tosu: Saga Forest Management Office and NPO Big Leaf
- Daisen: Tottori Local government and Hino Forestry Association

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012), using a site-specific coefficient for land protection in Japan, based on a study by the Ministry of Land Development titled *Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I* (See references). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

“Pre-project” is defined as the developed condition of the land that would result if it were not protected. “Post-project” is defined as the forested condition that is maintained as a result of the protection agreements. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

Where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical land protection activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.1 was selected for ΔK for all five locations, based on the Japan Ministry of Land Development Technical Standards.

Calculated water quantity benefits are provided below. **The total benefit (runoff reduction) for the five project locations is: 99.8 million liters per year (ML/yr).**

Summary of Results

Location of Protected Land	Time Period for Protection Agreement	Surface Area (ha)	2006-2011 Annual Average Precipitation (mm)	Ultimate Water Quantity Benefit (ML/yr)
Mt. Shirahata	2011-2060	26	1,259	32.7
Kyoto	2007-2016	12	1,543	18.5
Hongo	2009-2018	8	1,436	11.5
Tosu	2006-2035	17	1,665	28.3
Daisen	2007-2016	5	1,744	8.7
TOTAL		68		**99.8**

Numbers don’t sum exactly to total due to rounding.

<u>The total (ultimate) benefit:</u> 99.8 ML/yr
<u>TCCC total (ultimate) benefit taken as a function of cost share is:</u> 99.8 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

<u>2012 Replenish Benefit</u>

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 99.8 ML/yr and TCCC’s benefit (adjusted for cost share) is 99.8 ML/yr.

<u>Projected Replenish Benefits</u>

The table below shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits for two of the projects are anticipated to continue to be generated through the year 2020, with three agreements expiring prior to 2020. All projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)*
2013	99.8	99.8
2014	99.8	99.8
2015	99.8	99.8
2016	99.8	99.8
2017	99.8	99.8
Ultimate Benefit:	99.8	99.8

**These projections assume contract agreements are renewed in the years they expire. If the contracts are not renewed, then the projected benefits will be adjusted downward.*

Data Sources:

- Size of protected land area: provided by contact.
- Annual average precipitation was calculated for the 2006-2011 period using data from the online "TuTiempo.net" meteorological database (http://www.tutiempo.net/en/). The table below presents the nearest climate station to each of the five project sites.

Site Location:	Kyoto	Hongo	Tosu	Daisen	Mt. Shirahata
Nearest Climate Station:	Kyoto	Hiroshima	Fukuoka	Yonago	Tomakomai

Assumptions:

- ΔK (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.1 for all locations as a conservative and simplifying assumption.
- The pre-project condition can be described as having forest, wilderness and farmland accounting for more than 70% of total area.
- The post-project developed condition can be described as having impermeable areas accounting for less than 40% of total area.
- The 68 hectares at the five locations were assumed to be subject to a mix of development such as residential, recreational (villas and golf courses), commercial (shopping malls) land and cemeteries.

OTHER BENEFITS NOT QUANTIFIED

- Improved outdoor recreation for local residents.
- Water quality improvements including reduced sedimentation

NOTES

- None.

REFERENCES

Redder, T. and W. Larson, 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20, 2012.

Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I. The Japan Housing Corporation (March 1974, December 1979); The Japan River Association (March 1974, December 1979, March 1987); The Japan Regional Development Corporation (December 1979, March 1987); The Housing and Urban Development Corporation (March 1987).

PROJECT NAME: Restoration of Water Resources as an Adaptation to Climate Change
PROJECT ID #: 106

DESCRIPTION OF ACTIVITY: Establishment of infiltration wells for artificial aquifer recharge of rainwater

LOCATION: Sibolangit Sub-District, Deli Serdang District, North Sumatra Province, Indonesia

PRIMARY CONTACT:
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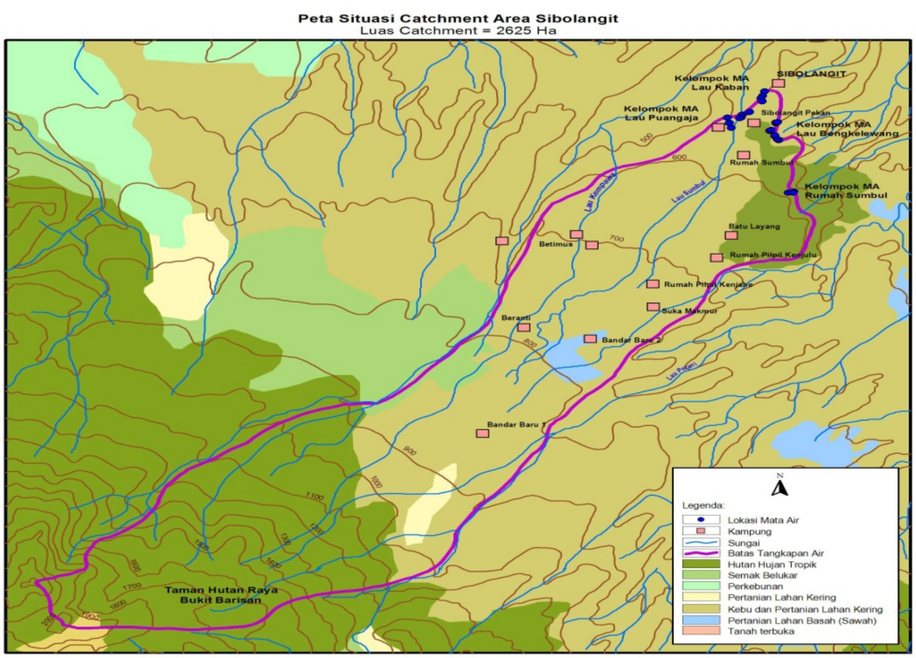
OBJECTIVES:

- Increase in recharge of local aquifer which provides 20% of the water for Medan City

BACKGROUND & ACTIVITY DESCRIPTION: A spring aquifer provides 20% of the water for Medan City, which has a population of 3 million. Over the last ten years, discharge from this aquifer has been deteriorating at a rate of 5% per year. If this continues, the water utility (PDAM Tirtanadi) will lose one of their most reliable water sources, with an immediate effect on the people of Medan.

Coca-Cola, in conjunction with partner organizations, has established infiltration wells to increase aquifer recharge. The main purpose of this project was to provide clean water for residents of Medan City, by increasing infiltration of rainwater through the construction of 800 infiltration wells in the catchment area.

The project was initiated in the catchment area of PDAM Tirtanadi in the villages of Puangaja, Rumah, Sumbal, Sibolangit and Rumah Pil Pil dan Batu Layang in Sibolangit sub-district. Project locations are shown below in blue circles.



SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 431.4 ML/YR

ACTIVITY TIMELINE:

- January 2012 – December 2012

COCA-COLA CONTRIBUTION: 88%

WATERSHED BENEFITS CALCULATED:

1. Increase in infiltration

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1. INCREASE IN INFILTRATION

Approach:

The Rain Water Harvesting/Artificial Aquifer Recharge (RWH/AAR) Probabilistic Model, Version 1.5 was used to estimate the volume of water successfully used for artificial aquifer recharge based on available rainfall. The model has been used to quantify replenish benefits for similar projects in India (GCC, 2010). The Coca-Cola Company partnered with the Global Corporate Consultancy (GCC), formerly known as Delta Consultants, to develop the RWH/AAR model. Data obtained from the RWH/AAR system survey were used with the model to estimate the benefits for this project. The assumptions used in the model application are described in the following sections. RWH/AAR model is split into three modules based upon: 1) the flow of water from precipitation to the catchment, 2) storage capacity water balance, and 3) delivery of water to the desired end use (i.e., community access or AAR).

Rainwater Available for AAR:

To calculate the potential rainwater collected and made available for AAR, the model utilizes the following formula and variables:

(Catchment Size) X (Total Precipitation) X (Catchment Runoff Coefficient)

Catchment Size – The size of the surface catchment evaluated is 800,000 m^2

Total Precipitation – The model requires monthly rainfall data. Average annual rainfall totals were provided for the project area. Long-term monthly climate data for this region were obtained by LimnoTech through a global climate dataset (Hearn et al. 2003). The percent of precipitation by month for the project area was estimated based on the global climate dataset, and then used to apportion the total annual rainfall amount indicated in the survey.

Catchment Runoff Coefficient – The runoff coefficient represents the efficiency of a catchment in producing runoff. A runoff coefficient of 30%, typically used for unpaved surfaces (GCC, 2010), was selected for the calculations.

Storage Capacity Water Balance Module:

The RWH/AAR model uses a water balance approach and monthly precipitation data to estimate the volume of water not lost due to insufficient storage or infiltration rate of structure used for AAR. During each month the model calculates the rainwater available to meet community demand and/or AAR. If the combined community and AAR demand is less than the available water in a given month, it is assumed both demands would be completely met, and any excess water would remain in the AAR structure (up to the volume of structure, with any water beyond that volume assumed to be lost due to insufficient storage). This project does not incorporate any storage structures but utilizes water recharge through infiltration wells. Therefore each well was assigned to have a recharge rate of 4 m^3/day. This recharge rate translates to a percolation rate of 1 m/day for the 2m x 2m infiltration wells. It should be noted that the recharge rate of 4 m^3/day for the infiltration wells is a reasonable assumption of potential rate. It was also assumed that all available water is utilized for AAR (i.e., no community demand).

Artificial Aquifer Recharge Water Balance Module:

For this project, 100% of the captured water is used for AAR. The RWH/AAR model estimates the volume of water successfully used for AAR based on the recharge mechanism used. Based on responses provided in the questionnaire, it was determined that the primary mechanism of AAR is through percolation pits or recharge wells/shafts. The volume of water successfully recharged to the aquifer through percolation pits or recharge wells/shafts was estimated by the model using the following formula:

$(Q_{AAR\text{ - }PPRW})$ X (Efficiency of the AAR processes) X (Maintenance Efficiency)

where $Q_{AAR\text{ - }PPRW}$ is the annual volume of water received by the infiltration wells.

For this project, an AAR process efficiency of 95% corresponding to recharge via infiltration wells was used. A maintenance efficiency of 95% was used for the project corresponding to annual maintenance frequency.

Results:

A summary of benefits calculated using the RWH/AAR model is provided in Table 1 below.

Table 1. Summary of Project Model Inputs and Outputs

Location		Sibolangit, North Sumatra Province
	Catchment area (m^2)	800,000
	Annual rainfall (mm/year)	2,263
	Estimated rainfall on the catchment (ML)	1,810.4
	Volume captured (ML)	543.1
AAR	**Volume recharged (ML)**	**490.2**

The total (ultimate) water quantity benefit is: 490.2 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 431.4 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 490.2 ML/yr and TCCC's benefit (adjusted for cost share) is 431.4 ML/yr.

Projected Water Quantity Benefits Summary

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. If additional projects are added or projects are expanded, the future benefits will increase. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	490.2	431.4
2014	490.2	431.4
2015	490.2	431.4
2016	490.2	431.4
2017	490.2	431.4
Ultimate Benefit:	490.2	431.4

Data Sources

- RWH survey completed by the Indonesia Division. An annual rainfall of 2,263 mm/yr was reported in the survey, which is very similar to the value that obtained from the global database (2,062 mm; Hearn et al., 2003). Monthly values from the global database were used to apportion the annual rainfall provided in the survey.
- JKM and CCF (2010) report.

Assumptions:

- Assumptions and limitations of the RWH/AAR model as defined within a document developed by Global Corporate Consultancy (2010).
- Without this project, a negligible amount of water infiltrates at the site where the infiltration wells are constructed.
- A recharge rate of 4 m^3/day was assumed for use in the RWH model. This value generates benefits that are comparable to, and slightly lower than those provided by the Indonesia Division with their own calculations.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in storm water runoff and associated pollutant load

NOTES

- None

REFERENCES

Global Corporate Consultancy (GCC), 2010. Manual for RWH/AAR Probabilistic Model Version 1.5. Methodology and Analysis Summary.

Hearn, P., T. Hare, P. Schruben, D. Sherrill, C. LaMar, and P. Tsushima, 2003. "Global GIS – Global Coverage DVD." DVD developed by the U.S. Geological Survey and published by the American Geological Institute. URL: http://www.agiweb.org/pubs/pubdetail.html?item=624108.

Jaringan Kesehatan/Kesejahtraan Masyarakat and The Coca-Cola Foundation (JKM and CCF), 2010. Restoration of water resources as an adaptation to climate change. Establishment of infiltration wells in the upstream area of Sibolangit Deli Serdang Regency, North Sumatra 2011 – 2012.

PROJECT NAME: Conservation and Restoration of Ramsar Site Lagunas de Guanacache Desaguadero and del Bebedero
PROJECT ID #: 107

DESCRIPTION OF ACTIVITY: Wetland restoration (1,000 hectares)

LOCATION: Lagunas de Guanacache Desaguadero and del Bebedero, in the provinces of San Juan, Mendoza and San Luis, Argentina. Located between 32.415889°S, – 67.362278°W and 32.414358°S, -67.295033°W

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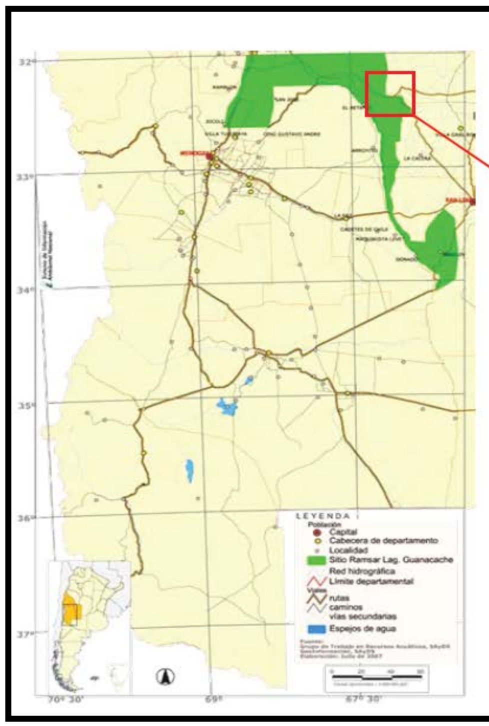
OBJECTIVES:
- Increase water storage in the wetlands
- Restore wetland services for the local communities
- Control receding erosion

BACKGROUND & ACTIVITY DESCRIPTION: A Ramsar site, Lagunas de Guanacache Desaguadero and del Bebedero protects a system of chained lagoons and marshlands. This site has a surface area of 962,370 hectares and is fed by the Mendoza and San Juan Rivers (and sporadically by Bermejo effluent), which drain through the Desaguadero River. These wetlands are inhabited by approximately 2,000 people that historically relied on the Guanacache wetlands for water supply, fishing, subsistence farming in the floodplains, goat farming, and for the natural resources provided by the wetland (cat tail, rush, reed, etc.).

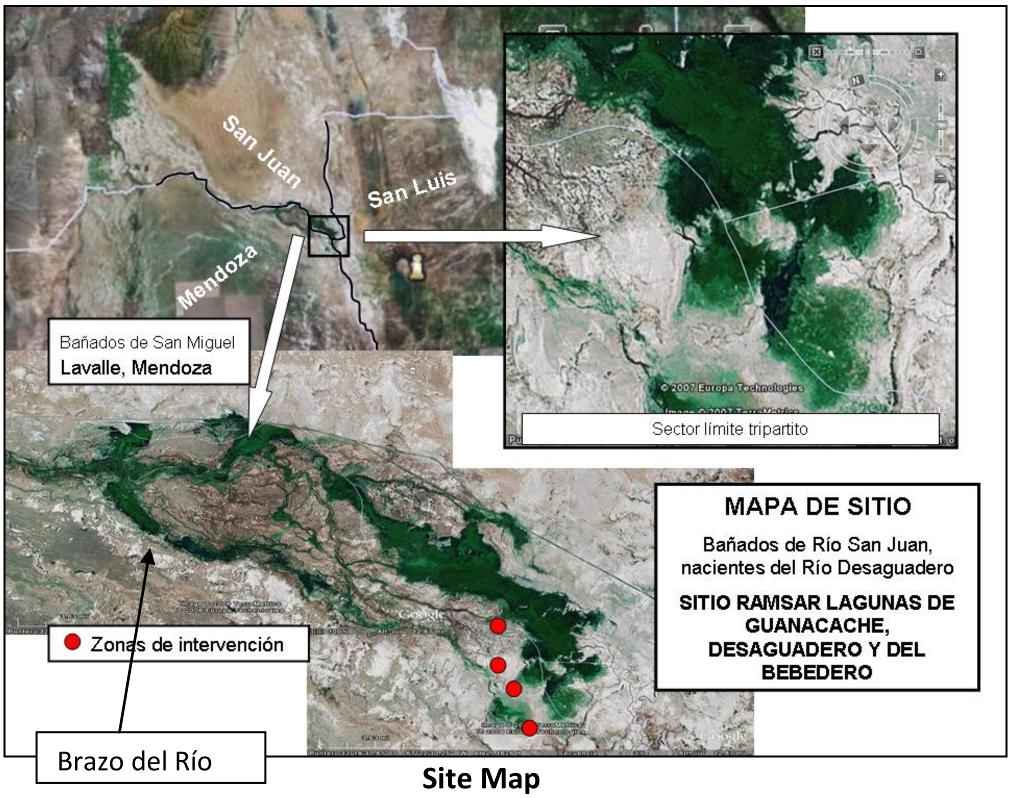
Between 1950 and 1960, the Guanacache wetlands suffered from drying due to natural and anthropogenic alterations. The result was a reduced surface area of the wetland that affected traditional activities of the local population and loss of water for irrigation. Local flooding was also caused by these alterations. The primary natural causes of degradation were long periods of drought, receding erosion and the formation of gullies at the headwaters of the Desaguadero River. Anthropogenic causes included construction of channels to reroute the river for roads, and increased water use upstream for crop irrigation.



Guanacache Wetland

This project aims to control receding erosion at the site and increase water levels in the wetland; locations for the planned activities are shown below. The work currently planned includes:

1. Installation of dams to divert up to 20% of San Juan River flow into the wetland;
2. Construction of dams over gullies and runoff paths to trap sediments and retain water in the wetland;
3. Revegetation to prevent erosion; and
4. Annual maintenance and adjustment.



Site Map

General Works Strategy a) Closure over river arm, b) La Pasarela and c) La Puertita

This work is being implemented in partnership with Fundacion Humedales (Wetlands Foundation), Tecnicatura en Conservacion de la Naturaleza (Technical Specialization in Nature Conservation) (Mendoza), the Direccion Provincial de Hidraulica (Provincial Hydraulics Bureau) (Government of Mendoza), and the Direccion de Recursos Naturales Renovables (Bureau of Renewable Natural Resources) (Government of Mendoza).

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1,050 ML/YR

ACTIVITY TIMELINE:

- 2012 30% of the wetland has been flooded.
  - Repaired a sediment trap and built another.
- 2013 60% of the wetland will be flooded.
  - Construction of two sediment traps
- 2014 90% of the wetland will be flooded.
  - Construction of sediment traps and closure on the arm of the river San Juan
- 2015 100% of the wetland will be flooded.
  - System settings and revegetation actions to favor the trapping of sediments.

COCA-COLA CONTRIBUTION: 70%

- Total cost (USD) for wetland restoration 2012: $42,857 USD
  - TCCC contribution: $30,000 USD
  - Dirección de Recursos Naturales Renovables y Dirección de Hidráulica de Mendoza: $ 12,857 USD

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Increase in wetland soil water storage and deep infiltration

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1. INCREASE IN WETLAND SOIL WATER STORAGE & DEEP INFILTRATION

<u>Approach & Results:</u>

The water quantity benefit is calculated as the total annual volume of water that: 1) is stored in the shallow surface soils; and 2) infiltrates to deep subsurface soils, as a direct result of the restoration of flooding to approximately 1,000 hectares of floodplain/wetland area annually. The actual area of flooding in a given year will depend on the watershed hydrology for that year; for example, in wet years the total area flooded will be approximately 2,000 hectares. For the purpose of this calculation a flooded area of 1,000 hectares (10,000,000 m^2) is conservatively assumed for any given year (Fundacion Humedales, 2012).

Component #1 – Wetland Storage

When wetland flooding occurs, the upper soil zone will become saturated with approximately 0.20 meter of water over the area of inundation (Fundacion Humedales, 2012). Therefore, the total water volume stored in the wetland system for each year can be calculated as:

[Wetland Storage Volume] = (0.20 m) * (10,000,000 m^2) = 2,000,000 m^3 = **2,000 ML/yr**

Component #2 – Deep Infiltration

In addition to the water volume that enters and is retained in the shallow soil zone of the wetland, additional water volume infiltrates deeper into subsurface soils. This deep infiltration volume represents the second component of the water quantity benefit estimated for the project. Infiltration rates for the soils present in the wetland system are estimated to be 10 mm/day (0.01 m/day) under saturated conditions (Fundacion Humedales, 2012). Deep infiltration of water will occur during time periods when the wetland is inundated by floodwaters and the surficial soils are saturated. Therefore, the time period of inundation must be also be estimated to calculate the total volume of water that is captured via deep infiltration. Inundation of the 1,000 ha of the wetland system will occur when combined flows from upstream rivers exceed 3.0 m^3/s. Flow rates for the system vary seasonally, but average flows are greater than the 3.0 m^3/s threshold for several months of the month (Fundacion Humedales, 2012). Conservatively, inundation of the wetland system is assumed to occur for a total of 30 days in each year. Based on this assumption, the water volume captured via deep infiltration can be estimated as follows:

$$[\text{Deep Infiltration Volume}] = (0.01\ \text{m/day}) * (30\ \text{days}) * (10{,}000{,}000\ \text{m}^2) = 3{,}000{,}000\ \text{m}^3$$

$$= \mathbf{3{,}000\ ML/yr}$$

The total water quantity benefit is calculated as the sum of the "water storage" and "deep infiltration" volumes. **The total benefit for this project is: 5,000 million liters per year (ML/yr).**

Total (ultimate) benefit: 5,000 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 3,500 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 1,500 ML/yr and TCCC's benefit (adjusted for cost share) is 1,050 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	3,000	2,100
2014	4,500	3,150
2015	5,000	3,500
2016	5,000	3,500
2017	5,000	3,500
Ultimate Benefit:	5,000	3,500

Assumptions:

- On average, approximately 1,000 hectares of the wetland system will flood annually following completion of the project.
- A representative infiltration rate for soils in the wetland system is 10 mm/day.
- The wetland system will be inundated for at least 30 days each year (but not necessarily for 30 consecutive days).
- Other assumptions for the project are documented in Fundacion Humedales (2012).

Data Sources:

- Data were obtained from Fundacion Humedales (2012) and provided by contact.

OTHER BENEFITS NOT QUANTIFIED

- None

NOTES

- None

REFERENCES

Fundacion Humedales. 2012. “Conservation and Restoration of Ramsar Site Lagunas de Guanacache, Desaguadero, and del Bebedero.”

PROJECT NAME: Reserves in La Calera, Province of Cordoba: Management as a Tool for Basin Recovery
PROJECT ID #: 108

DESCRIPTION OF ACTIVITY: Suppression of fire within the 13,500 hectare La Calera Reserve

LOCATION: La Calera Reserve, Province of Cordoba, Argentina 64.3500 degrees W; 31.3500 degrees S

PRIMARY CONTACT:
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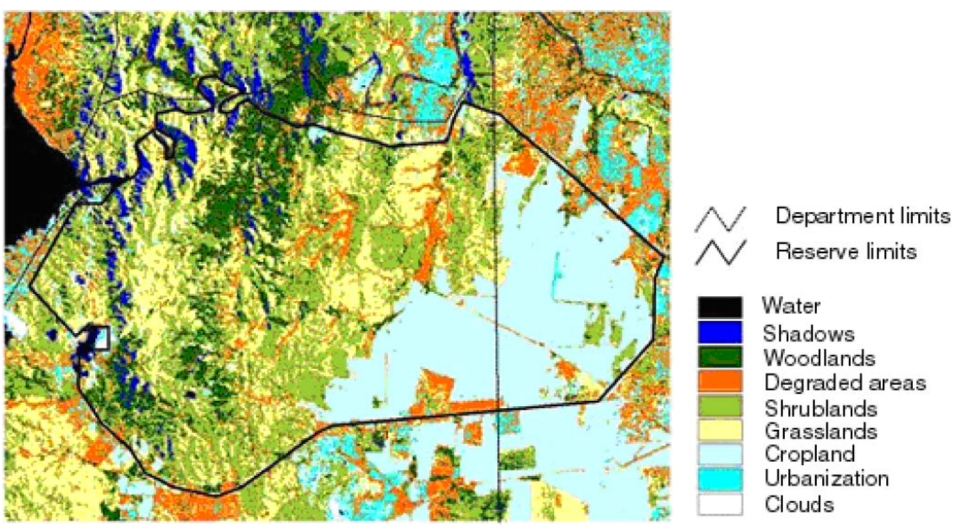
OBJECTIVE:
- Improve hydrology

BACKGROUND & ACTIVITY DESCRIPTION: A 13,500-hectare Military Natural Reserve La Calera is located west of the city of Cordoba, on the eastern slope of the Sierras Chicas. This reserve is located in a recharge area for the City of Cordoba's water supply, and located just east of San Roque Lake. The reserve is important for the conservation of native ecosystems and woodlands and is under severe water stress. It is comprised of roughly 8,500 hectares of woodlands, 2,000 hectares of grasslands and 3,000 hectares cropland, which are located in two ecoregions. As a result of fire and grazing dynamics, the woodlands are characterized as a mosaic of woodlands, shrublands and grasslands. Within the reserve, there are also islands of native espinal forest.



Land Cover within Calera Reserve
San Roque Lake is shown to the west of the reserve; La Cordoba is located to the east, off the map

Mountain woodlands

Espinal forest patch

Fallow soybean field

Livestock (cattle)

Photos of Different Areas Within La Calera Reserve

There are many pressures on the reserve that are affecting hydrology. These include: agriculture and livestock/ranching, exotic species encroachment along waterways, historical deforestation, recurring forest fires, mining, military training activities (for ~65 years) and urbanization pressure.

Work in this reserve is part of a larger four-year, multi-country initiative to make a significant impact on issues related to water resource conservation and access to drinking water in Argentina, Chile and Peru. In La Calera reserve, a number of different activities are planned. These include characterization of vegetation, seasonal hydrology monitoring of waterways that enter the reserve, development of management guidelines for livestock and agriculture, protection of native espinal forest patches for reforestation of 3,000 agricultural hectares, development of a germ plasm bank to guarantee the spread of native trees, control of exotic species, revegetation, and fire suppression. The benefit of fire suppression is described in this fact sheet. Additional activities described above are not being quantified to avoid double counting of benefits.

Fire suppression

The risk of fires is very high in the Province of Cordoba. Fires are caused principally by human activity and, in minor measure, by natural effects. Between June and August 2012, there were seven fires in the reserve affecting a total of 250 hectares (Source, La Calera Firemen). Computer simulations for La Calera Reserve indicate that if fire suppression measures are not taken, approximately 3,500 ha may be affected by fire within 8 hours of a fire starting (assumes 36% grassland and 64% dry bushlandgrassland). Without fire suppression measures, it is estimated that the entire 13,500 ha La Calera Reserve will be affected by fire in a given year. For comparison, in 2011, over 70% (4,200 ha) of a similar reserve (La Quebrada) was affected by fire.

Woodlands (left) and grasslands (right) after a fire

This project involves development of a Fire Management Plan, training of military and civil staff on the use of firefighting equipment and compliance with safety standards, and acquisition of firefighting equipment for the reserve, specific to the topography of the area.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 2,739 ML/YR

ACTIVITY TIMELINE:

- 2012. 50% of the reserve will be protected from fire.
  Activities: Production of Plan for Managing the Native Forest, prevention and fight against fires (training, purchase of equipment and planning for fight against fires);
- 2013. 80% of the reserve will be protected from fire.
  Activities: Accomplishment of firebreak, protocol of action and acquisition of equipment.
- 2014. 90% of the reserve will be protected from fire.
  Activities: Plan for fire management, construction of complementary firebreaks and training.
- 2015. 100% of the reserve will be protected from fire.
- Activities: Control and maintenance, complementary equipment, and general adjustments to management.

COCA-COLA CONTRIBUTION: 90%

- Total cost (USD) for fire suppression: $ 110,100 USD
  - TCCC contribution: $ 99,000 USD
  - The Firemen's Barrack of La Calera contribution: $ 11,100 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in infiltration water quantity

1. INCREASE IN INFILTRATION WATER QUANTITY

Approach & Results:

The water quantity benefit for this project was calculated based on the estimated difference between the annual infiltration volumes for each land component (i.e., forest, grasslands, and old agricultural lands) for 1) pre-project (i.e., fire-affected) conditions, and 2) post-project conditions (i.e., after fire suppression achieved). For both the pre-project and post-project cases, the following equation was used to calculate the total annual infiltration volume (*Inf*, m^3/yr):

$$Inf = P * (1 - IntFrac) * (1 - C) * Area \quad \text{(Eqn. 1)}$$

where *P* is the mean annual precipitation (m/yr) for the region, *IntFrac* is the fraction of precipitation that is captured by the canopy, *C* is the fraction of precipitation reaching the ground that is lost to surface runoff, and *Area* is the land surface area (m^2). The mean annual precipitation for the entire 13,500 hectare La Calera Reserve was assumed to be 715 mm/yr (0.715 m/yr) based on Vicario (2008). Table 1 provides a listing the parameters selected for the analysis based on Ramirez (1984); the parameters are also summarized below:

- Interception is estimated to be 10% for native forest, 5% for grasslands, and 0% for old agricultural areas.
- The runoff factor (*C*) for area that has not been disturbed by fire is estimated to be 0.25 for native forest and grassland, and 0.45 for old agricultural areas.
- Based on Ramirez (1984), the runoff factor (*C*) is increased by a factor of 1.3 for native forest and grasslands and 1.1 for old agricultural areas to represent fire-disturbed conditions.

Table 1. Summary of Calculation Input Parameters by Land Area Type

Land Area Type	Surface Area (ha)	Interception Fraction (“*IntFrac*”)	Runoff Factor, “*C*” (with no fire disturbance)	Runoff Factor Multiplier	Runoff Factor, “*C*” (with fire disturbance)
Native forest	8,500	0.10	0.25	1.3	0.325
High grasslands	2,000	0.05	0.25	1.3	0.325
Old agricultural	3,000	0.00	0.45	1.1	0.495

Based on the parameters described above, annual infiltration volumes for each land area type were estimated as follows using Equation 1:

- “Without fire suppression” (fire-disturbed condition):
  - Native forest: $Inf = (0.715\text{ m/yr})*(1 - 0.10)*(1 - \mathbf{0.325})*(8.5 \times 10^7\text{ m}^2)$
    $= 36{,}920{,}813\text{ m}^3\text{/yr}$ (**36,920.8 ML/yr)**
  - High grasslands: $Inf = (0.715\text{ m/yr})*(1 - 0.05)*(1 - \mathbf{0.325})*(2.0 \times 10^7\text{ m}^2)$
    $= 9{,}169{,}875\text{ m}^3\text{/yr}$ (**9,169.8 ML/yr)**
  - Old agricultural: $Inf = (0.715\text{ m/yr})*(1 - 0.00)*(1 - \mathbf{0.495})*(3.0 \times 10^7\text{ m}^2)$
    $= 10{,}832{,}250\text{ m}^3\text{/yr}$ (**10,832.2 ML/yr)**

- "With fire suppression" (no fire disturbance condition):
  - Native forest: Inf = (0.715 m/yr)*(1 – 0.10)*(1 – **0.25**)*(8.5 x 10^7 m^2)
    = 41,023,125 m^3/yr (**41,023.5 ML/yr**)
  - High grasslands: Inf = (0.715 m/yr)*(1 – 0.05)*(1 – **0.25**)*(2.0 x 10^7 m^2)
    = 10,188,750 m^3/yr (10**,188.7 ML/yr**)
  - Old agricultural: Inf = (0.715 m/yr)*(1 – 0.00)*(1 – **0.45**)*(3.0 x 10^7 m^2)
    = 11,797,500 m^3/yr (**11,797.5 ML/yr**)

The water quantity benefit is then calculated as the difference between the total infiltration volume across the three land area types for the "fire-disturbed" condition (i.e., current condition) and the "no fire disturbance" condition (i.e., after fire suppression activities have occurred):

- Runoff volume "without fire suppression" (land disturbed by fire): 56,922.9 ML/yr
- Runoff volume "with fire suppression" (land not disturbed by fire): 63,009.4 ML/yr
- **Benefit (infiltration increase): 6,086.4 ML/yr**

Calculated water quantity benefits are provided in Table 2 below.

The total benefit (runoff reduction) for this project is: 6,086.4 million liters per year (ML/yr).

The total (ultimate) benefit: 6,086.4 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 5,478 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 3,043 ML/yr and TCCC's benefit (adjusted for cost share) is 2,739 ML/yr.

Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	4,869	4,382
2014	5,478	4,930
2015	6,086	5,478
2016	6,086	5,478
2017	6,086	5,478
Ultimate Benefit:	6,086	5,478

Assumptions:

- This calculation assumes that the full 13,500 hectares in the reserve would be affected (i.e., high-intensity burn) by wildfires in a given year, without implementation of the fire suppression activities planned for this project.
- Estimates of runoff factors available from Ramirez (1984) were assumed to apply to land areas within the La Calera Reserve.

Data Sources:

- Area and land cover within the reserve: provided by contact.
- Area affected by fire, in the absence of fire suppression activities: provided by contact.
- Precipitation data: provided by contact, "Mean annual precipitation in the project area totals 715 mm (Vicario, L. 2008). The rate considered for the assessment has been 715 mm."
- Runoff coefficients were determined based on Ramirez (1984).

OTHER BENEFITS NOT QUANTIFIED

- None

NOTES

- None

REFERENCES

Vicario, L. 2008. Evaluacion de las Sequials Hidrometeorologicas, en la Cuenca del Dique San Roque, Cordoba. Engineering Master's Thesis, Majoring in Water Resources. School of Exact, Physical and Natural Sciences. National University of Cordoba. Unpublished. 195 pages.

Ramirez, Rázuri H. 1984. Estructura de Conservación de Suelos y Aguas. P7-33- Serie Riego y Drenaje 32 (RD-32) Centro interamericano de desarrollo de aguas y tierras. Mérida, Venezuela.

PROJECT NAME: St. Lawrence Restoration (Saint-Eugene Marsh)
PROJECT ID #: 109

DESCRIPTION OF ACTIVITY: Wetland restoration (34 ha)

LOCATION: North shore of Lake St. Pierre Quebec, Canada.
Coordinates (latitude/longitude): 46.28231, 72.65156

PRIMARY CONTACT:

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OBJECTIVES

- Preserve water in the marsh, improving habitat.
- Allow better circulation of water and fish throughout the marsh.
- Improve water quality.

BACKGROUND & DESCRIPTION OF ACTIVITY: The 34-hectare Saint-Eugene marsh is hydrologically connected to Lac Saint Pierre, and offers exceptional wildlife habitat. This marsh is located in an urban area and receives sediment and agrochemical loads from several tributaries during spring floods. In 1994, the hydrology of the marsh was significantly altered by installation of three structures fitted with a control system to manage water levels. Furthermore, the marsh is divided by a road, with a culvert connecting the east and west sections of the marsh.

Saint-Eugene Marsh

Prior to this restoration project, water entered the marsh from the east end, but due to the size and placement of the culvert under the road, circulation between the east and west portions of the marsh was poor. There was no control structure at the east end of the marsh, and water left the marsh naturally at the low point in the far eastern part of the marsh. The western portion of the marsh dried out from roughly the end of June through September. It was dry for approximately 90 days each year.

The map below shows the tributaries that bring water to the marsh (blue lines), on which the sediment retention structures were installed. This map also shows the structures that were installed in 1994.

Between September and November 2012, a larger culvert was installed under the road, and a water control structure was installed at the eastern end of the marsh where it exchanges water with Lake St. Pierre. These are shown by red arrows. The culvert allows circulation between the two sections of the marsh, and the control structure prevents water from flowing out of the marsh to Lake St. Pierre when the marsh water level is at or below 4.4 meters. The control structure does not prevent water from entering the marsh during the spring flooding period.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 7.6 ML/YR

ACTIVITY TIMELINE:

- September 10, 2012 – Project initiation
- November 9, 2012– Project completion

COKE CONTRIBUTION: 32%

WATERSHED BENEFITS CALCULATED:

1. Increase in water storage

1. INCREASE IN WATER STORAGE

Approach and Results:

The increase in water storage was calculated based on bathymetry/topography information provided for the marsh and the difference in marsh volume between 4.4 meters (i.e., the elevation of the proposed control structure) and 3.8 meters, which represents the elevation at which the marsh typically recedes to during the summer months. The estimated additional water volume that will be retained annually in the marsh due to placement of the new control structure results in a **water quantity benefit of 23.7 ML/yr.**

The total (ultimate) benefit is: 23.7 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 7.6 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 23.7 ML/yr, and TCCC's benefit (adjusted for cost share) is 7.6 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	23.7	7.6
2014	23.7	7.6
2015	23.7	7.6
2016	23.7	7.6
2017	23.7	7.6
Ultimate Benefit:	23.7	7.6

Data Sources:

- Hypsography for Saint-Eugene marsh – the hypsograph summarizes the bathymetry/topography for the marsh by expressing the marsh wetted surface area as a function of water surface elevation in the marsh.
- Elevation of the spillway invert for the proposed control structure (4.4 meters).
- Estimate of the water elevation that the marsh typically draws down to in the summer months under current conditions (i.e., without a control structure in place).

Assumptions:

- The sill of the control structure will be constructed at the planned elevation of 4.4 meters.
- There is sufficient flow input from Lake St. Pierre to St. Eugene marsh each year to inundate the marsh to an elevation of 4.4 meters. (Note: historical water level data for 1900-2000 indicate that the peak spring water level exceeds 4.4 meters by at least 20-cm 99% of all years.)
- The water level in the marsh typically declines to 3.8 meters, primarily as the result of water lost from the marsh system via outflow to Lake St. Pierre during the summer months (estimate provided by WWF contact, and also supported by review of historical water level data).

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for aquatic species.

NOTES

- None

REFERENCES

WWF. 2012. "Data for Replenish Calculation – St. Eugene Marsh, ZIP Lac Saint Pierre." PDF document provided by WWF via e-mail on July 3, 2012.

PROJECT NAME: Verde River Program
PROJECT ID #: 110

DESCRIPTION OF ACTIVITY: In-stream flow restoration

LOCATION: Verde River, Arizona

PRIMARY CONTACTS:

Todd Reeve, CEO	Rena Ann Striker	Jon Radtke
Bonneville Environmental Foundation	Contract Ecologist	Manager, Water Resources
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OBJECTIVES:

- Install new irrigation infrastructure to reduce irrigation diversion of water and restore connectivity and stream flow through a reach of the upper Verde River to support fish, wildlife and recreation.
- Allow local irrigators to use less water and maintain full production on irrigated acreage

BACKGROUND & DESCRIPTION OF ACTIVITY: The Verde River is Arizona's only designated wild and scenic river and it is a critical Colorado River tributary, providing many ecological benefits to imperiled desert fishes and wildlife. The Verde River also provides 40% of the surface water for the metropolitan Phoenix area.

Between Clarkdale and Camp Verde, AZ, Verde River flows are diverted by seven major irrigation canals, leaving sections of the Verde River dry and others chronically dewatered. The Nature Conservancy's Verde River Program has launched a long-term strategy to work with local irrigators to improve irrigation infrastructure and design water efficiency solutions that can restore significant flow to the Verde River.

Many opportunities for increasing efficiency and restoring flows through collaboration with ditch companies (irrigators) are being explored. The first flow restoration project to emerge is the Diamond-S Flow Restoration Project. This project has several phases: Phase 1 is a summer 2012 test phase which has been completed; and Phase 2 is a proposed 2013 full implementation phase. The benefits of the Phase 1 test phase are described in this fact sheet.

Diamond-S Flow Restoration, Phase 1

The Diamond-S ditch is located in Camp Verde, Arizona. It is approximately 5 miles long and has nearly 60 agricultural users and one large production farming operation. The pre-project diversion structure for this ditch diverted the majority of the river's flow (approximately 30 cfs) into the ditch throughout the low flow period of the year. Much of this water was not used by irrigators, in large part because the headgates and lateral turnouts on the ditch system could not be practically adjusted to control how much water was diverted and delivered. Under pre-project conditions, the irrigators typically left the headgates open, diverting most of the river water through their canal system, annually removing more than 1.5 billion liters of water from the river that was not used for agricultural production.

Water that was not used by irrigators was returned to the river at the end of the ditch, approximately 5 miles downstream from the initial diversion. This resulted in chronic dewatering of more than 4.5 miles of the Verde River. The photo below shows the Diamond-S ditch (filled with water) and the river (forested section with little visible water).

A phased solution has been developed and implemented, which invests in new irrigation infrastructure that allows the Diamond-S irrigators to better control and manage the water they divert from the river. This facilitates the restoration of flows to an approximately 4.5 mile reach of the mainstem Verde River.

It is hoped that this project will set a precedent for collaborative flow restoration solutions in Arizona and will facilitate the restoration of other dewatered sections of the upper Verde River.

New Automated Headgate Diversion Structure

Photo: Tana Kappel

The Verde River provides critical habitat to myriad fish and wildlife species
Photo: Stephen Trimble

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 170 ML/YR

ACTIVITY TIMELINE:

- May-June 2012: Installation of automated headgate diversion structures and associated monitoring systems.
- Summer 2012: Irrigators test the new diversion structures, refine management actions, and monitor and document water restored to the river. Irrigators successfully begin diverting less water than had been diverted during baseline conditions—this resulted in water being restored to a dewatered reach of the Verde River.
- Fall 2012/Winter 2013 – Additional infrastructure and automated management upgrades in the Diamond-S ditch and lateral turnouts, and implementation of a first-year contract with irrigators to secure flow restoration for 2013. TCCC has pledged funding in fall 2012 to support this work and pave the way for increased replenish benefits in 2013.

COCA-COLA CONTRIBUTION: 100 %

Total Cost of Project: $10,000 USD (For pilot project described for Diamond-S ditch)

- Coca-Cola Foundation: $10,000 USD

*Funding above is for Diamond-S ditch only. If this project is expanded, it is expected that funding will increase.

WATERSHED BENEFITS CALCULATED:

1. Increase in stream flow, resulting from reduced water being diverted from the Verde River

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1. INCREASE IN STREAMFLOW

Approach & Results

2012 Benefit Calculation

- Pre-project: Based on 2012 flows, 30 cfs from the creek would have been diverted to irrigators from July 15 through September 15, 2012, resulting in a de-watered stream
- Post-project: After installation of new automated headgate diversion structures and associated monitoring systems, more than 1.5 cfs were retained in the river during a two month pilot period.

  The project used several years of data to assess the baseline diversion rate of the Diamond-S irrigation diversion. Using several calculation methods, the historical Diamond-S diversion rate was established at 30 cfs. Automated stage telemetry systems were used to gage the ditch diversion rates while the phase I pilot project was in effect during summer 2012. Data from the continuous stage recorders show that at least 170 million liters were "returned" to the river during the test 2012 test period.

As a result of this pilot flow restoration project, 170 ML/yr were retained in the Verde River, which otherwise would have been diverted to irrigators during the July 15 through September 15 period. The total water quantity benefit is the increase in streamflow to date.

The total (ultimate) benefit is: 170 ML/yr

The total (ultimate) benefit taken as a function of cost share is: 170 ML/yr

The current (2012) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 170 ML/yr and TCCC's benefit (adjusted for cost share) is 170 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column. While TCCC contributed 100% of the implementation costs for the 2012 pilot, Coke's contribution as a percent of total project costs going forward is unknown at this time. Based on TCCC's funding pledge for 2013, a 75% project cost share is estimated for 2013.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)*	Adjusted for TCCC Cost Share (ML/yr)
2013	unknown	unknown
2014	unknown	unknown
2015	unknown	unknown
2016	unknown	unknown
2017	unknown	unknown
Ultimate Benefit:	unknown	unknown

* Future benefits are unknown and will vary based on project annual precipitation, performance, and Coke's future investments in the project.

Data Sources/Site-specific characteristics:

- Bonneville Environmental Foundation (undated).

Assumptions:

- None.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for fish and other wildlife
- Increased recreational opportunities

NOTES

- None

REFERENCES

Bonneville Environmental Foundation. Undated. Verde River, Arizona Spring 2012 "Test" Stream Flow Restoration Project Proposal.

PROJECT NAME: Prickly Pear Creek Re-Watering Project
PROJECT ID #: 111

DESCRIPTION OF ACTIVITY: In-stream flow restoration through water leasing agreements

LOCATION: Prickly Pear Creek, Montana

PRIMARY CONTACT:

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OBJECTIVES:

- Enhance stream flows in a de-watered reach to allow creek to regain a more natural hydrograph
- Restore the fishery of the stream and restore and maintain the integrity of the aquatic system
- Improve water quality (temperature, nutrients, sediment and metals)

BACKGROUND & DESCRIPTION OF ACTIVITY: Prickly Pear Creek is the largest tributary in the Helena Valley, flowing into Lake Helena and ultimately into the Missouri River. It provides one of the only major wetland and riparian corridors for many miles and offers critical habitat for migratory songbirds, raptors and wild fish.

The water in Prickly Pear Creek is heavily over appropriated, and historically a portion of the creek dries up each year as irrigators divert the entire flow during late summer months. For roughly 100 years, this portion of the creek has been a largely non-functional aquatic ecosystem with poor water quality, limited habitat and no connectivity or passage for fish. Section MT41I006_030 of this creek, from Wylie Drive to the Helena Wastewater Treatment Plant Discharge is identified by Montana Fish Wildlife and Parks as being chronically dewatered. In addition, Montana Department of Environmental Quality has identified this segment of Prickly Pear Creek as being impaired due to metals, nutrients, siltation and thermal modifications.

In 2008, the Montana Water Trust worked with stakeholders to develop and test a potential project to re-water Prickly Pear Creek, using funds from a 319 grant. As a result of this pilot project, a Helena Valley Irrigation District (HVID) canal was filled with water delivered from a large flood control reservoir on the mainstem Missouri River, which then served as an alternate water source for irrigators withdrawing from Prickly Pear Creek. The new withdrawals do not impact the alternate water source, which is a very large Bureau of Recreation reservoir. Contracts were signed to ensure 3,000 acre-feet of water would be made available to Prickly Pear water users via this canal, under the condition that the irrigators would cease diverting water from the creek during late summer low-flow periods.

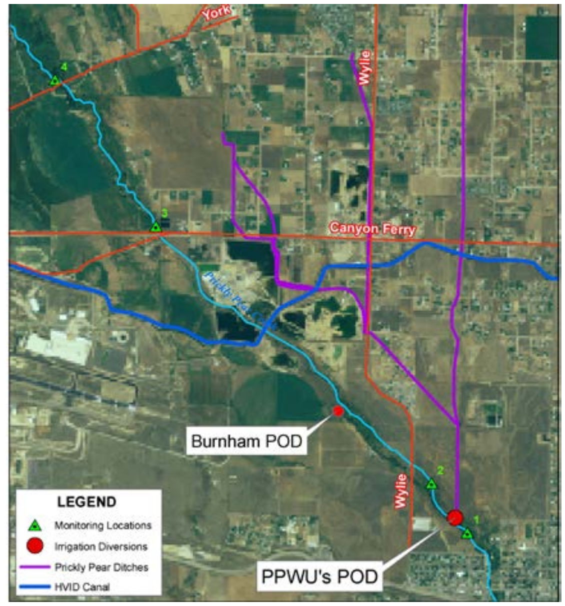
In 2010, Bonneville Environmental Foundation's Water Certificate Project program provided funding to restore the natural flow of Prickly Pear Creek throughout the dry, late summer months. As a result of this project, approximately two miles of Prickly Pear Creek that were previously dry or critically dewatered were re-watered, reconnecting habitat throughout the Prickly Pear watershed, and augmenting low flows across 2-4 additional miles of lower Prickly Pear Creek.

(Before) Prickly Pear Creek in the historically dewatered reach affected by the project (below PPWU Point of Diversion).

(After) Prickly Pear Creek in the same location of the historically dewatered reach (below PPWU Point of diversion).

The 2011 Prickly Pear Creek Montana Water Restoration Certificate Project employed a split season lease agreement with local irrigators to restore all natural flow to lower Prickly Pear Creek during the critical low flow period (July through September). Supplementary water from a Bureau of Reclamation reservoir was purchased, transferred and delivered to Prickly Pear irrigators during the late summer and ensuring that they have ample water for irrigation, while leaving all natural flow in Prickly Pear Creek during the critical summer and fall months when it was historically de-watered. The same approach was employed in 2012, resulting in the restoration of all natural flow to lower Prickly Pear Creek during the critical low flow period in 2012.

The re-watered reach of Prickly Pear Creek extends from the Prickly Pear Water User's Point of Diversion (PPWU POD) downstream (northwest) past site #4 and off the map.



This project has been independently reviewed by the National Fish and Wildlife (NFWF) Foundation and met the independent criteria for environmental flow restoration developed by NFWF (and which was based largely on criteria developed by the Independent Scientific Advisory Board for the Columbia Basin).

The project has been funded by Coca Cola in 2011 and 2012 with some additional funding provided by other partners.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1.85 BILLION LITERS

ACTIVITY TIMELINE:

- Project initiation: 2011
- Project end date: Project is funded by TCCC through 2012
- Funding beyond 2012 is unknown at this time.

COCA-COLA CONTRIBUTION: 54.6 %

Total Cost of Project: $27,472 USD

- Coca-Cola Foundation: $15,000 USD
- Bonneville Environmental Foundation and other Montana WRC customers: $12,472 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in stream flow

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1. INCREASE IN STREAMFLOW

Approach & Results (Holmes, 2012b)

In 2012, stream discharge was recorded at two locations to quantify the benefit of the Prickly Pear flow restoration project. Flow measurements were taken downstream of the Prickly Pear water users point of diversion (site 1) and at the lower end of the enhanced reach, near Canyon Ferry Road (Site 2). Flow, which without this restoration project would have been diverted to irrigators, was measured and quantified during the irrigation season. In 2012, Prickly Pear Creek hit its low flow trigger on approximately June 22, 2012, initiating the flow agreements between Farm Stream Solutions LLC, Bonneville Environmental Foundation (BEF), Helena Valley Irrigation District (HVID), Prickly Pear Creek Water User Association (PPWU) and the Bureau of Reclamation (BOR). The flow restoration project was in effect for 70 days in 2012 and restored a substantial amount of flow to Prickly Pear Creek during this period. As a result of this project, Prickly Pear Creek flowed all year in 2012. If this project were not in place, the entire volume of the creek would have been diverted to irrigators from June 25, 2012 through the end of the irrigation season into October.

2012 Benefit Calculation

- Pre-project: Based on 2012 flows, the entire volume of the creek would have been diverted to irrigators from June 25 through the end of the irrigation season into October.
- Post-project: The flow agreements between FSS, BEF, HVID, PPWU and the BOR were initiated on June 22. The flow restoration project was in effect for 70 days in 2012, restoring a substantial amount of flow to Prickly Pear Creek.

The total annual water quantity benefit resulting from decreased withdrawals (and increased stream flow) from Prickly Pear Creek was calculated as the difference in the pre-project and post-project stream flows. Stream gauging occurred over the course of the non-diversion period (once the irrigation point of diversion was shut down) to determine the amount of water this project restored to the Prickly Pear ecosystem. During this period, the total amount of water was measured that flowed past the Prickly Pear point of diversion (where irrigators had been diverting their full water right up until the project flow trigger was reached). For each day that the stream delivered water past the point of diversion, BEF calculated the amount of water that the irrigators would have diverted and used this to determine the amount restored to the creek. On days when the stream delivered more water than the total water diversion right, the benefit was calculated to be equal to the volume of the full water diversion right. Once the stream flow dropped below the full water diversion right (and the irrigators would have diverted the entire stream flow) the project was assessed to restore the full amount of flow that passed the point of diversion headgate on Prickly Pear Creek (this was the period when irrigators normally would divert the entire flow of the creek). To account for any measurement error, measured flows were decreased by 0.05%.

- Pre-project (dewatered stream): 0 BL/yr
- Post-project (stream flow resulting from the restoration project): 2,746 Acre-feet/yr =3.39 BL/yr

The total water quantity benefit is the increase in streamflow.

The total (ultimate) benefit is: 3.39 BL/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 1.85 BL/yr

The current (2012) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 2,746 AF (3.39 BL/yr) and TCCC's benefit (adjusted for cost share) is 1.85 BL/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. Benefits beyond 2012 are dependent on funding and on flows past the Prickly Pear Point of Diversion. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column. Benefits beyond 2012 are unknown and are not reported, although BEF is working with partners to try to ensure the project generates a long-term continuing benefit.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	unknown	unknown
2014	unknown	unknown
2015	unknown	unknown
2016	unknown	unknown
2017	unknown	unknown
Ultimate Benefit:	unknown	unknown

Data Sources/Site-specific characteristics:

- All data were obtained from the Prickly Pear Creek 2012 Flow Restoration Report for The Bonneville Environmental Foundation (Holmes, 2012b).

Assumptions:

- None

OTHER BENEFITS NOT QUANTIFIED

- Promote the recovery of neotropical migrant and resident birds and other terrestrial species
- Improve floodplain and in-channel conditions fish and aquatic life
- Improve water quality
- Increase recreational opportunities

NOTES

- None

REFERENCES

Bonneville Environmental Foundation, 2010 Prickly Pear Creek Montana Water Restoration Certificate Project Proposal.

Holmes, R. 2012a. Prickly Pear Creek: 2011 Flow Restoration Report for The Clark Fork Coalition and The Bonneville Environmental Foundation.

Holmes, R. 2012b. Prickly Pear Creek: 2012 Flow Restoration Report for The Bonneville Environmental Foundation

The Montana Water Trust. 2009 Prickly Pear Creek Re-Watering Project. DEQ 319 Grant Application.

PROJECT NAME: Middle Deschutes Instream Flow Restoration
PROJECT ID #: 112

DESCRIPTION OF ACTIVITY: In-stream flow restoration through water leasing agreements

LOCATION: Middle Deschutes River, Oregon from 44° 04' 33.86"N, 121°18'24.73"W to 44°30'16.29" N; 121° 18' 39.84" W

PRIMARY CONTACT:

Todd Reeve, CEO	Rena Ann Stricker	Jon Radtke
Bonneville Environmental Foundation	Contract Ecologist	Manager, Water Resources
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OBJECTIVES:

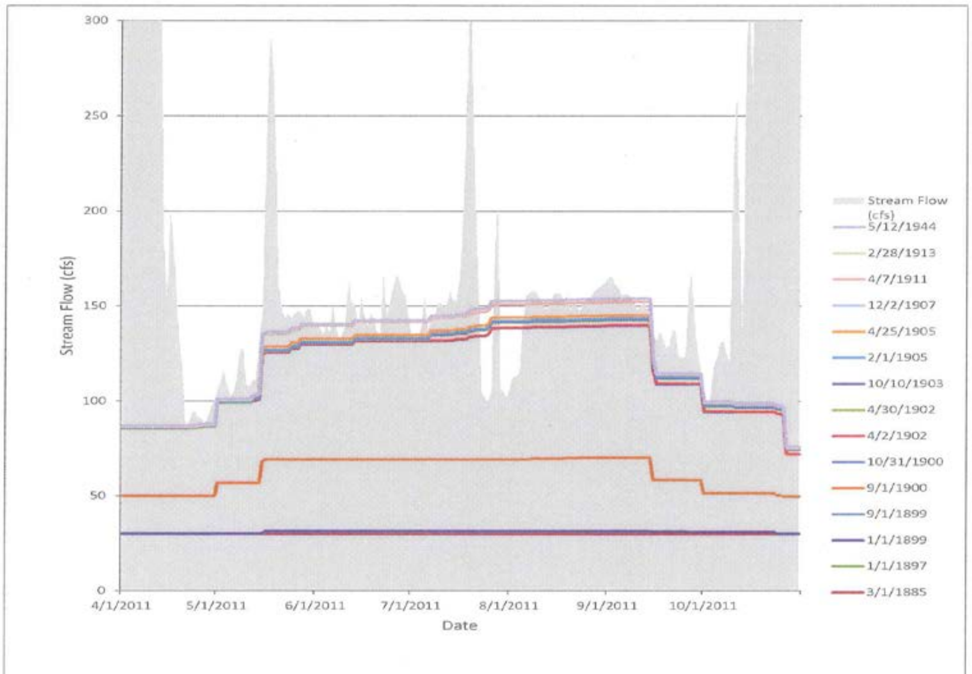
- Enhance stream flows to allow river to regain a more natural hydrograph and reestablish ecological function
- Provide native fish and wildlife benefits
- Improve water quality

BACKGROUND & DESCRIPTION OF ACTIVITY: The 35-mile section of the Deschutes River that flows between Bend, Oregon and Lake Billy Chinook, Oregon is referred to as the Middle Deschutes. The Middle Deschutes supports numerous fish and wildlife species including redband and brown trout, deer, quail, coyotes, muskrats, rattlesnakes and foxes. Historically, this section of the river has been heavily impacted by water withdrawals with 98% of the river's flow being diverted at Bend during the summer irrigation season. As a result of this flow diversion, the Middle Deschutes has suffered from poor water quality, inadequate habitat to support healthy populations of native trout and a general decline in overall river health.

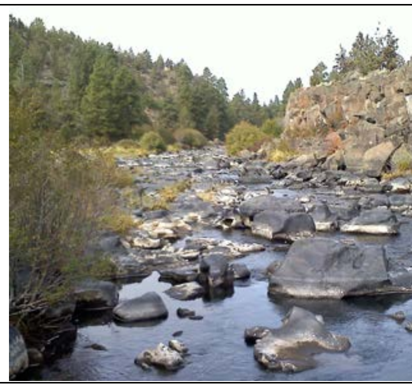
Local irrigators and the Deschutes River Conservancy (DRC) have been working to implement solutions that help balance human and environmental needs for the river water. Over the past decade, the DRC has been working with local irrigators to restore flows to the Middle Deschutes. This project facilitates a large, rotating set of annual instream flow leases to be used to restore and protect instream flow through the Oregon Department of Water Resources instream flow program. The DRC leases water rights from multiple landowners in Swalley, Central Oregon, and Arnold Irrigation Districts and protects this water in throughout dewatered Middle Deschutes.

Each year, funding is needed to a) support lease payments to irrigators, b) support efforts to enroll and protect water rights for instream benefits, and c) administer the instream leasing program.
The instream leases protect the water rights in the Deschutes River between the irrigation district diversions near the City of Bend and Lake Billy Chinook. Funding from BEF is provided to the Deschutes River Conservancy to facilitate this work, and the leasing program has successfully aggregated hundreds of individual water rights and succeeded in restoring flows for over a decade to this critically dewatered and iconic river reach.

As a result of the partnership between the DRC and local irrigators, substantially less water is now being diverted from the river. During recent irrigation seasons, almost four times more water flowed through the Middle Deschutes than it did during periods of higher historical water withdrawal. The restored stream flow is helping to foster a healthy ecosystem for people, plants and wildlife.
The figure below shows streamflow in the Middle Deschutes during the irrigation season, with 2011 protected/restored streamflow shown in grey.



Streamflow protected in the Middle Deschutes during the 2011 irrigation season compared to historical flows

		
Circa 1980—15 cfs	**Circa 1990s 45 cfs**	**Present 148 cfs**

Middle Deschutes: Progression of Flow Restoration

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1,110 MILLION LITERS/YR

ACTIVITY TIMELINE:

- Project initiation: Spring 2012 (Coke's support for project begins)
- Project end date: Project is presently funded by TCCC for 2012 only
- Funding beyond 2012 is unknown at this time.

COCA-COLA CONTRIBUTION: 12.0 %

Total Cost of Project: $210,000 USD (2012)[1]

- Coca-Cola Foundation: $25,175 USD (2012)
- Others: $184,825 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in streamflow

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1. INCREASE IN STREAMFLOW

Approach & Results

As a result of this project, the leasing agreements between DRC and multiple water rights holders in Swalley, Central Oregon, and Arnold Irrigation Districts were initiated in Spring 2012. The flow restoration project was in effect for 155 days in 2012, restoring a substantial amount of flow to the Middle Deschutes. The volume of restored streamflow in 2012 was calculated based on streamflow monitoring. The DRC and the Oregon Department of Water Resources monitor restored and protected flow at gages on the Deschutes River, near Bend—these gages are just downstream of the primary points of diversion and represent the restored flow entering into the largely inaccessible Middle Deschutes Canyon. The DRC also regularly monitors streamflow across other priority reaches in the Upper Deschutes basin. DRC provides an independent annual report on streamflow restored in the middle Deschutes.

The total annual water quantity benefit resulting from decreased withdrawals (and increased stream flow) from the Middle Deschutes was calculated based on stream gauging over the course of the non-diversion period (once the irrigation point of diversion was shut down) to determine the amount of water this project restored to the Middle Deschutes ecosystem. The volume of stream flow restored to the Middle Deschutes River as a result of the leasing program, equals 7,500 acre-feet/year (=9,251 ML/yr).

Total (ultimate) benefit is: 9,251 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 1,110 ML/yr

The current (2012) benefit and project benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 9,251 ML/yr and TCCC's benefit (adjusted for cost share) is 1,110 ML/yr.

[1] Includes full transaction, staffing, travel, and project development costs over three years for both BEF and DRC to establish this project

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. Benefits beyond 2012 are dependent on funding and on flows past the Middle Deschutes Point of Diversion. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column. Benefits beyond 2012 are unknown and are not reported, although BEF and DRC are working with partners to try and ensure the project generates a long-term continuing benefit.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	9,251 (projected)	unknown
2014	9,251 (projected)	unknown
2015	9,251 (projected)	unknown
2016	9,251 (projected)	unknown
2017	9,251 (projected)	unknown
Ultimate Benefit:	9,251 (projected)	unknown

Data Sources/Site-specific characteristics:

- Data are derived from past and current reporting facilitated by the Deschutes River Conservancy.

Assumptions:

- Assumptions are that funders will continue investing in this project to achieve long-term flow restoration results. Projections assume that TCCC funding does not continue past 2012.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for fish and aquatic life
- Improved water quality
- Increased recreational opportunities

NOTES

- All benefits (present and future) are and will be based on stream gaging measurements, and State of Oregon Water Resources Department (OWRD) "Final Orders" which designate the amount of water to be restored and protected in the dewatered reach.

REFERENCES

- Bonneville Environmental Foundation. 2010. Environmental flow program final certification. Deschutes River Conservancy WRC Transaction. October 20, 2010.
- Project results provided by contact. Project report is under development

PROJECT NAME: Indian Valley High Mountain Meadow Restoration
PROJECT ID #: 113

DESCRIPTION OF ACTIVITY: Re-wetting high mountain meadows through hydrological restoration

LOCATION: The project area is located atop the Sierra Crest of the Sierra Nevada Divide in Alpine County, California, in the Eldorado National Forest adjacent to Mokelumne Wilderness, approximately 9 miles southeast of Carson Pass and Highway 88.

PRIMARY CONTACT:

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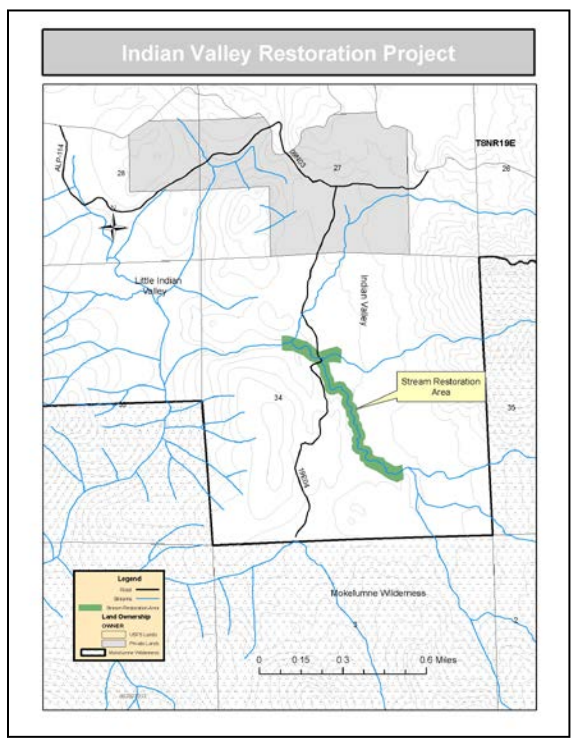
OBJECTIVES:
- Restore floodplain connectivity, groundwater recharge, and flood attenuation
- Restore wet meadow habitat
- Provide a clean and consistent water supply for human use

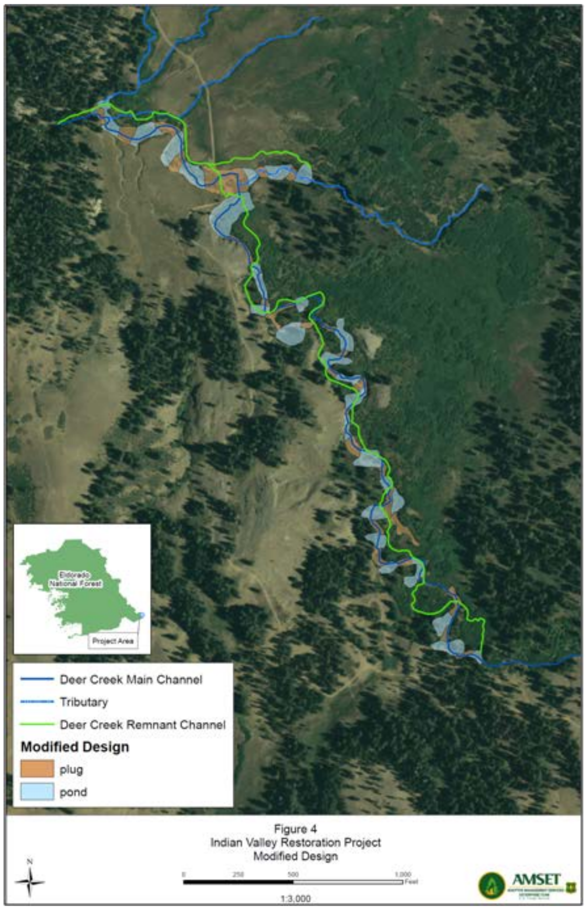
BACKGROUND & ACTIVITY DESCRIPTION: Indian Valley is a sensitive, high mountain (elevation) meadow that has been degraded due to past human activities (water development, recreational use, roads, animal grazing) and natural processes. The degraded condition consists of stream channel erosion with gullying and headcutting, sedimentation in the stream channel, lowering of the ground water table in the meadow, drying of the meadow vegetation, loss of willows, and sagebrush encroachment (Bakker 2009, USDA FS 2012a).

Pre-project degraded condition



Location of Stream Restoration Area

The desired condition for the meadow is for it to be hydrologically functional, to maintain and enhance habitat to support desired plants and wildlife, and to provide water that meets the goals of the Clean Water Act and Safe Water



Design for Meadow Restoration

Drinking Act to support downstream uses (i.e., fishable, swimmable, and drinkable after normal treatment) (USDA FS 2012a,b).

To achieve the desired condition, sites of accelerated erosion, such as gullies and headcuts, need to be stabilized and recovering. Vegetation roots also need to be established through the available soil profile. Finally, meadows with perennial streams need the following characteristics: 1) stream energy from high flows is dissipated, reducing erosion and improving water quality, 2) streams filter sediment and capture bedload to aid floodplain development, 3) meadow conditions enhance floodwater retention and groundwater recharge, and 4) root masses stabilize stream banks against cutting action) (USDA FS 2012a,b).

The restoration activities were completed in 2012 and consist of a “plug and pond” remediation method of approximately 6,000 feet of low gradient stream. Deep gullies were filled or “plugged” to encourage flows to reconnect with the remnant or historic stream channel. Shallow “ponds” were created to connect the stream channel to its floodplain, increase groundwater replenishment and improve aquatic habitat. Volunteer labor was used for revegetation, seeding, planting, and monitoring of project effectiveness (USDA FS 2012a,b).

These restoration activities have restored channel connections to the floodplain, attenuated peak floods and increased groundwater recharge during spring snowmelt. The increased groundwater allows for increased summer baseflow and restoration of wet meadow habitat to maintain and enhance plants and wildlife. The created ponds add complexity to the floodplain and provide amphibian rearing and breeding habitat with warmer, shallow edges for tadpoles, and deeper pools with boulders for amphibian escape cover. A reduction in sediment erosion will also improve water quality.

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 305 ML/YR

ACTIVITY TIMELINE:

- August 2012 – Project initiation
- October 2012 – Project completion

COCA-COLA CONTRIBUTION: 100%

- Total cost (USD) for meadow restoration 2012: $350,000 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in annual groundwater storage

1. INCREASE IN ANNUAL GROUNDWATER STORAGE

Approach & Results:

The Replenish benefit was calculated as the increase in annual groundwater storage resulting from meadow restoration. This volume was predicted based on the following equation (National Fish and Wildlife Foundation 2010):

Storage change = meadow area x average gully depth x specific yield x shape factor

where:

Storage change (acre-ft)
Increase in annual ground water storage as a result of meadow restoration

Meadow area (acres)
Total area of the meadow affected by restoration = 500 acres

Average gully depth
Estimate of an average gully depth = 3 feet

Specific yield (%)
Average specific yield of the meadow alluvium = 33%.
Specific yield is defined as the ratio of the volume of water that a saturated soil will yield by gravity to the total volume of soil. Based on soil properties of similar meadows in the project area, silty, fine sand was assumed as the most prevalent texture of the alluvial deposit in the meadow (ICF Jones and Stokes 2008). Typical average specific yield corresponding to fine sand is 33% (ICF Jones and Stokes 2008).

Shape factor (unitless)
A shape factor of 0.5 was assumed to account for the shape of the alluvium that extends from the incised stream to the edge of the basin (ICF Jones and Stokes 2008).

Increase in annual ground water storage as a result of meadow restoration = 247.5 acre-ft = 305 ML/yr

The total benefit for this project is: 305 million liters per year (ML/yr).

Total (ultimate) benefit is: 305 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 305 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 305 ML/yr and TCCC's benefit (adjusted for cost share) is 305 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	305	305
2014	305	305
2015	305	305
2016	305	305
2017	305	305
Ultimate Benefit:	305	305

Data Sources:

- The US Department of Agriculture Forest Service (USDA FS) provided the total area of the meadow affected by restoration and the estimate of an average gully depth.
- The average specific yield of the meadow alluvium and the shape factor was based on guidance provided in ICF Jones and Stokes (2008).

Assumptions:

- The most prevalent texture of the alluvial deposit in the meadow was assumed to consist of silty, fine sand based on soil properties of similar meadows in the project area.
- To account for the shape of the alluvium that extends from the incised stream to the edge of the basin, a shape factor of 0.5 was assumed.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in sediment loading
- Improve water quality
- Provide shading/reduce water temperatures
- Improve habitat/increase biodiversity
- Protect drinking water supply

NOTES

- None

REFERENCES

Bakker, G. 2009. Indian Valley Restoration Project Amador Ranger District Eldorado National Forest. Hydrology, Specialist Report. United States Forest Service (USFS), Adaptive Management Services Enterprise Team, Nevada City, California, December 2009.

ICF Jones and Stokes. 2008. Consultant's Report, Plumas Watershed Forum Program Review Prepared for: Plumas County Flood Control and Water Conservation District, County of Plumas Courthouse, Quincy, CA. May 2008.

National Fish and Wildlife Foundation (NFWF). 2010. Sierra Nevada Meadow Restoration. Business Plan. March 5, 2010.

United States Department of Agriculture Forest Service (USDA FS)a. 2012. Environmental Assessment for Indian Valley Restoration Project. Eldorado National Forest. USDA FS, Pacific Southwest Region, Region 5, Report No. R5-MB-000, May 2012.

United States Department of Agriculture Forest Service (USDA FS)b . 2012. Working Together, Indian Valley Meadow Restoration Project. USDA FS, Pacific Southwest Region, Region 5. URL: http://www.fs.usda.gov/detailfull/r5/workingtogether/?cid=stelprdb5390138&width=full [Accessed October 16, 2012].

PROJECT NAME: Trail Creek Restoration, Colorado
PROJECT ID #: 114

DESCRIPTION OF ACTIVITY: Construction of sediment detention basins and rehabilitation of alluvial fans.

LOCATION: The Trail Creek Watershed is located in the Pike National Forest, approximately 55 miles south of Denver, Colorado.

PRIMARY CONTACT:

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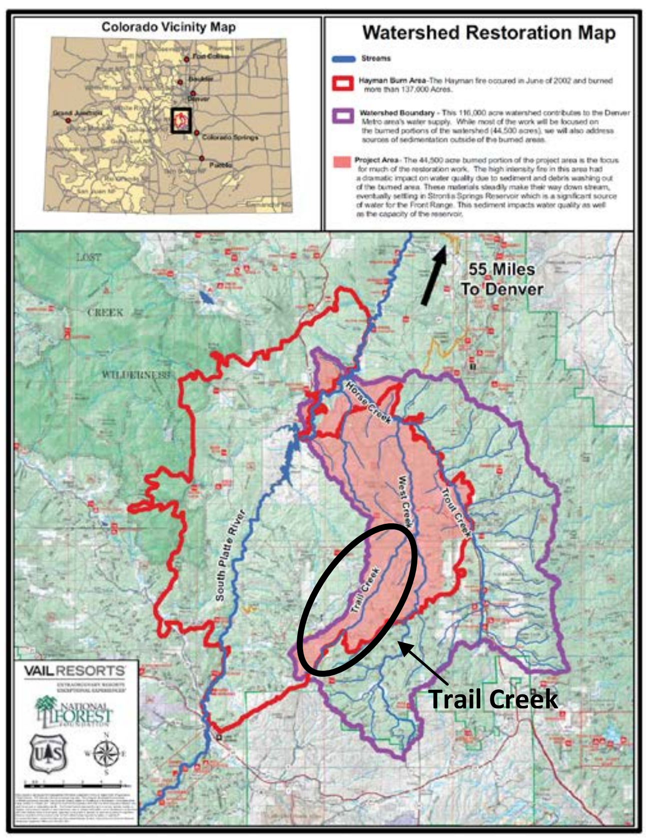
OBJECTIVES:

- Positively impact the water supply and storage capacity for the Denver Metro water supply
- Reduce erosion
- Improve water quality

BACKGROUND & ACTIVITY DESCRIPTION: The Trail Creek Watershed is located within the Hayman Fire area. The 2002 Hayman Fire, until recently, was the largest and most destructive in Colorado's history. The fire burned a total of 137,760 acres in the Pike National Forest, as well as on state, county and private lands, eradicating ground cover and allowing the transportation of bare soils into the source water watershed of Denver's water supply. The fire consumed 600 structures and damaged habitat for numerous threatened or endangered species, and severely impacted the water source for more than 75% of Colorado's 4.3 million residents and states downstream (Vail Resorts et al., 2012). The US Forest Service (USFS) is addressing post-fire restoration needs through a public-private partnership, The Hayman Restoration Partnership. This partnership is helping to reduce erosion and improve water quality, replenishing water for Colorado residents by positively impacting the water supply and storage capacity for the Denver Metro water supply.



Trail Creek Project Location

Trail Creek tributary showing unstable banks and erosion processes

The Hayman Fire area contains 59 sub-watersheds, and sub-watershed 6 is the number one priority due to large sediment yields from roads, surface erosion, streambank erosion and post-fire excess peak flows (Rosgen 2011a). Sub-watershed 6 drains to Trail Creek. The restoration approach for this sub-watershed addresses three major sources of sediment to Trail Creek: channel processes; surface erosion; and roads and trails. Most of the restoration activities within sub-watershed 6 are related to channel processes, as the channels within this sub-watershed are incised, confined and associated with headcuts (Rosgen 2011a,b).

The major restoration activities include construction of sediment detention basins and rehabilitation of alluvial fans of two impaired tributaries that drain to Trail Creek (Rosgen 2011a,b). These activities are projected to restore the function of alluvial fans to naturally store sediment directly below high sediment supply and high transport stream types; reduce accelerated streambank erosion rates; and eliminate any advancing headcuts (Rosgen 2011a,b). Restoration activities also include slope revegetation efforts to increase ground cover density to reduce surface erosion on exposed stream slopes (Rosgen 2011a,b).

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 232 ML/YR

ACTIVITY TIMELINE:

- March 2012 – Project initiation
- November 2012 - Project completion

COCA-COLA CONTRIBUTION: 100%

- Total cost (USD) for stream channel restoration 2012: $150,000 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment load

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1. DECREASE IN RUNOFF

Approach & Results:

Table 1 presents modeled flows for three different conditions in sub-watershed 6. These are pre-fire condition, post-fire condition, and post-restoration condition. The water "restoration benefits" are defined as the decrease in runoff, or runoff, expected to occur after restoration activities are complete. These benefits were estimated as the difference between "post-fire" and the estimated "post-restoration" conditions using modeled flow results from Rosgen (2011b), and are presented in Table 1 for sub-watershed 6.

Table 1. Estimates of Runoff from Sub-Watershed 6 (Source: Rosgen, 2011b)

	Pre-Fire	Post-Fire	Total Increase	Post-Restoration	Water Restoration Benefits
Runoff (acre-ft/yr)	2,069	2,421	352	2,152	269

Using the values from Table 1, the water "restoration benefits" were estimated as the difference between "post-fire" and the estimated "post-restoration" conditions.

Runoff (acre-ft/yr) = 2,421 [Post-Fire] – 2,152 [Post-Restoration] = 269 acre-ft/yr

The "restoration benefits" presented in Table 1 represent an upper bound estimate resulting from all of the restoration activities in sub-watershed 6. It was assumed that 70% of the estimated water "restoration benefits" would result from the activities identified above and described in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

Runoff (acre-ft/yr) = 269 acre-ft/yr x 0.70 = 188 acre-ft/yr

Estimated Replenish Benefit = 188 acre-ft/yr = 232 ML/yr

The total benefit for this project is: 232 million liters per year (ML/yr).

Total (ultimate) benefit is: 232 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 232 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 232 ML/yr and TCCC's benefit (adjusted for cost share) is 232 ML/yr.

Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	232	232
2014	232	232
2015	232	232
2016	232	232
2017	232	232
Ultimate Benefit:	232	232

Data Sources:

- Modeled flow results for sub-watershed 6 were obtained from Page D-33 of Appendix-D of the Rosgen (2011b) report.

Assumptions:

- It was assumed that 70% of the estimated "restoration benefits" would result from the activities described in the "Background & Description of Activity" section above and in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

2. DECREASE IN SEDIMENT LOAD

Approach & Results:

Table 3 presents modeled flows for three different conditions in sub-watershed 6. These are pre-fire condition, post-fire condition, and post-restoration condition. The sediment "restoration benefits" are defined as the decrease in sediment load expected to occur after restoration activities are complete. These benefits were estimated as the difference between "post-fire" and the estimated "post-restoration" conditions using modeled sediment results from Rosgen (2011b), are presented in Table 3 below for sub-watershed 6.

Table 3. Estimates of Sediment Load from Sub-Watershed 6

	Pre-Fire	Post-Fire	Total Increase	Post-Restoration	Restoration Benefits
Sediment (ton/yrs)	65	1,705	1,640	460	1,245

Using the values from Table 3, sediment "restoration benefits" were estimated as the difference between "post-fire" and the estimated "post-restoration" conditions.

Sediment (tons/yr) = 1,705 [Post-Fire] – 460 [Post-Restoration] = 1,245 tons/yr

The "restoration benefits" presented in Table 3 represent an upper bound estimate resulting from all of the restoration activities in sub-watershed 6. It was assumed that 70% of the estimated sediment "restoration benefits" would result from the activities identified above and described in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

Sediment (tons/yr) = 1,245 tons/yr x 0.70 = 871.5 tons/yr

Estimated reduction in sediment load as a result of restoration activities: 871.5 tons/yr

The total benefit (sediment load reduction) is: 871.5 tons per year (tons/yr).

The total benefit (reduced sediment load) is: 871.5 tons/yr and TCCC's benefit (adjusted for cost share) is 871.5 tons/yr

The 2012 benefit is: 871.5 tons/yr and TCCC's benefit (adjusted for cost share) is 871.5 tons/yr

Data Sources:

- Modeled sediment yield results for sub-watershed 6 were obtained from Page D-33 of Appendix-D of the Rosgen (2011b) report.

Assumptions:

- It was assumed that 70% of the estimated "restoration benefits" would result from the activities described in the "Background & Description of Activity" section above and in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

OTHER BENEFITS NOT QUANTIFIED

- Reestablish a functional riparian corridor
- Provide ecological restoration (including birds, fish, mammals and amphibians)
- Improve fish habitat diversity and function
- Reduce road and trail maintenance
- Provide for improved recreational opportunities

NOTES

- None

REFERENCES

Rosgen, D. 2011a. The Trail Creek Watershed Master Plan for Stream Restoration and Sediment Reduction. Wildland Hydrology, Fort Collins, Colorado. April 22, 2011.

Rosgen, D. 2011b. Trail Creek Watershed Assessment and Conceptual Restoration Plan The WARSSS Results of the Hayman Fire. Wildland Hydrology, Fort Collins, Colorado. February 18, 2011.

Vail Resorts, National Forest Foundation, United States Department of Agriculture Forest Service (USDA FS). 20120. Hayman Overview. URL:http://www.nationalforests.org/press/releases/haymanevent [Accessed October 17, 2012]

PROJECT NAME: Dawson Forest Acquisition (Georgia for Generations)
PROJECT ID #: 115

DESCRIPTION OF ACTIVITY: Conservation of Dawson Forest

LOCATION: Dawson Forest is located in the Etowah River watershed, a subbasin of the Coosa River Basin in the state of Georgia

PRIMARY CONTACT:

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OBJECTIVES:

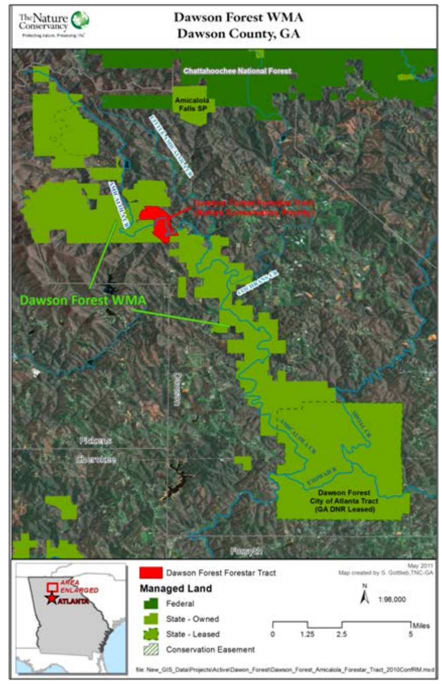
- Maintain natural hydrologic regime and water quality
- Ensure habitat connectivity
- Protect biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: Dawson Forest is an oasis for both people and wildlife, providing a wide range of outdoor recreational opportunities for out-of-state visitors and the metro-Atlanta population. The scenic beauty and abundant wildlife are important to the economic vitality of the local counties and the state, and the forest serves as an active wildlife corridor for both game (black bear, deer, turkey, doves, quail, rabbits) and non-game species (migratory birds). Important for its ecological diversity, this property contains mature hardwood forests and nearly two miles of Amicalola Creek, a vital tributary to the Etowah River (TNC, 2012).

The stunning beauty of Dawson Forest and its proximity to the metro-Atlanta area make this tract highly desirable for residential development and limited agriculture. In support of the conservation of Dawson Forest, The Nature Conservancy (TNC) secured a 469-acre (189.8 hectare) parcel that is an in-holding within the state-owned Dawson Forest Wildlife Management Area (WMA). Sources of funding for conservation in the area and along the Etowah River have come from United States Fish and Wildlife Service grants, mitigation funds from the Georgia Wetland Trust Fund administered by the Georgia Land Trust Service Center, grants and low-interest loans from the Georgia Land Conservation Program, private funds from the Woodruff Foundation, and Coca Cola's "Georgia For Generations" grant program (TNC 2012).

Dawson Forest (TNC, 2012)

The acquisition of this forest brings the land under state ownership and prevents land conversion from forestland to residential and agricultural uses that would negatively impact the natural hydrologic regime and water quality of Amicalola Creek and the Etowah River. The acquisition also protects tributaries of the upper Etowah, which harbor many endangered, threatened, and rare aquatic species. In addition, the tract fills the gap between 15,000 acres of state owned property to the north and 10,000 acres of state managed property to the south, creating over 25,000 acres of connected, protected forest. The acquisition of this tract maintains contiguous buffers along Amicalola Creek and its tributaries. Furthermore, since this tract fills in the gap between the WMA's Wildcat Creek area and Amicalola area, it extends the length of contiguous corridor protection for Amicalola Creek, safeguarding downstream habitat (TNC, 2012).



Location of Dawson Forest Acquisition

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 29.7 ML/YR

ACTIVITY TIMELINE:

- 2008 – Project initiation
- 2012 – Project completion

COCA-COLA CONTRIBUTION: 14%

- TCCC contribution: $700,000 USD
- Total cost (USD) for forest acquisition 2012: $5,000,000 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment erosion/runoff

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1. DECREASE IN RUNOFF

<u>Approach & Results:</u>

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff that would occur by preventing the conversion of forest to residential development (assumed to be 290.8 acres of pervious surface and 178.2 acres of impervious surface for a total of 469 acres). Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the without protection condition and the with protection condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

For the 290.8 acre (117.7 hectare) pervious residential development parcel:

- <u>Without protection</u>: (pervious residential development)

- Hydrologic soil group (HSG) "C"
- Lawns in "good" condition , grass cover >75% (CN = 74)

- With protection: (forested)
  - Hydrologic soil group (HSG) "C"
  - Woodland in "good" condition (CN = 70)

For the 178.2 acre (72.1 hectare) impervious residential development parcel:

- Without protection: (impervious residential development)
  - Hydrologic soil group (HSG) "C"
  - Pavement, driveways, rooftops, etc. (CN = 98)
- With protection: (forested)
  - Hydrologic soil group (HSG) "C"
  - Woodland in "good" condition (CN = 70)

Daily precipitation and air temperature data were obtained from the EPA's Better Assessment Science Integrating Point and Non-point Sources (BASINS) meteorological database for the 3 Miles NNW Dahlonega (COOP ID: 2479) station for the 1970 to 2006 time period (http://www.epa.gov/waterscience/ftp/basins/met_data/). Years 1997 to 2006 were selected for the analysis because the average precipitation for these ten years (1,449 mm) was consistent with the annual average precipitation range (~1,320 to 1,626 mm) reported for the area by GDNR EPD (1998). The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963). Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as the difference in the without conservation and with conservation runoff volume.

- Without conservation (pervious plus impervious residential development) runoff volume: 1,454 ML/yr

- With conservation (mature forest) runoff volume: 1,242 ML/yr

The total (ultimate) benefit is: 212.2 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 29.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 212.2 ML/yr and TCCC's benefit (adjusted for cost share) is 29.7 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	212.2	29.7
2014	212.2	29.7
2015	212.2	29.7
2016	212.2	29.7
2017	212.2	29.7
Ultimate Benefit:	212.2	29.7

Data Sources:

- Size of protected land area: 469 acres (189.8 hectares) (provided by contact)
- Slope: ~10% (conservative estimate from global GIS datasets)
- Soil type: assigned as HSG "C" (low infiltration rates) based on the NRCS Soil Survey Geographic (SSURGO) database (http://soils.usda.gov/survey/geography/ssurgo/)
- Daily precipitation and air temperature data were obtained from the BASINS meteorological database for the 3 Miles NNW Dahlonega (COOP ID: 2479) station (http://www.epa.gov/waterscience/ftp/basins/met_data/).

Assumptions:

- If the land were not protected, it would become medium-density residential development
- The medium-density residential development area is assumed to be 62% pervious (290.8 acres) and 38% impervious (178.2 acres)(Neitsch et al., 2011).
- SWAT model parameter "CNCOEF" was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the SWAT model was used to compute the change in sediment erosion and washoff that would occur as a result if the land were not protected from residential development. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for years 1997 to 2006.

The Cover/Management Factors (C_{usle}) used in the MUSLE were estimated as follows based on Haith (1992):

- Without protection: pervious residential development, open space with ~80% grass cover assumed (C_{usle} = 0.01)
- Without protection: impervious residential development; rooftops, driveways, rooftops, etc. with minimum sediment availability assumed (C_{usle} = 0.0)
- With protection: woodland with 75-100% tree canopy (C_{usle} = 0.001)

Total annual sediment yields for the residential and forested land areas were estimated as follows:

- Without protection (residential) sediment yield: 1,691 MT/yr
- With protection (forested) sediment yield: 282 MT/yr

The total benefit (sediment yield reduction) is: 1,409 MT/yr

The total benefit (reduced sediment yield) is: 1,409 MT/yr and TCCC's benefit (adjusted for cost share) is 197 MT/yr.

The 2012 benefit is: 1,409 MT/yr and TCCC's benefit (adjusted for cost share) is 197 MT/yr.

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The tree canopy in the forested areas was assumed to be mature.
- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER BENEFITS NOT QUANTIFIED

- Protection of habitat and biodiversity

NOTES

- None

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PROJECT NAME: Construction of Check Dams in Rajasthan and Himachal Pradesh, India
PROJECT ID #: 116

DESCRIPTION OF ACTIVITY: Check dam construction for recharge

LOCATION: Nagrota, Tappa and Bedu Khuaa villages in Himachal Pradesh and Ajmer region in Rajasthan

PRIMARY CONTACT:

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OBJECTIVES:
- Harvest catchment runoff and recharge local aquifer
- Provide source to meet irrigation water demand during non-monsoon season

BACKGROUND & ACTIVITY DESCRIPTION: The primary objective of the projects is to increase groundwater recharge to improve water supply reliability for agriculture in a region subject to severe droughts. Water is collected during the monsoon season through construction of small check dams on fourth order streams.

Check dams were constructed in the states of Himachal Pradesh and Rajasthan. In Himachal Pradesh, three check dams were constructed in Nagrota, Tappa and Bedu Khuaa villages. The construction of check dams was conducted by local panchayats and with the help of local villagers. About 2,000 villagers in the area are benefiting from the projects. In Rajasthan, two check dams were constructed in Mandavaria and Paluna villages at Ajmer district to recharge local groundwater in this drought prone village. About 10,000 villagers are benefiting from the construction of the check dams.

No impacts on ecological flows have been observed or are anticipated. The check dams are constructed on small ephemeral fourth order streams to collect flash flood waters. TCCC India does not construct check dams on higher order rivers because of potential impacts on ecological flows.

The photographs below provide before and after images of the project sites.

Check dam (before and after construction) at Nagrota Surin village in Himachal Pradesh

Check dam (before and after construction) at Tappa village in Himachal Pradesh

Check dam (before and after construction) at Bedu Khuaa village in Himachal Pradesh

Check dam (before and after construction) at Mandavaria village in Rajasthan

Check dam (before and after construction) at Paluna village in Rajasthan

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1,806 ML/YR

ACTIVITY TIMELINE:

Himachal Pradesh

- Project was started in 2010 and completed in 2011

Rajasthan

- Project was started in 2011 and completed in 2012

COCA-COLA CONTRIBUTION: 100%

- Funding for construction of check dams in Himachal Pradesh - $75,000 USD
- Funding for construction of check dams in Himachal Pradesh - $149,170 USD

WATERSHED BENEFITS CALCULATED:

1. Increased infiltration

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1. INCREASED INFILTRATION

Approach & Results:

The majority of the run-off in the watershed occurs during the monsoon season. The volume of water available for aquifer recharge is estimated by calculating the supply of available runoff from the catchment according to the following equation:

Supply (m3) = Catchment Area (m2) x Annual Rainfall (m) x Catchment Coefficient

The "supply" from the catchment is compared to the storage potential of the check dam. Storage potential was estimated by calculating the number of times the ponded area of the check dam will fill to maximum volume. The pond volume was estimated using the dimensions provided in Table 1. The available "supply" from the catchment is then compared to the storage potential of the check dam. The volume of water available for recharge is estimated as the minimum of supply and storage potential.

India Division suggested that for catchments in its natural state a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations to account for any evaporation or usage loss during storage of water in the check dams. Therefore, when the supply is less than the available storage potential, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of "supply" is in excess of the available storage potential, evaporation and usage losses are accounted explicitly by assuming a fraction of stored water was lost and the remaining amount was considered as benefit.

Table 1. Dimensions of the ponded area of the check dam

State	Check Dam Location	Length (m)	Width (m)	Avg. Depth (m)	Pond Volume (m3)
Himachal Pradesh	Nagrota Surin	750	46.6	2	69,945
	Tappa	700	36	2.57	64,764
	Bedu Khuaa	600	37	1.5	33,300
Rajasthan	Mandavaria	950	500	4.1	1,947,500
	Paluna	1,800	1,200	3.8	8,208,000

Table 2. Summary of check dam characteristics and estimated recharge volume

State	Location of Check Dam	Catchment Area (ha)	Annual Rainfall (mm)	Supply (m3/yr)	Storage Potential (m3)	Recharge Volume[1] (m3/yr)	Total Recharge Volume (m3/yr)
Himachal Pradesh	Nagrota Surin	320	1599	383,760	139,890	83,934	201,611
	Tappa	494	1599	592,430	129,528	77,717	
	Bedu Khuaa	202	1599	242,249	66,600	39,960	
Rajasthan	Mandavaria	713	499	266,680	1,947,500	266,680	1,604,551
	Paluna	2,704	660	1,337,872	8,208,000	1,337,872	

[1]For Rajasthan sites, supply was less than storage potential, therefore supply side was considered as the benefit. For Himachal Pradesh sites, supply was greater than available storage. Therefore, a 40% loss of storage potential was accounted for evaporation and usage and the reminder 60% was considered as the benefit.

The benefit is estimated as sum of the total recharge volume from Himachal Pradesh and Rajasthan sites.

Total benefit (increased infiltration) = 201,611 + 1,604,551 = 1,806,162 m3/yr = 1,806 ML/yr

The total (ultimate) benefit is: = 1,806 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: = 1,806 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for the implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 1,806 ML/yr and TCCC's benefit (adjusted for cost share) is 1,806 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	1,806	1,806
2014	1,806	1,806
2015	1,806	1,806
2016	1,806	1,806
2017	1,806	1,806
Ultimate Benefit:	1,806	1,806

Data Sources:

- All data used in the calculations were provided by the Coca-Cola India Division

Assumptions:

- For Himachal Pradesh sites, due to high rainfall and hard rock sub-surface geology it was conservatively assumed that storage potential is equal to twice the ponded volume (i.e., filled twice in a year).
- For the Rajasthan sites, due to limited rainfall, storage volume is assumed equal to the volume of the pond.

OTHER BENEFITS NOT QUANTIFIED

- Decrease in sediment erosion/runoff
- Employment opportunities through project construction
- Wildlife have been observed drinking water at night

NOTES

- None

REFERENCES

- Calculations in Excel file named: India-CheckDams_v2.xlsx

PROJECT NAME: Rehabilitation of Farm Ponds across India
PROJECT ID #:117

DESCRIPTION OF ACTIVITY: Desilting and rejuvenation of farm ponds

LOCATION: Various locations in the states of Andhra Pradesh**,** Chhattisgarh, Delhi, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal.

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OBJECTIVES:
- Recharge local aquifers
- Provide source water for irrigation

BACKGROUND & ACTIVITY DESCRIPTION: Some Indian farmers have developed ponds in localized depressions that collect water that is used for irrigation. However, over the years the ponds often get silted up due to lack of required maintenance. With the help of the bottlers, various farm ponds have been identified and rejuvenated using appropriate technology options suitable to local topographical, geological, hydrological and usage conditions. Such rejuvenated ponds recharge the aquifer during the monsoon period and provide water for farmers during the irrigation period.

The project activity involves three steps in design of an engineered system: 1) identification of localized depression and silted ponds; 2) desilting of the ponds and the removal of bottom clay material; and 3) installation of a shaft system to facilitate recharge of ground water (Figure 1). Desilting typically increases the pond depth from 2-3 meters to 3-5 meters, depending on the location. To date, function has been restored in a total of 40 farm ponds in seven states: Andhra Pradesh, Chhattisgarh, Delhi, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal. Approximately 50,000 villagers are benefiting as a result of these activities. The projects are maintained annually.

Figure 1. Farm pond showing recharge shafts on the bottom surface

SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 893.5 ML/YR

ACTIVITY TIMELINE:

- The projects were initiated in 2010 and all were completed in 2012

COCA-COLA CONTRIBUTION: 100% (except for one pond which is 50% funded)

- All projects are funded and implemented by the Coca-Cola bottlers in the local community

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Increased infiltration

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1. INCREASED INFILTRATION

Approach & Results:

The benefit is calculated as the volume of water recharged to the aquifer. The volume of water available for aquifer recharge is estimated separately for each farm pond by calculating the supply of available runoff from the catchment according to the equation below:

Supply (m3) = Catchment Area (m2) x Annual Rainfall (m) x Catchment Coefficient

The supply from the catchment is then compared to the storage potential of the farms ponds. Storage potential was estimated by considering the number of times the farm ponds will fill to maximum volume. It was conservatively assumed that each pond can potentially be filled twice (in case of hard rock sub-surface geology) and three times (in case of soft rock sub-surface geology) to its volume annually. The volume of water captured by the farm pond is estimated as the minimum of supply and storage potential.

The total volume of each pond, catchment area, and annual rainfall were provided by the India Division. India Division suggested that for catchments in their natural state a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations to account for uncertainties in the catchment area estimation and any evaporation or usage loss during storage of water in the farm ponds. Therefore, when the supply is less than the available storage potential, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of "supply" is in excess of the available storage potential, evaporation and usage losses are accounted explicitly by assuming a fraction of stored water was lost and the remaining amount was considered as benefit. When supply is greater than available storage, it is assumed that 50% of the water captured in the ponds is lost to evaporation and withdrawal for irrigation. This is a conservative assumption because the shaft design in the pond will facilitate quick recharge of the stored water. The recharge volume is estimated as the volume of captured water remaining after evaporative losses and withdrawals.

The total estimated benefit (increase in recharge) from the farm ponds is 929.9 ML/yr

The total (ultimate) benefit is: 929.9 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 893.5 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for the implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 929.9 ML/yr and TCCC's benefit (adjusted for cost share) is 893.5 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quality Benefits Summary

Year	Total Benefit (ML/yr)*	Adjusted for TCCC Cost Share (ML/yr)
2013	929.9	893.5
2014	929.9	893.5
2015	929.9	893.5
2016	929.9	893.5
2017	929.9	893.5
Ultimate Benefit:	929.9	893.5

*It is assumed that projected benefits will remain the same as 2012.

Data Sources:

- Data on pond volumes, catchment areas and rainfall were provided by the Coca-Cola India Division.

Assumptions:

- The farms ponds are maintained properly to prevent further silting. This includes annual clearing the openings of the recharge shafts of debris prior to the arrival of monsoon rain.

OTHER BENEFITS NOT QUANTIFIED

- Local employment opportunities during construction and maintenance
- Increased incomes due to improved water supply and higher yields

NOTES

- None

REFERENCES

Calculations in Excel file named: 117_India_Farmponds_v3.xls

PROJECT NAME: Coca-Cola Rain Gardens
PROJECT ID #: 118

DESCRIPTION OF ACTIVITY: Construction of rain gardens in the United States

LOCATION: Village of Niles, IL; Lexington, KY, St. Louis, MO, Atlanta, GA, Etowah, GA, , Canton, GA, Seminole County, GA, Montgomery, AL, Trussville, AL, Birmingham, AL, Grand Rapids, MI, Jacksonville, FL

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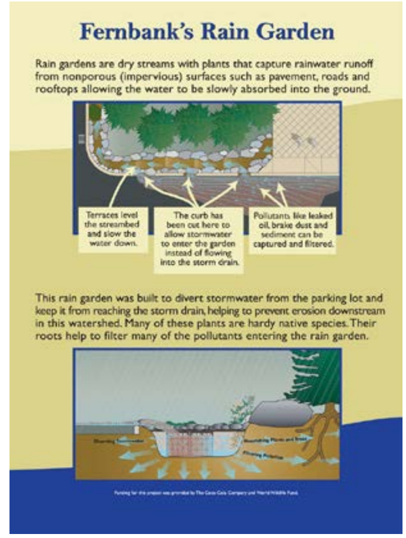
OBJECTIVES:
- Reduction of sediment and other pollutant run-off
- Improved stormwater infiltration

BACKGROUND & ACTIVITY DESCRIPTION: A rain garden is a shallow depression that is designed to capture rainfall and stormwater runoff. It is usually a small garden of plants that can withstand the extremes of moisture and elevated levels of nutrients found in stormwater runoff. Rain gardens are ideally located close to the source of the runoff and they serve to slow the stormwater as it travels downhill, giving the water more time to infiltrate and less opportunity to gain momentum and erosive power.

Coca-Cola has funded rain gardens at various locations in the United States to reduce stormwater runoff, and help prevent erosion downstream in the project watersheds. In some locations such as Lexington, KY, the use of native wildflower and grass species provides food for numerous pollinators and birds.

Diagrams of some of the rain gardens are shown below.

Village of Niles, conceptual plan



SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 44.42 ML/YR

ACTIVITY TIMELINE:

- Through 2012 - Fifteen rain gardens have been completed.

COCA-COLA CONTRIBUTION: Variable, as shown below.

Name	TCCC cost share (% of total cost)	Partner
Village of Niles (IL)	100%	**Village of Niles**
Lexington Rain Garden #1 (KY)	100%	Bluegrass Rain Garden Alliance
Lexington Rain Garden #2 (KY)	11%	Bluegrass Rain Garden Alliance
St. Louis -2 gardens (MO)	100%	Maryland Heights CCR
Etowah - 2 gardens (GA)	100%	WWF, Upper Etowah River Alliance
Bioswales in Jacksonville (FL)	100%	St. Johns Riverkeeper
Canton Fire Station (GA)	71%	TNC, WWF, Upper Etowah River Alliance
Montgomery (AL)	100%	WWF, Alabama Clean Water Partnership
Trussville Library (AL)	100%	WWF, Cahaba River Society
Grand Rapids (MI)	*	West Michigan Environmental Action Committee
Birmingham (AL)	100%	United Bottling Company
Seminole County/Donalsonville (GA)	100%	TNC
Fernbank Rain Garden (GA)	100%	**WWF**

**Note: information is not yet available for the rain garden in Grand Rapids, MI*

WATERSHED BENEFITS CALCULATED:

1. Decrease in stormwater runoff into sewers and streams

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1. DECREASE IN STORMWATER RUNOFF INTO SEWERS AND STREAMS

Approach & Results:

The water quantity benefit was calculated separately for each rain garden, using the CCNA Rain Garden Calculator. Based on annual average rainfall, the CCNA Rain Garden tool estimates the volume captured based on the area of rain garden and the runoff that flows into the rain garden from pervious and impervious surfaces.

Inputs

Annual Average Precipitation:

The user inputs annual precipitation in inches/year. If the annual precipitation is not known, the user can input location information by either selecting the location of interest from 'location/region' or by inputting the latitude and longitude of the site. The CCNA Rain Garden Calculator then provides an estimate of annual precipitation for that location.

Catchment Area:

Catchment area is the drainage area that will contribute runoff to the rain garden. The areas of pervious and impervious surfaces that are contributing runoff to the rain garden are entered by the user.

Total Area of Rain Garden:

This input represents the total area of the rain garden designed to capture rainfall and runoff

Calculator

The CCNA Rain Barrel Calculator calculates the total volume of runoff captured by the rain garden in million liters per year (ML/yr), based on the following equation:

Runoff = runoff from pervious catchment surfaces + runoff from impervious catchment surfaces + rainfall volume directly on rain garden

Runoff (ML/yr) = [annual rainfall (in/yr) x area of pervious surface (acres) x 0.25] + [annual rainfall (in/yr) x area of impervious surface (acres) x 0.85] + [annual rainfall (in/yr) x area of rain garden (acres) x 1 x 0.0254] x 4046.8564/1000

Rain Garden Location	Total estimated 2012 benefit (ML/yr)	TCCC estimated 2012 benefit adjusted for cost share (ML/yr)
Village of Niles (IL)	5.5	5.5
Lexington Rain Garden #1 (KY)	3.2	3.20
Lexington Rain Garden #2 (KY)	6.84	0.75
St. Louis -2 gardens (MO)	4.35	4.35
Etowah - 2 gardens (GA)	5.15	5.15
Bioswales in Jacksonville (FL)	1.75	1.75
Canton Fire Station (GA)	0.59	0.42
Montgomery (AL)	0.72	0.72
Trussville Library (AL)	0.24	0.24
Grand Rapids (MI)		
Birmingham (AL)	21.40	21.40
Seminole County/Donalsonville (GA)	0.60	0.60
Fernbank Rain Garden (GA)	0.34	0.34
TOTAL	**50.68**	**44.42**

**Note: information is not yet available for the rain garden in Grand Rapids, MI*

Total (ultimate) benefit is: 50.68 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 44.42 ML/yr

The current (2012) benefit and project benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 50.68 ML/yr and TCCC's benefit (adjusted for cost share) is 44.42 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	50.68	44.42
2014	50.68	44.42
2015	50.68	44.42
2016	50.68	44.42
2017	50.68	44.42
Ultimate Benefit:	50.68	44.42

Data Sources:

- LTI CWP Survey
- Precipitation and runoff coefficients are documented in the "Assumptions and References" worksheet of the CCNA Rain Garden Calculator.

Assumptions:

- Runoff coefficients tell what percent of the rainfall might occur as runoff from a given surface. Runoff coefficients for pervious and impervious surfaces are obtained from the literature. For impervious surfaces including concrete, metal, gravel, asphalt and fiberglass, the coefficient values typically range from 0.7 - 1.0. A value of 0.85 is used in the calculations. Likewise, runoff coefficients for bare soils range from 0.2 - 0.75. Therefore, for pervious surfaces, a conservative value of 0.25 is used in the calculations. A runoff coefficient of 1 is used for rainfall directly on the rain garden.
- The CCNA Rain Garden Calculator is designed to provide a reasonable estimate of the amount of runoff generated from pervious and impervious surfaces in a catchment. It is assumed that this runoff will be intercepted by the rain garden.
- It is assumed the design of the rain garden is such that it will be located close to the runoff source, will be able to withstand extremes of moisture conditions, and is capable of storing precipitation and snowmelt runoff events of any size. If the rain garden is underdesigned for certain runoff events, then it may be necessary to use more advanced (e.g., daily) calculations to estimate the volume of water effectively captured by the rain garden over the course of an average year.

OTHER BENEFITS NOT QUANTIFIED

- Decreased pollutant loading to sewers/streams.

NOTES

- This fact sheet replaces fact sheets #18 (Niles Community Rain Garden), #78 (Coca-Cola Lexington Rain Garden), #84 (Birmingham Three Parks Initiative) and #89 (Fernbank Rain Garden), combining these in a single fact sheet. This fact sheet also includes other rain gardens.

REFERENCES

PROJECT NAME: Chongón-Colonche – Cerro Blanco Ecological Corridor: An Initiative to Conserve and Restore Key Water Sources and Biodiversity in Ecuador
PROJECT ID #: 119

DESCRIPTION OF ACTIVITY: Reforestation of 32.6 hectares in the Cerro Blanco Protected Forest

LOCATION: The Cerro Blanco Protected Forest located near Guayaquil, Ecuador

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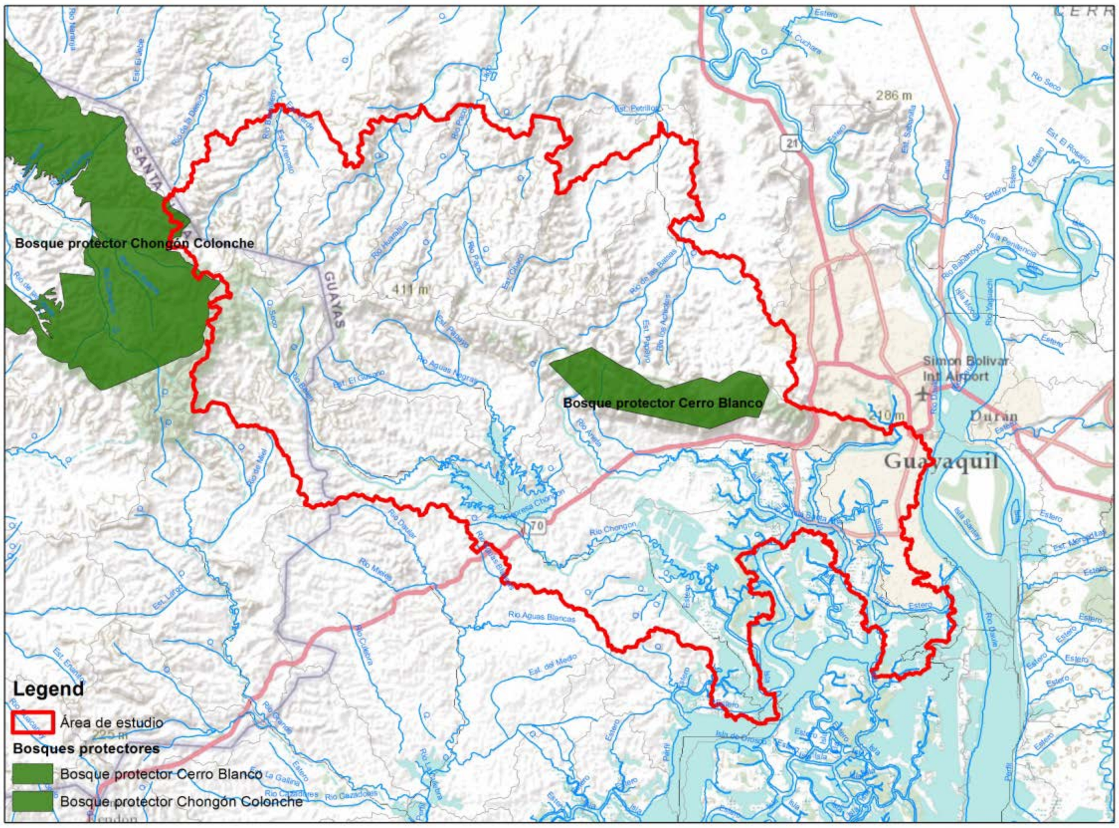
OBJECTIVES:
- Water flow regulation
- Improving water quality
- Protect and improve biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: The Cerro Blanco Protected Forest is an Ecuadorian dry tropical forest. The seasonal dry forests of Ecuador are among the most threatened and biologically important ecosystems in South America, with a high percentage of endemic and threatened species. These forests are home to threatened jaguars, jaguarundis, pumas, brocket deer, howler monkeys and great green macaws. The forests are also natural suppliers and regulators of water for nearby towns and rural communities. The forests are currently threatened by clearing for agriculture, urban expansion, and market hunting of native wildlife.


Cerro Blanco Reforestation Transect

The long-term vision of this project is to restore watersheds and increase the hydrological and ecological connectivity. The overall project entails designing an ecological corridor between two important conservation areas: Cerro Blanco Protected Forest and Chongón-Colonche Protected Forest. Environmental services (principally water) are a key attribute in the design. The main activities to be implemented are reforestation and restoration of natural forests, and conservation of key zones through conservation agreements to avoid deforestation. These activities serve to increase the capacity of the ecosystems to capture water, regulate flows, and improve water quality through reduction of sedimentation and other pollutants such as nitrogen and phosphorus. This project is in collaboration with The Nature Conservancy (TNC), Fundación Pro-Bosque and Coca-Cola.

The outcome for the first year is 32.6 hectares of reforestation in the Cerro Blanco Protected Forest. The areas selected for reforestation were degraded areas that needed to be enriched with native species. This work was done from October 2011 to March 2012 and included preparation of the land, transportation of the plants, and the planting itself. A total of 34,780 trees, consisting of more than 22 native species, were planted.



Study area and conservation zones within study area (TNC et al., 2012)

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 5.6 ML/YR

ACTIVITY TIMELINE:

- October 2011 – Project initiation
- March 2012 – Reforestation of 32.6 ha completed

COCA-COLA CONTRIBUTION: 47.4%

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

"Pre-project" is defined as the deforested condition of the land that existed prior to reforestation, while "post-project" is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for ΔK consistent with the recommendations made in the "Alternative Annual Method" memorandum (Redder and Larson, 2012).

For the Cerro Blanco site, the estimated average annual rainfall depth is 904 mm (0.904 m/yr) (Hearn et al. 2003). The surface area is 32.6 hectares (326,000 m^2).

Therefore, the water quantity benefit is calculated as follows:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

11,788 (m^3/yr) = [0.04*0.904 (m/yr)]*[326,000 (m^2)] = 11.78 ML/yr

The total (ultimate) benefit is: 11.78 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 5.6 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 11.78 ML/yr and TCCC's benefit (adjusted for cost share) is 5.6 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	11.78	5.6
2014	11.78	5.6
2015	11.78	5.6
2016	11.78	5.6
2017	11.78	5.6
Ultimate Benefit:	11.78	5.6

Data Sources:

- Size of protected land area: 32.6 hectares (provided by contact and TNC et al., 2012)
- Average annual precipitation from "Global GIS" database (Hearn et al., 2003)

Assumptions:

- ΔK (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.04 as a conservative and simplifying assumption.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity
- Carbon footprint reduction

NOTES

- None

REFERENCES

Hearn, P., T. Hare, P. Schruben, D. Sherrill, C. LaMar, and P. Tsushima. 2003. "Global GIS – Global Coverage DVD, 1st Edition." URL: http://www.agiweb.org/pubs/pubdetail.html?item=624108.

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

The Nature Conservancy (TNC), Fundacion Coca-Cola de Ecuador, Fundacion Probosque Ecuador. 2012. Chongón-Colonche – Cerro Blanco ecological corridor: an initiative to conserve and restore key water sources and biodiversity in Ecuador. Mid-term report, July 2012.

PROJECT NAME: Reforestation at Shiroishi
PROJECT ID #: 120

DESCRIPTION OF ACTIVITY: Reforestation of 5 hectares

LOCATION: Fukuokafukaya Shiroishi in Miyagi Prefecture, Japan

PRIMARY CONTACT:
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OBJECTIVES:
- Reduce runoff and associated sedimentation
- Protect drinking water supply
- Improve habitat and increase biodiversity
- Reestablish or protect corridor for wildlife passage

BACKGROUND & ACTIVITY DESCRIPTION: Between 2006 and 2010, 4,200 trees were planted at Shiroishi. The trees were planted in a deforested area as shown in the photo below. The trees are being maintained by a local forestry association, the Shiroishi Zao Forestry Association. It is expected that this project will help decrease runoff from the site, and provide secondary benefits such as recreational opportunities for people and habitat for wildlife.

Reforestation at Shiroishi

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 2.6 ML/YR

ACTIVITY TIMELINE:

- 2006 – Project initiation
- 2010 – Reforestation of 5 ha completed

COCA-COLA CONTRIBUTION: 100%

- Total cost (USD): $138,325 USD
    - o TCCC contribution: $138,325 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

"Pre-project" is defined as the deforested condition of the land that existed prior to reforestation, while "post-project" is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for ΔK consistent with the recommendations made in the "Alternative Annual Method" memorandum (Redder and Larson, 2012).

For the Shiroishi site, the estimated average annual rainfall depth is 1,284 mm (1.3 m/yr). The surface area is 5 hectares (50,000 m^2).

Therefore, the water quantity benefit is calculated as follows:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

2,568 (m^3/yr) = [0.04*1.3 (m/yr)]*[50,000 (m^2)] = 2.6 ML/yr

The total (ultimate) benefit is: 2.6 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 2.6 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 2.6 ML/yr and TCCC's benefit (adjusted for cost share) is 2.6 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	2.6	2.6
2014	2.6	2.6
2015	2.6	2.6
2016	2.6	2.6
2017	2.6	2.6
Ultimate Benefit:	2.6	2.6

Data Sources:

- Size of reforested land area: 5 hectares (provided by contact)
- Average annual precipitation from "Global GIS" database (Hearn et al., 2003)

Assumptions:

- ΔK (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.04 as a conservative and simplifying assumption.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity
- Carbon footprint reduction

NOTES

- None

REFERENCES

Hearn, P., T. Hare, P. Schruben, D. Sherrill, C. LaMar, and P. Tsushima. 2003. "Global GIS – Global Coverage DVD, 1st Edition." URL: http://www.agiweb.org/pubs/pubdetail.html?item=624108.

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

PROJECT NAME: Forest Maintenance in Japan
PROJECT ID #: 121

DESCRIPTION OF ACTIVITY: Forest maintenance to ensure healthy forest on 48.8 hectares

LOCATION: Nine locations in Japan

PRIMARY CONTACT:

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OBJECTIVES:
- Reduce runoff and associated sedimentation
- Improve forest health

BACKGROUND & ACTIVITY DESCRIPTION: In the 1960s and 1970s, forests of the same species were planted at various locations in Japan. The trees are now roughly 40-50 years old. The density of the trees is very high, some are dead and the condition of the forest is generally unhealthy. Maintenance activities are being implemented at the locations indicated below to promote a healthy forest, increase the capacity of the soil to hold water, decrease runoff and increase infiltration to groundwater. These activities consist of pruning dead branches, thinning the forest and maintaining the underbrush.

Locations of Forest Maintenance Activities

Location	Lat	Long	Area (ha)
Numata in Gunma Prefecture	36.77901	139.062271	2
Minakami in Gunma Prefecture	36.6787	138.999064	2
Fujimi Maebashi in Gunma Prefecture	36.46749	139.108076	3
Yokose Chichibu, Saitama Prefecture	35.978768	139.135837	4.8
Kaninariki Oume, Tokyo	35.840667	139.215437	22.8
Toga Nanto, Toyama Prefecture	36.524356	137.026694	3.8
Kurokawa Aso in Kumamoto	32.935321	131.079975	8
Suenaga Ebino in Miyazaki Prefecture	31.945612	130.843475	2
Taiho Ogimi in Okinawa	26.668602	128.120637	0.43
Total			48.8

SUMMARY OF REPLENISH BENEFIT
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 26.8 ML/YR

ACTIVITY TIMELINE:

- Project initiation dates vary by location, as shown below:
    - 2011 - Numata in Gunma Prefecture
    - 2011 - Minakami in Gunma Prefecture
    - 2011 - Fujimi Maebashi in Gunma Prefecture
    - 2010 - Taiho Ogimi in Okinawa
    - 2008 - Suenaga Ebino in Miyazaki Prefecture
    - 2006 - Yokose Chichibu, Saitama Prefecture
    - 2006 - Kurokawa Aso in Kumamoto
    - 2005 - Toga Nanto, Toyama Prefecture
    - 2003 - Kaninariki Oume, Tokyo
- Maintenance activities are ongoing at all locations.

COCA-COLA CONTRIBUTION: 59%

- Total cost (USD): $149,975 USD
    - TCCC contribution: $88,725 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

“Pre-project” is defined as the unhealthy condition of the land that existed prior to forest maintenance, while “post-project” is defined as the healthy forest condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical forest maintenance activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.05 was selected for Δ*K*, consistent with the delta K (0.06 to 0.08) documented in a 2009 research report describing forest maintenance in Japan (Yamaguchi Prefecture, 2009).

The estimated average rainfall depth and surface area for the nine project sites are provided in the table below, along with water quantify benefit. The water quantity benefit is calculated as follows:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

For each location, this is calculated as: [0.05*precipitation (m/yr)]*[Area (m^2)]

Location	Annual precipitation (m/yr)	Area (m^2)	Water Quantity Benefit (m^3/yr)
Numata in Gunma Prefecture	1.736	20,000	1,736
Minakami in Gunma Prefecture	1.757	20,000	1,757
Fujimi Maebashi in Gunma Prefecture	1.757	30,000	2,636
Yokose Chichibu, Saitama Prefecture	1.281	48,000	3,074
Kaninariki Oume, Tokyo	1.598	228,000	18,217
Toga Nanto, Toyama Prefecture	2.273	38,000	4,319
Kurokawa Aso in Kumamoto	2.552	80,000	10,208
Suenaga Ebino in Miyazaki Prefecture	2.816	20,000	2,816
Taiho Ogimi in Okinawa	2.447	4,300	526
Total		**488,300**	**45,289**

The benefit for all locations is summed to calculate the total (ultimate) benefit.

The total (ultimate) benefit is: 45,289 m^3/yr = 45.3 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 26,793 m^3/yr = 26.8 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 45.3 ML/yr and TCCC's benefit (adjusted for cost share) is 26.8 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	45.3	26.8
2014	45.3	26.8
2015	45.3	26.8
2016	45.3	26.8
2017	45.3	26.8
Ultimate Benefit:	45.3	26.8

<u>Data Sources:</u>

- Size of maintained land area: 48.8 hectares (provided by contact)
- Average annual precipitation from "Global GIS" database (Hearn et al., 2003)

<u>Assumptions:</u>

- ΔK (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.05 as a conservative and simplifying assumption which is consistent with Yamaguchi Prefecture, 2009.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity

NOTES

- None

REFERENCES

Hearn, P., T. Hare, P. Schruben, D. Sherrill, C. LaMar, and P. Tsushima. 2003. "Global GIS – Global Coverage DVD, 1st Edition." URL: http://www.agiweb.org/pubs/pubdetail.html?item=624108.

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

Yamaguchi Prefecture, 2009. Evaluation Report on Projects Related to Prefectural Tax Used for Forest Maintenance in Yamaguchi. Watershed Management Section, Forest Planning Division, Department of Agriculture, Forestry and Fisheries. May.

PROJECT NAME: Mississippi River Basin Treatment Wetlands
PROJECT ID #: 122

DESCRIPTION OF ACTIVITY: Construction of treatment wetland

LOCATION: Root River, MN

PRIMARY CONTACTS:

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OBJECTIVES

- Reduce pollutants in runoff from agricultural fields
- Increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: The Nature Conservancy (TNC) is constructing treatment wetlands in agricultural watersheds of the Mississippi River watershed. A primary objective is to reduce pollutants including nitrate-nitrogen in leachate and runoff to local waterways. A larger goal is to reduce nitrogen loads in the Mississippi River and Gulf of Mexico where nutrient enrichment contributes to algal blooms and hypoxia. The wetlands are generally located in low lying areas that are not well-suited for planting. Water drains to the wetlands through tile drains where it is retained to reduce nutrient and sediment loads. This treatment is not required by law.

Contamination due to agricultural runoff is a long-term problem in the Root River watershed, and karst geology compounds the problem by allowing rapid flow between surface and groundwater. Nitrogen concentrations are increasing in the Root River and high concentrations of nitrate are common in private wells. Approximately 19% of samples collected in 2008 and 2009 showed nitrate concentrations greater than the drinking water standard of 10 mg/l (NRCS, 2010).

TNC constructed one wetland in the Root River watershed in the fall of 2012. The wetland is approximately 1.5 acres in area, treating 23 acres of subsurface watershed and approximately 15 acres of surface runoff before it enters the Root River near Sargent, MN. The wetland was designed by NRCS engineers using NRCS CP-39 practice standards. A berm was constructed downslope of an agricultural field in an area at the edge of a field. Tile line draining the field was intercepted and ‘daylighted’ to drain into an excavated area upslope of the berm.

Similar wetlands have been constructed by TNC in the Mackinaw River watershed in Illinois, where extensive data have been collected on demonstration wetlands in collaboration with University of Illinois and Illinois State University (TNC, 2010). Water quality data collected in the demonstration wetlands have shown that nitrate concentrations in the inflow have been measured as high as 33 mg/l. The nitrate concentration in effluent from the wetlands is consistently below the U.S. EPA standard of 10 mg/l, with rare exceptions during large storm events.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 53.28 ML/YR

ACTIVITY TIMELINE:

- September 26 – October 1 2012: Wetland construction
- Seeding completed: December 7, 2012
- Wetland will be fully functional when the vegetation is established in July 2013

COCA-COLA CONTRIBUTION: 100%

- $13,000 provided by Coca-Cola

WATERSHED BENEFITS CALCULATED:

1. Volume of water treated

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1. VOLUME OF WATER TREATED

Approach and Results

The replenish benefit was calculated as the average annual volume of water treated by the wetland. No measurements of flow are available so flow was estimated based on NRCS guidance (NRCS, 1980) using a drainage coefficient. The drainage coefficient is expressed as inches of water depth to be removed from cropland in 24 hours. NRCS uses a 3/8" drainage coefficient (D) for most cropland. This represents the maximum amount of water that would typically be pulled from a soil profile. During a wet period, the tile line will be full and it will not be removing that amount from all of the soil, but a prolonged flow in the tile line will occur after a rain. No water flows through the wetland during dry periods.

The design flow rate (Q) from the tile drainage system is estimated as follows:

Q = D x A
where:
D is the drain coefficient = 3/8" = 0.375 inch/day
A is subsurface drainage area = 23 acres

Q = 0.375 inch/day x 23 acres = 8.625 acre-inch/day = 0.72 acre-ft/day = 888 m3/day

Conservatively assuming that water flows through the wetland 60 days per year, the volume of flow is estimated as follows:

888 m3/day x 60 days/yr = 53,280 m3 = 53.28 ML/yr

The total (ultimate) benefit is: 53.28 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 53.28 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is estimated to be 53.28 ML/yr and TCCC's benefit (adjusted for cost share) is 53.28 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	53.28	53.28
2014	53.28	53.28
2015	53.28	53.28
2016	53.28	53.28
2017	53.28	53.28
Ultimate Benefit:	53.28	53.28

Data Sources

- TNC provided size of wetland (approximately 1.5 acres) and acres of subsurface and surface runoff
- TNC provided drainage coefficient of 0.375 inches/day

Assumptions

- In the absence of flow data it was conservatively assumed that water flows through the wetland 60 days a year and that all water is from the tile drains.
- It is recognized that the wetland also receives water from approximately 15 acres of surface runoff. But conservatively, the calculations only count the subsurface drainage water to be treated by the wetlands
- The wetland complex will function effectively to reduce the nitrate concentrations below established water quality standard
- The entire volume of water treated by the wetland can be treated as replenish benefit.
- Wetland has the capacity to treat the full volume of water that it intercepts annually from the tile drainage
- The drainage system will be maintained properly

OTHER BENEFITS NOT QUANTIFIED

- Improved wetland habitat
- Flood protection benefits

NOTES

- TNC plans to monitor water quality at the outlet in 2013.
- During the 2013 & 2014 growing season mowing will be necessary to control annual weeds while native vegetation is established. The control and outlet structures will be monitored annually for function.

REFERENCES

NRCS. 2010. Mississippi River Basin Initiative. WREP - The Nature Conservancy. http://www.mn.nrcs.usda.gov/programs/mrbi/TNC%20Lower%20Root%20-%20WREP.pdf

NRCS. 1980. Subsurface Drain. Code 606. Natural Resources Conservation Service Conservation Practice Standard. http://efotg.sc.egov.usda.gov/references/public/NE/NE606.pdf

TNC (The Nature Conservancy). 2012. Demonstration Farm Annual Report-2009. Authored by T. Lindenbaum, K. Kirkham, D., M., W. Perry, S. Van der Hoven, B. Grebliunas, and M. Lemke.

PROJECT NAME: Wet Lagoon Conservation Cobega
PROJECT ID #: 124

DESCRIPTION OF ACTIVITY: Wastewater reuse for conservation

LOCATION: Mollet del Vallés, Spain

PRIMARY CONTACTS:

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OBJECTIVES

- Maintain ecological flow
- Increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: A portion of the wastewater from the Cobega-Vallés bottling plant is treated to standards and discharged to a lagoon. The lagoon is part of a biological corridor between the Park of the Sierra Litoral and the Besos River. The corridor was integrated into the construction of the Cobega-Vallés Plant, and it facilitates the exchange of living organisms between the mountains and the river that would otherwise be isolated due to the barrier effect of industrial parks, infrastructures and housing projects existing in the zone (TCCC, 2012).

The primary objective of the project is to maintain water levels in the lagoon by replacing water lost to evaporation and to support a healthy ecosystem. An increase in fish and bird populations has been observed since the project was initiated. The project also includes planting of native vegetation and construction of a platform for birdwatchers and other visitors.

The Cobega- Vallés bottling plant obtains its water from the municipality, which draws from a surface water source. The wastewater that is not discharged to the lagoon is pumped to the municipal treatment plant where it is further treated and discharged to surface water. Compliance with all regulatory requirements has been demonstrated.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 29.2 ML/YR

ACTIVITY TIMELINE:

- Project initiation: 2008
- Continuous discharge to the lagoon every year since 2008 and continuing into the future

COCA-COLA CONTRIBUTION: 100%

- All costs are covered by the bottler

WATERSHED BENEFITS CALCULATED:

1. Volume of wastewater reused

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1. VOLUME OF WASTEWATER REUSED

Approach and Results

The replenish benefit was calculated as the annual average volume of treated wastewater reused by discharge to the lagoon:

80 m^3/day x 365 days/year = 29,200 m^3/year = 29.2 ML/yr

The total (ultimate) benefit: 29.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 29.2 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is estimated to be 29.2 ML/yr and TCCC's benefit (adjusted for cost share) is 29.2 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	29.2	29.2
2014	29.2	29.2
2015	29.2	29.2
2016	29.2	29.2
2017	29.2	29.2
Ultimate Benefit:	29.2	29.2

Data Sources

- Volume of treated wastewater provided by TCCC

Assumptions

- None

OTHER BENEFITS NOT QUANTIFIED

- Improved wetland habitat and biodiversity
- Increased aquifer recharge

NOTES

- None

REFERENCES

- TCCC. 2012. "The natural corridor of Can Fenosa." Website of Coca-Cola Cobega. URL (accessed 12/12/12): http://www.cobega.es/sites/eng/environment/canfenosa.aspx

PROJECT NAME: Reforestation in the San Roque Lake Watershed
PROJECT ID #: 125

DESCRIPTION OF ACTIVITY: Reforestation of 5 hectares

LOCATION: San Roque Lake Watershed, Province of Córdoba, Argentina

PRIMARY CONTACT:
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OBJECTIVES:

- Decrease runoff and increase water infiltration
- Improve water quality
- Protect and improve forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: The San Roque Lake watershed is located in the province of Córdoba, Argentina. San Roque Lake is a man-made reservoir that provides water for domestic uses in the city of Córdoba as well as for industries and irrigation. Forested areas in the watershed (Hills of Córdoba) have been impacted by agriculture, exotic species encroachment along waterways, deforestation and urbanization pressure. These activities have lead to altered hydrology and degraded water quality.

This project focused on reforesting and revegetating strategic locations in the San Roque Lake watershed with both native and highly valuable exotic tree and shrub species. The restoration activities serve to decrease runoff and increase water infiltration to restore a more natural hydrologic regime, reduce soil erosion to improve water quality, and improve and protect forest habitat. A total of 5 hectares were reforested and revegetated in the San Roque Lake watershed. The reforestation projects included the activities described below, and shown in Figure 1:

1) **Enrichment of native forest patches (2 hectares)**: This involved the planting of arboreal species (*Lithraea molleoides, Zantoxylum coco, Acacia caven, Acacia atramentaria, Ruprechtia apétala, Prosopis alba, P.chilensis*) and many shrubby species. The planting density was approximately 400 trees per hectare.
2) **Riparian vegetation recovery (3 hectares)**: This involved the planting of native trees and shrubs along a watercourse. 400 trees and 200 shrubs were planted.

Native Vegetation Enrichment

Riparian Forestry

Figure 1. Photos of reforestation and revegetation activities

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 1.48 ML/YR

ACTIVITY TIMELINE:

- May 2012 – Project initiation
- December 2012 – Project completion

COCA-COLA CONTRIBUTION: 37%

- Total cost (USD) for reforestation: $68,300 USD
  - TCCC contribution: $25,271 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

“Pre-project” is defined as the deforested condition of the land that existed prior to reforestation, while “post-project” is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

$[\Delta \text{ Runoff (m/yr)}] = \Delta K * [\text{Annual Rainfall Depth (m/yr)}]$

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition.

Runoff coefficients were estimated based on Benítez et al. (1980) and Ramirez (1984). The project location soils are permeable and the slopes are up to 30%. The pre-project (before reforestation) vegetative cover is grassland, shrubland, invasion of non-native vegetation; the post-project (after reforestation) vegetative cover is forest vegetation, dense. The pre-project (before reforestation) runoff coefficient is 0.30, which is based on a pasture, light vegetation cover categorization; the post-project (after reforestation) runoff coefficient is 0.20, which is based on a forest, dense vegetation cover categorization. The annual runoff condition is calculated as:

$\Delta K = 0.30 \text{ (pre-project)} – 0.20 \text{ (post-project)} = 0.10$

The mean annual precipitation for the entire project reforestation area was assumed to be 800 mm/yr (0.80 m/yr). The project reforestation area is 5 hectares (50,000 m^2).

Therefore, the water quantity benefit is calculated as follows:

$[\text{Water quantity benefit } (m^3/yr)] = [\Delta \text{ Runoff (m/yr)}] * [\text{Surface Area } (m^2)]$

$4{,}000\ (m^3/yr) = [0.10 * 0.80\ (m/yr)]*[50{,}000\ (m^2)] = 4.0 \text{ ML/yr}$

The total benefit (runoff reduction) for this project is: 4.0 million liters per year (ML/yr).

The total (ultimate) benefit is: 4.0 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 1.48 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 4.0 ML/yr and TCCC’s benefit (adjusted for cost share) is 1.48 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	4.0	1.48
2014	4.0	1.48
2015	4.0	1.48
2016	4.0	1.48
2017	4.0	1.48
Ultimate Benefit:	4.0	1.48

Data Sources:

- Size of reforested land area: provided by contact.
- Annual precipitation: provided by contact, average rainfall in the project area ranges from 700 mm in the low areas to 900 mm in the high areas. An average value of 800 mm was used.
- Runoff coefficients based on Benítez et al. (1980) and Ramirez (1984): provided by contact.
- Vegetative cover, slope, and soil type information: provided by contact.

Assumptions:

- The reforested area is assumed to have reached mature vegetation.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of forest habitat and biodiversity

NOTES

- None

REFERENCES

Benítez, C., W. Arias and J. Quiroz. 1980. Manual de conservación de suelos y aguas. Ministerio de Agricultura y Alimentación. Lima, Perú.

Ramirez, Rázuri H. 1984. Estructura de Conservación de Suelos y Aguas. P7-33- Serie Riego y Drenaje 32 (RD-32) Centro interamericano de desarrollo de aguas y tierras. Mérida, Venezuela.

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

PROJECT NAME: Reforestation in the Hills of Cordoba
PROJECT ID #: 126

DESCRIPTION OF ACTIVITY: Reforestation of 21 hectares

LOCATION: Malambo River Basin, Province of Córdoba, Argentina

PRIMARY CONTACT:
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OBJECTIVES:
- Decrease runoff and increase infiltration
- Improve water quality
- Protect and improve forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: The Malambo River Basin is located in the province of Córdoba, Argentina. The project area is a 30 hectare site that had a high percentage of bare and eroded soil and little forest cover due to deforestation. The project site was comprised of 40% eroded soil, 30% exposed rock, and 30% grassland. Less than 1% of the area was covered with bushes and trees.

A total of 21 hectares are being reforested in the Malambo River Basin over a three-year period. The remaining 9 hectares are rocks. The restoration objective is to reduce the area of exposed soil (exposed rock) and increase tree coverage to decrease runoff and increase water infiltration, reduce soil erosion, improve water quality, and protect and improve forest habitat. The species of trees planted include *Polylepis autralis*, *Maitenus boaria* and *Escalonia cordobensis*.

Photo of a project site location to be forested and material acquired for the closure.

SUMMARY OF REPLENISH BENEFIT
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 3.13 ML/YR

ACTIVITY TIMELINE:
- August 2012 – Project initiation
- December 2012 – Project 33% complete

- 2013 – Project 66% complete
- 2014 – Project 100% complete

COCA-COLA CONTRIBUTION: 56.5%

- Total cost (USD) for reforestation: $44,200 USD
    - TCCC contribution: $24,973 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

"Pre-project" is defined as the deforested condition of the land that existed prior to reforestation, while "post-project" is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition.

Runoff coefficients were estimated based on Benítez et al. (1980) and Ramirez (1984). The soils are permeable and the slopes range from 3 to 20%. The pre-project (before reforestation) vegetative cover is 30% grassland and less than 1% of the area was covered with bushes and trees; the post-project (after reforestation) vegetative cover is forest vegetation, dense. The pre-project (before reforestation) runoff coefficient is 0.25, which is based on a pasture, light vegetation cover categorization; the post-project (after reforestation) runoff coefficient is 0.15, which is based on a forest, dense vegetation cover categorization. The runoff coefficients were estimated based on Benítez et al. (1980) and Ramirez (1984). The annual runoff condition is calculated as:

ΔK = 0.25 (pre-project) – 0.15 (post-project) = 0.10

The mean annual precipitation for the entire project reforestation area was assumed to be 800 mm/yr (0.80 m/yr). The project reforestation area is 21 hectares (210,000 m^2).

Therefore, the water quantity benefit is calculated as follows:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

16,800 (m^3/yr) = [0.10 * 0.80 (m/yr)]*[210,000 (m^2)] = 16.8 ML/yr

The total benefit (runoff reduction) for this project is: 16.8 million liters per year (ML/yr).

The total (ultimate) benefit is: 16.8 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 9.49 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 5.54 ML/yr and TCCC's benefit (adjusted for cost share) is 3.13 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	11.09	6.26
2014	16.8	9.49
2015	16.8	9.49
2016	16.8	9.49
2017	16.8	9.49
Ultimate Benefit:	16.8	9.49

Data Sources:

- Size of reforested land area: provided by contact.
- Annual precipitation: provided by contact.
- Runoff coefficients based on Benítez et al. (1980) and Ramirez (1984): provided by contact.
- Vegetative cover, slope, and soil type information: provided by contact.

Assumptions:

- The reforested area is assumed to have reached mature vegetation.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of forest habitat and biodiversity

NOTES

- None.

REFERENCES

Benítez, C., W. Arias and J. Quiroz. 1980. Manual de conservación de suelos y aguas. Ministerio de Agricultura y Alimentación. Lima, Perú.

Ramirez, Rázuri H. 1984. Estructura de Conservación de Suelos y Aguas. P7-33- Serie Riego y Drenaje 32 (RD-32) Centro interamericano de desarrollo de aguas y tierras. Mérida, Venezuela.

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

PROJECT NAME: Reforestation in the Quilimari River Basin
PROJECT ID #: 127

DESCRIPTION OF ACTIVITY: Reforestation of 15 hectares

LOCATION: Quilimari River Basin, Coquimbo Region, Chile

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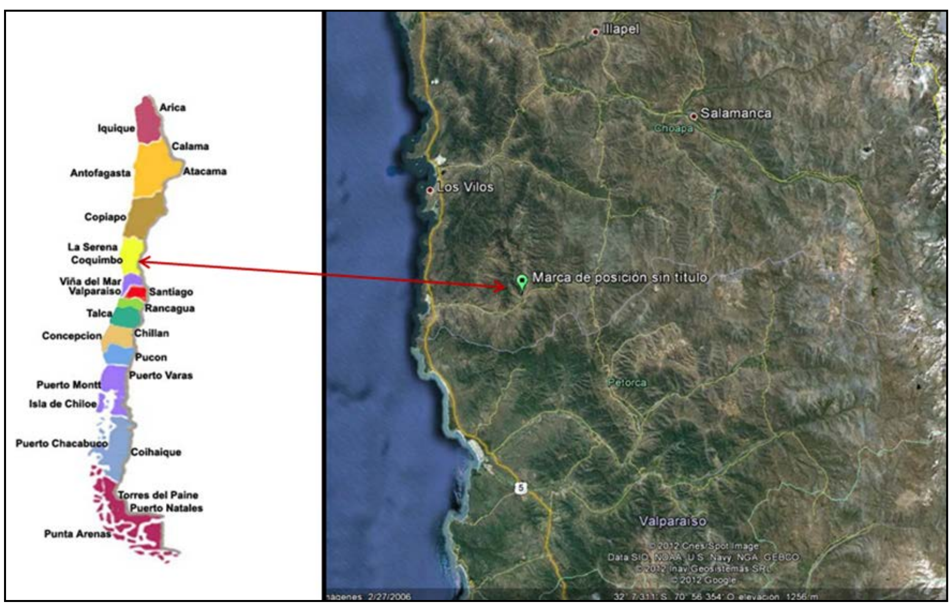
OBJECTIVES:
- Decrease runoff and increase infiltration
- Improve water quality
- Protect and improve forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: The Quilimari River Basin is located in the province of Coquimbo Region, Chile which is located 43 km from Los Vilos. This project is being implemented in the Quilimari River Basin, divided amongst the areas of Los Condores, Guangualí and Quilimari. These areas are primarily comprised of rural populations dedicated to agriculture. In the last few years the population has been suffering from drinking water supply shortages due to drought conditions.

This project focuses on reforestation of shrubland, grassland, and bare soil with native vegetation, including trees. A total of 15 hectares will be reforested in the Quilimari River Basin over an 11-month period.



Project area location

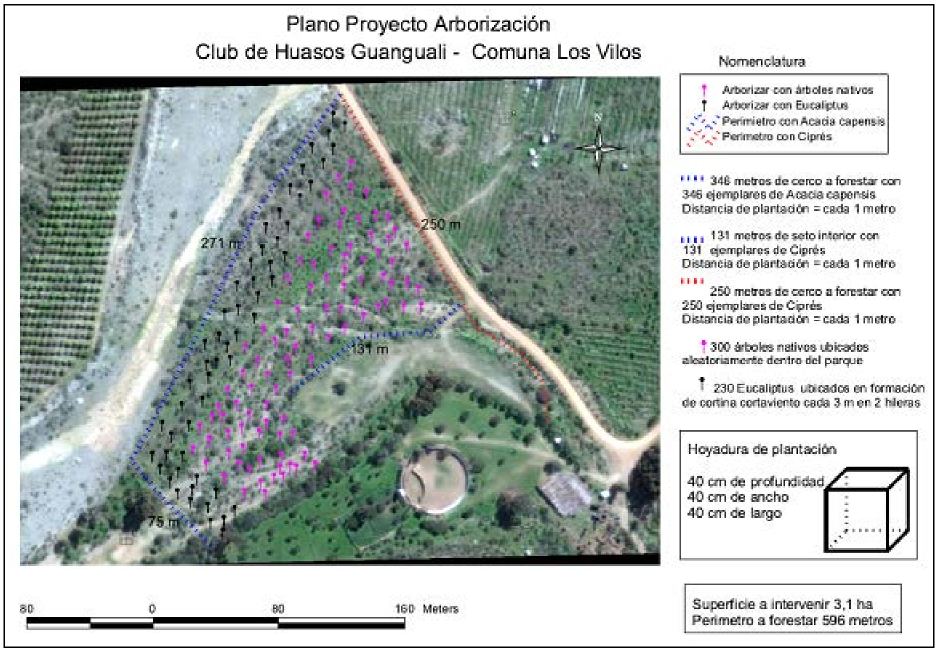


Photo of a reforestation sector. The pre-project vegetation cover includes open shrubland, grassland, and bare soil.

Photos of reforestation site locations. Pre-project vegetation cover includes lowlands with grasslands and open shrublands (upper left photo) and scattered shrublands (upper right photo). Regional view reforestation sites (bottom center photo).

The objectives of the project are to decrease runoff and improve infiltration to groundwater, increase the stabilization and improvement of soils, decrease soil erosion, improve water quality and contribute to the enhancement of the local flora which serve vital ecological functions. The project also contributes to water availability for access and sustainable human consumption by the local community.

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 2.59 ML/YR

ACTIVITY TIMELINE:

- May 2012 – Project initiation
- December 2012 – Project 80% complete
- March 2013 – Project 100% complete

COCA-COLA CONTRIBUTION: 80%

- Total cost (USD) for reforestation: $91,499 USD
  - TCCC contribution: $73,199 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

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1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the "Alternative Annual Method" as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated "pre-project" and "post-project" runoff depths multiplied by the total surface area:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = { [Pre-project Runoff Depth (m/yr)] – [Post-project Runoff Depth (m/yr)] }

"Pre-project" is defined as the deforested condition of the land that existed prior to reforestation, while "post-project" is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition.

Runoff coefficients were estimated based on Benítez et al. (1980) and Ramirez (1984). The soils are permeable and the slopes are mild to moderate. The pre-project (before reforestation) vegetative cover is open shrubland, grassland, bare soil; the post-project (after reforestation) vegetative cover is forest vegetation, dense. The pre-project (before reforestation) runoff coefficient is 0.20, which is based on a pasture, light vegetation cover categorization; the post-project (after reforestation) runoff coefficient is 0.10, which is based on a forest, dense vegetation cover categorization. The runoff coefficients were estimated based on Benítez et al. (1980) and Ramirez (1984). The annual runoff condition is calculated as:

ΔK = 0.20 (pre-project) – 0.10 (post-project) = 0.10

The mean annual precipitation for the entire project reforestation area was assumed to be 270 mm/yr (0.27 m/yr). The project reforestation area is 15 hectares (150,000 m^2).

Therefore, the water quantity benefit is calculated as follows:

[Water quantity benefit (m^3/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m^2)]

4,050 (m^3/yr) = [0.10 * 0.27 (m/yr)]*[150,000 (m^2)] = 4.05 ML/yr

The total benefit (runoff reduction) for this project is: 4.05 million liters per year (ML/yr).

The total (ultimate) benefit is: 4.05 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 3.24 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 3.24 ML/yr and TCCC's benefit (adjusted for cost share) is 2.59 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	4.05	3.24
2014	4.05	3.24
2015	4.05	3.24
2016	4.05	3.24
2017	4.05	3.24
Ultimate Benefit:	4.05	3.24

Data Sources:

- Size of reforested land area: provided by contact.
- Annual precipitation: provided by contact.
- Runoff coefficients based on Benítez et al. (1980) and Ramirez (1984): provided by contact.
- Vegetative cover, slope, and soil type information: provided by contact.

Assumptions:

- The reforested area is assumed to have reached mature vegetation.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of forest habitat and biodiversity

NOTES

- None.

REFERENCES

Benítez, C., W. Arias and J. Quiroz. 1980. Manual de conservación de suelos y aguas. Ministerio de Agricultura y Alimentación. Lima, Perú.

Ramirez, Rázuri H. 1984. Estructura de Conservación de Suelos y Aguas. P7-33- Serie Riego y Drenaje 32 (RD-32) Centro interamericano de desarrollo de aguas y tierras. Mérida, Venezuela

Redder, T. and W. Larson. Memorandum to Joe Rozza, TCCC. 2012. Review of a Simplified Alternative Approach for Estimating Water Quantity Benefits for Land Use / Land Cover (LU/LC) Alteration Activities. April 20.

PROJECT NAME: Infiltration Trenches in the Yali Salt Marsh Basin
PROJECT ID #: 128

DESCRIPTION OF ACTIVITY: Construction of infiltration trenches

LOCATION: The Yali Salt Marsh Basin is located west of San Pedro, Chile (33.7500 and 34.0833 south latitude; 71.2500 and 71.7500 west longitude).

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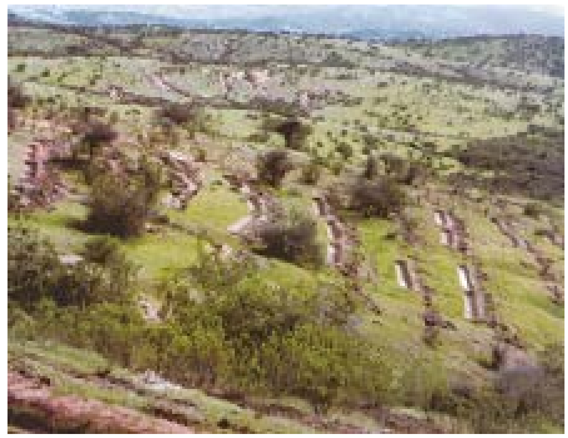


General configuration of infiltration trenches

OBJECTIVES:

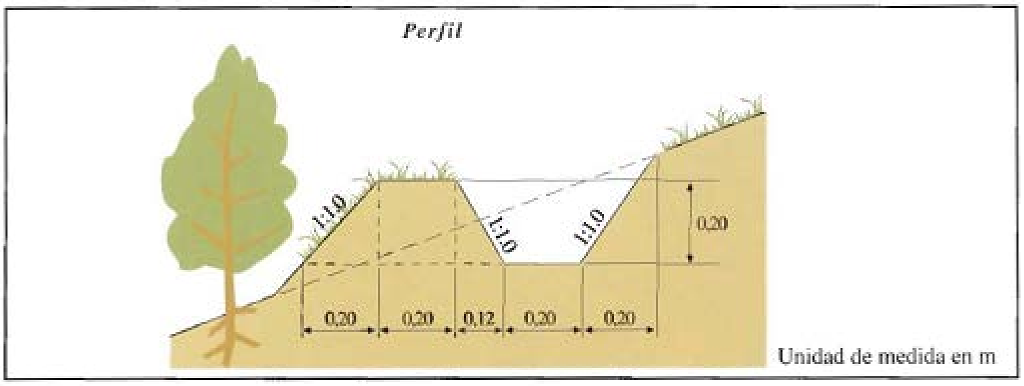
- Reduce runoff / increase infiltration
- Improve water quality and reduce sedimentation
- Improve and enhance important ecological habitat and function

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located within the Yali Salt Marsh Basin, which is west of the Metropolitan Region, San Pedro Commune and Alto Loica. The Yali Salt Marsh Basin is an exoreic coastal basin that covers an area of approximately 750 km^2. The marsh borders the Maipu River basin to the north; the Rapel River basin to the south; the Alhue marsh sub-basin to the east; and the Pacific Ocean to the west.

Trench channel cross-section

This project involves the construction of infiltration trenches to facilitate infiltration of water to groundwater, which also helps improve water availability for human access. Other benefits of the trenches include stabilization and improvement of soils, decreased soil erosion, and improvement and enhancement of important ecological habitat and function.

Each infiltration trench is 0.30 meters deep, 0.30 meters wide and is 5 to 7 meters long. The upslope length (or the distance between the trenches as you move downhill) is 4.5 meters and the distance between the trenches is 1 meter. In sum, the infiltration trenches constructed for this project have a total length of 1,200 m.



Generalized conceptual model of the infiltration trenches. Note that the trench dimensions in the graphic are for illustrative purposes and are not project-specific.

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 0.34 ML/YR

ACTIVITY TIMELINE:

- Project initiation: 2012 (50% complete)
- Project completion: 2013 (100% complete)

COCA-COLA CONTRIBUTION: 64.67%

- Total cost (USD) for reforestation: $56,900 USD
  - TCCC contribution: $36,800 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in infiltration

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1. INCREASE IN INFILTRATION

Approach and Results:
The total infiltration rate was calculated as the sum of direct infiltration (the quantity of water that falls directly in each trench each year) plus infiltration of runoff from untrenched areas (i.e., drain surface = indirect infiltration).

The water quantity benefit was calculated as follows:

- The total length of the trenches = 1,200 m
- Each trench has the following dimensions: Length = 5 to 7 m; Width = 0.3 m; and Depth = 0.3 m.
- The “total surface area” of the trenches = Total trench length x Width = 1,200 m x 0.3 m = 360 m^2

- The "total drainage area" of the trenches = total trench length x upslope length = 1,200 x 4.5 m = 5,400 m^2

- The assumed runoff capture coefficient for untrenched areas = 0.8

- The average annual rainfall = 350 mm/year (measured) = 0.350 m/yr

Direct infiltration = total surface area of trenches (360 m^2) x annual precipitation (0.350 m/yr) = 126 m^3/yr = 0.126 ML/yr.

Indirect infiltration = total drainage area (5,400 m^2) x average precipitation (0.350 m/yr) x runoff capture coefficient (0.8) = 1,512 m^3 = 1.512 ML/yr

Total infiltration = (direct infiltration) + (indirect infiltration) = (0.126 ML/yr) + (1.512 ML/yr) = 1.64 ML/yr

Total (ultimate) benefit is: 1.64 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 1.06 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 0.82 ML/yr and TCCC's benefit (adjusted for cost share) is 0.53 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	1.64	1.06
2014	1.64	1.06
2015	1.64	1.06
2016	1.64	1.06
2017	1.64	1.06
Ultimate Benefit	1.64	1.06

Data Sources:

- Infiltration trench dimensions provided by contact
- Annual precipitation provided by contact

Assumptions:

- The soil infiltration rate within the trenches is sufficiently high to allow 100% of: 1) runoff from the “drain surface”; and 2) direct precipitation to the trench surface to infiltrate into the soil matrix for the range of precipitation conditions experienced in the watershed.

OTHER BENEFITS NOT QUANTIFIED

- Decrease in sediment erosion
- Improvement in water quality
- Improvement and enhancement of important ecological habitat and function
- Human access to water

NOTES

- None

REFERENCES

PROJECT NAME: Wet Meadow Conservation and Management Optimization in the Province of Jujuy
PROJECT ID #: 129

DESCRIPTION OF ACTIVITY: Wet meadow restoration

LOCATION: Territory of the Lagunilla de Farallónes Community, Province of Jujuy, Argentina. Located near the Argentina borders with Chile and Bolivia and the RAMSAR site Laguna de Vilama (longitude/latitude coordinates: 22.4614°S, 66.6282°W)

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OBJECTIVES
- Develop improved vegetation coverage in high plateau wet meadows and swamps in order to improve grazing conditions for livestock and overall ecosystem function.

BACKGROUND & DESCRIPTION OF ACTIVITY: People have been raising cattle in the Altiplano (high plateau) of the arid northwest region of Argentina for over 2,000 years. Because of the arid conditions, water is a critical resource in the Altiplano. The region is characterized by wet meadow and swamp systems that have historically retained water supplied to the Altiplano by natural springs and streams. In present times, these systems are an essential water source for livestock such as llamas and wild herbivorous animals (such as "vicuña").

Traditional management techniques are necessary to develop and maintain the wet meadow and swamp systems. Some indigenous cultures have always managed the meadows or swamps to maintain and extend their productive pastures. However, the abandonment of sustainable management practices in some locales, such as in the Lagunilla de Farallónes community, has resulted in deterioration of the wet meadow and swamp system from drying and/or erosion (Figures 1 and 2). Factors contributing to wet meadow deterioration include the replacement of native livestock types with exotic species (e.g., goats, horses, and cattle), overgrazing, poor irrigation management, and decreased precipitation in the region in recent years.

Figure 1. Current degraded wet meadow conditions

This project is aimed at restoring traditional, sustainable land management practices in the Lagunilla de Farallónes community through education, training, planting of native vegetation species, and the implementation of techniques to manage wet meadow health and irrigation. Project activities are being implemented by the Lagunillas de Farallónes community, in partnership with COAJ (Council of Indigenous Organizations of Jujuy) and Corporación Norte Grande from Chile. The project's objective is to develop improved vegetation coverage (currently estimated at 40%), which will in turn improve the organic content and water retention capacity provide sustainable grazing conditions for livestock and increase local groundwater storage. Figure 3 shows examples of restored wet meadows. It is anticipated that the improvement of the water meadows will be fully realized two growing seasons following improved land management practices implemented during summer 2012-13.

Figure 2. Degraded landscape conditions in the Territory of the Lagunilla de Farallónes Community

Figure 3. Photos showing examples of water meadow management patterns

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 21.5 ML/YR

ACTIVITY TIMELINE:

- 70% of the project activities will be implemented by the end of 2012.
- Remaining project activities are expected to be completed by the end of 2013.

COCA-COLA CONTRIBUTION: 65%

- Total cost of the project is $46,300 USD
  - Approximately $30,100 USD provided by Coca-Cola.

WATERSHED BENEFITS CALCULATED:

1. Increase in storage volume in the wet meadow system(s)

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1. INCREASE IN STORAGE VOLUME

Approach and Results

The replenish benefit was calculated as the average annual storage volume restored in the local wet meadow system due to improved land management practices implemented through the project. The regional climate is arid, with annual precipitation of only approximately 200 mm per year. However, the wet meadow / swamp systems receive the majority of their water supply from natural springs and streams that deliver water from higher elevations.

It is conservatively assumed that the fully restored wet meadow systems will capture and retain approximately 0.6 liters per hectare per second ($L\ ha^{-1}\ s^{-1}$) beyond the existing capture rate of water in the degraded meadow system (Zabala and Cepeda, 2006). This estimated capture/retention rate is applicable during the growing season when the presence of mature vegetation promotes water retention. “Active” vegetation will be present in the wet meadow system(s) for approximately 6 months of the year. Applying the capture rate of 0.6 $L\ ha^{-1}\ s^{-1}$ to a 6-month period generates a volume per unit area of 9,460.8 cubic meters per hectare per year ($m^3\ ha^{-1}\ yr^{-1}$):

(0.6 L/ha x sec) x (60 sec/min) x (60 min/hr) x (24 hr/day) x (365 day/yr) x ($1m^3$/1000 L) *(6 mo/12 mo) = 9,460.8 $m^3\ ha^{-1}\ yr^{-1}$

Applying the 9,460.8 $m^3\ ha^{-1}\ yr^{-1}$ estimate to the 5 hectare wet meadow restoration area results in a total water quantity benefit of 47,304 m^3/yr (47.3 ML/yr):

The total (ultimate) benefit: 47.3 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 30.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is based on 70% implementation of project activities through December 2012 and is estimated to be 33.1 ML/yr, and TCCC’s benefit (adjusted for cost share) is 21.5 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	47.3	30.7
2014	47.3	30.7
2015	47.3	30.7
2016	47.3	30.7
2017	47.3	30.7
Ultimate Benefit:	47.3	30.7

Data Sources

- Wet meadow area provided by contact (5 ha)

- The water retention rate restored in the affected wet meadow system(s) as a result of the project is estimated to be 0.6 L ha^{-1} s^{-1} based on Zabala and Cepeda (2006).

<u>Assumptions</u>

- Improved pasture land management practices implemented through the project will be sufficient to substantially increase vegetative cover and restore ecosystem function in the wet meadow systems.
- For Table 1, it was assumed that all restoration will be completed by the end of December 2013. This will be verified before the benefits are updated for 2013 and future years.

OTHER BENEFITS NOT QUANTIFIED

- Improvements to overall ecosystem function in the wet meadow system
- Benefits to livestock production and development, and related economic benefits to the community

NOTES

- None

REFERENCES

Zabala, H and P. Cepeda. 2006. Caudales Ecológicos en Vegas Altoandinas. GEOECOLOGÍA de los ANDES desérticos. La Alta Montaña del Valle del Elqui. CEPEDA P., J. (ed). : 525-551. Ediciones Universidad de La Serena. La Serena. Chile.

Appendix E

Fact Sheets for Water Productive Use Projects

Fact sheets for updated and new activities quantified:

Appendix E Table of Contents

PROJECT NAME: Big Spring Watershed Protection
PROJECT ID #: 14

DESCRIPTION OF ACTIVITY: Leak detection and repair of municipal water distribution and piping system

LOCATION: Borough of Bellefonte, Pennsylvania

PRIMARY CONTACT:

Rena Ann Stricker Contract Ecologist CCR Environment & Sustainability	Jon Radtke Manager, Water Resources CCR Environment & Sustainability	James Gazza, CSP Safety, Environmental and Security Manager The Coca-Cola Company Howard, PA
404-395-6250 rstricker@coca-cola.com	404-676-9112 jradtke@coca-cola.com	814-357-8631 jgazza@coca-cola.com

OBJECTIVE:

- Increase water use efficiency

BACKGROUND & DESRIPTION OF ACTIVITY: Big Spring is an artesian ground water source serving the Borough of Bellefonte, a number of neighboring communities (including the Borough of Milesburg) and commercial customers. Approximately 16 million gallons per day are pumped from the spring. The Borough of Bellefonte is allocated five million gallons of water per day and uses, on average, three million gallons to service its community. The city has had problems with aging piping and distribution infrastructure that were causing leaks and water loss. The leaking water is not infiltrating back into the aquifer because it is deep and confined. The Borough Council considered increasing water fees to fund infrastructure improvements, but Coca-Cola (the Milesburg plant) offered to partner with the Borough Council to fund improvements in its infrastructure in lieu of increasing water fees. The Coca-Cola plant partnered with the Borough to support the construction of a catchment around and a cover over the Big Spring from 1998 to 1999, to support improvements in the Big Spring pump house from 2006 to 2007, and to provide sonic testing of the piping system to detect leaks from 2006 to the present.

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE**-** 614.7 ML/YR

ACTIVITY TIMELINE:

- Construction of a catchment around and a cover over the Big Spring from 1998 to 1999
- Improvements in the Big Spring pump house from 2006 to 2007
- Sonic testing of the piping system to detect leaks and repair of detected leaks from 2006 (ongoing)

COCA-COLA CONTRIBUTION: Variable over time (see below)

Time period	Total Cost ($)	Borough of Bellefonte contribution ($)	TCCC contribution ($)	TCCC contribution (%)
2006-2010	$318,000	$276,000	$42,000	13%
2011	$38,671	$31,171	$7,500	19%
2012	$42,500	$35,000	$7,500	18%

Note: Total project costs for 2011 were not available until recently, so the previous fact sheet assumed the 2011 TCCC contribution was 13%. The 2011 contribution noted above updates the previous estimate.

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Decrease in ground water pumping

1. DECREASE IN GROUND WATER PUMPING

Approach

Water savings from the detection and repair of leaks in the water supply distribution system were initially obtained in a project survey in 2009. Subsequently, updated leak detection and repair information was provided through 2010, through 2011 and then again through 2012 via e-mails from The Coca-Cola Company Milesburg plant. A summary of water savings based on this information is provided below.

Time period	Number of leaks identified and repaired	Water savings from leak repair (gallons/day)
2006	47	1,153,520
2007	27	596,000
2008	16	241,000
2009	26	268,750
2010	22	247,250
2011	25	228,000
2012	35	421,000
Cumulative total (2006-2012)	**198**	**3,155,520**

The cumulative water savings for 2012 is calculated as the sum of the estimated savings to date and equals 3,155,520 gals/day

The total water quantity benefit is therefore the savings from all leak repair conducted to date.

The total (ultimate) benefit is: 3,155,520 gal/day or 4,359.4 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share: 614.7 ML/yr.

The table below shows how the variable cost share is considered in the calculation of the TCCC benefit.

Time period	Annual water savings (ML/yr)	TCCC Cost Share (ML/yr)	TCCC benefit taken as a function of cost share (ML/yr)
2006	1,593.6	13%	207.2
2007	823.4	13%	107.0
2008	332.9	13%	43.3
2009	371.3	13%	48.3
2010	341.6	13%	44.4
2011	315.0	19%	59.8
2012	581.6	18%	104.7
Total	**4,359.4**		**614.7**

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 4,359.4 ML/yr and TCCC's benefit (adjusted for cost share) is 614.7 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	4,359.4	614.7
2014	4,359.4	614.7
2015	4,359.4	614.7
2016	4,359.4	614.7
2017	4,359.4	614.7
Ultimate Benefit:	4,359.4	614.7

Data sources

- 2006-2008 water savings were reported in survey response. Water savings through 2010, and again updated through 2011 and through 2012 were reported in e-mails from James Gazza (The Coca-Cola Company).

Assumptions

- Projected benefits assume no additional leak repairs are conducted in the future, but it is expected that leak repairs will continue and additional benefits will be reflected in future fact sheets.
- Assumed no depreciation in savings over 5 years.

OTHER BENEFITS NOT QUANTIFIED

- Source water protection benefits resulting from the construction of a catchment around and a cover over the Big Spring from 1998-1999 were not quantified.

NOTES

- Industries and homeowners benefited because water fees were not increased.
- This fact sheet updates the November 2011 fact sheet, by including 2012 benefits and updated information on TCCC cost share for 2011 and 2012.

REFERENCES

- Bellefonte annual reports on leak repairs provided to James Gazza

PROJECT NAME: Guangxi Sustainable Sugarcane Initiative: Phase II
PROJECT ID #: 94

DESCRIPTION OF ACTIVITY: Conversion of flood irrigation to drip irrigation

LOCATION: Xinhe sub-district of Jiangzhou District (Chongzuo City), Guangxi China

PRIMARY CONTACTS:

Jasmine Tian KO/PAC China KO Project Leader, UNDP jatian@apac.ko.com	Gongchen Li United Nations Development Program (UNDP) gongchen.li@gmail.com	Weidong Zhang Weidong.zhang@undp.org

OBJECTIVES:

- Support government efforts to improve water resources management

BACKGROUND & ACTIVITY DESCRIPTION: The Guangxi Autonomous Region plays an important role in China's sugar industry, with more than 20 million people working in sugarcane agriculture and sugar production. More than 60% of China's sugar production comes from this arid region, including sugar supplied to The Coca-Cola Company. Beginning in late 2009, Guangxi and four other provinces of southwest China experienced a severe drought of historic proportions, with significant impacts on crop yields. This project is a Public-Private Partnership demonstration project with the United Nations Development Program (UNDP) that addresses the need for reliable and efficient irrigation of sugarcane.

The second phase of the initiative involved the replacement of flood irrigation with drip irrigation for 146 ha of sugarcane production in the Xinhe sub-district of Jiangzhou District, Guangxi. The project also involves the use of treated wastewater from the Xianggui Sugar Company and Fulaishun Yeast Company combined with river water (Figure 1) for irrigation. The implementation of drip irrigation substantially reduces the abstraction of river water for irrigation requirement compared to flood irrigation.

Figure 1. Treated wastewater (left) is combined with river water for irrigation (right)

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 508 ML/YR

ACTIVITY TIMELINE:

- Project initiation: 2011
- Nali irrigation area: 100% converted July-Dec 2011
- Xiangguix irrigation area: 100% converted July-Dec 2011

COCA-COLA CONTRIBUTION: 50%

- Total cost: $599,000 USD
- TCCC cost contribution: $299,500 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Improved irrigation efficiency

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1. <u>Water Savings through improved irrigation efficiency</u>

Approach and Results:

The replenish benefit was estimated based on the reduction in water consumption due to conversion to drip irrigation, calculated as follows.

The irrigation water requirements for the pre-and post-project conditions were based on the crop water requirement and irrigation efficiencies of flood and drip irrigation.

- Crop water requirement for sugarcane in the project area: 3,578 m3/ha
- Irrigation efficiency of flood irrigation: 25%
- Irrigation efficiency of drip irrigation: 90%
- Irrigation requirement with flood irrigation = 3,578/0.25 = 14,312 m3/ha
- Irrigation requirement with drip irrigation = 3,578/0.9 = 3,976 m3/ha

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a 'return flow' to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as 'return flow' to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for flood irrigation and micro-irrigation are 25% and 5%, respectively of the applied water. The calculations are as follows.

- Pre-project: (flood irrigation)
  - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 14,312 m3/ha
  - Consumed fraction = (1-fraction of return flow) x water applied

    = (1-0.25) X 14,312 m3/ha = 10,734 m3/ha

- Post-project: (drip irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 3,976 m3/ha
    - Consumed fraction = (1-fraction of return flow) x water applied

      = (1-0.05) X 3,976 m3/ha = 3,777.2 m3/ha
- Water savings = (10,734 – 3,777.2) m3/ha = 6,956.8 m3/ha
- Area of cultivation = 146 ha

Total benefits = Water savings x Area of cultivation

= 6,956.8 m3/ha x 146 ha = 1,015,693 m3 = 1,016 ML

The total (ultimate) benefit is: 1,016 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 508 ML/yr.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 1,016 ML/yr and TCCC's benefit (adjusted for cost share) is 508 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quality Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	1,016	508
2014	1,016	508
2015	1,016	508
2016	1,016	508
2017	1,016	508
Ultimate Benefit:	1,016	508

Data Sources:

- All data used in the calculations were provided by UNDP China.

Assumptions:

- Projected benefits assume project will continue as currently designed.
- Return flow is assumed to be 25% for flood irrigation and 5% for drip irrigation

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OTHER BENEFITS NOT QUANTIFIED

- Improved technological standards for recycling waste water in sugar industry and strengthening of water resource protection
- Economic and social benefits to sugarcane farmers
- Increased yields due to conversion from flood irrigation to drip irrigation.
- Reduced flooding due to improved drainage.
- Reduced vulnerability to droughts and climate change
- Benefits of scaling the demonstration sites for replication throughout China.

NOTES

- Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified

REFERENCES

Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012

Foster, S.S.D and Perry, C.J. 2010. Improving ground water resource accounting in irrigated areas: a prerequisite for promoting sustainable use. Hydrogeology Journal, 18: 291 – 294.

UNDP. 2012 Coca-Cola programs in Guangxi Autonomous Region.

PROJECT NAME: Guangxi Sustainable Sugarcane Initiative: Phases I and II
PROJECT ID #: 94

DESCRIPTION OF ACTIVITY: Water for productive use: new irrigation supply and improved irrigation efficiency

LOCATION: Shangsi County in Fangchenggang City of Guangxi Autonomous Region

PRIMARY CONTACTS:

Jasmine Tian	Gongchen Li	Weidong Zhang
KO/PAC China	United Nations Development Program (UNDP)	
KO Project Leader, UNDP		
jatian@apac.ko.com	gongchen.li@gmail.com	Weidong.zhang@undp.org

OBJECTIVES:

- Improve crop yields by proving reliable supply of irrigation water
- Improve water use efficiency
- Support economic and social stability and development

BACKGROUND & ACTIVITY DESCRIPTION: The Guangxi Autonomous Region plays an important role in China's sugar industry, with more than 20 million people working in sugarcane agriculture and sugar production. More than 60% of China's sugar production comes from this region, including sugar supplied to The Coca-Cola Company. Beginning in late 2009, Guangxi and four other provinces of southwest China experienced a severe drought of historic proportions, with significant impacts on crop yields and livelihoods in a region with high poverty levels. This project is a Public-Private Partnership demonstration project with the United Nations Development Program (UNDP) that addresses the need for reliable and efficient irrigation of sugarcane.

Treated water from a sugar plant is reused to irrigate sugarcane fields. The water is combined with Ming River water before it is used in irrigation. A sprinkler irrigation system is provided to improve water efficiency over traditional flood irrigation. A total of 433.3 mu are being irrigated in 2012. (Note that 15 mu are equivalent to 1 ha).

Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified.

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 650.0 ML/YR

Figure 1. In Shangsi County, water from a sugar plant is treated before it is mixed with river water and used for irrigation. The photo on the left shows untreated water and the photo on the right shows treated water.

ACTIVITY TIMELINE:

- January 2011: Project initiated
- July 2011: Phase I completed
- December 2012: Phase II 100% completed

COCA-COLA CONTRIBUTION: 50%

Total project cost: $320,000 USD

- Coca-Cola: $160,000 USD
- Other Partners: $160,000 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Increase in irrigation water supply

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1. INCREASE IN IRRIGATION WATER SUPPLY

Approach and Results:

Based on metering data, 1,299.9 ML/yr of combined sugar plant reused water and river water is delivered to the fields. The total area surface area for irrigation is 433.3 ha.

Total (ultimate) benefit is: 1,299.9 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 650.0 ML/yr

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 1,299.9 ML/yr and TCCC's benefit (adjusted for cost share) is 650.0 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	1299.9	650.0
2014	1299.9	650.0
2015	1299.9	650.0
2016	1299.9	650.0
2017	1299.9	650.0
Ultimate Benefit:	1299.9	650.0

It is unknown at this time if the project will expand in the future so it is assumed that benefits will continue to be generated at the 2012 rate.

Data Sources:

- Metered data and estimates from farmers

Assumptions

- It is assumed that irrigation water was provided to farmers throughout the 2012 growing season (June through August).
- It is assumed that the irrigation water will be provided from June to August every year at the same rate as estimated for 2012.

OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to sugarcane farmers
- Improved irrigation efficiencies and increased yields due to conversion from flood irrigation to drip and channel irrigation.
- Reduced flooding due to improved drainage
- Reduced vulnerability to droughts and climate change
- Demonstration sites are scalable and replicable throughout China

NOTES

- This factsheet updates the November 2011 factsheet to provide a new project contact and document an increase in the area irrigated since 2011 in Shangsi County. The work in Longzhou County was removed from this updated fact sheet because it does not currently meet replenish project requirements for irrigation projects.

Names of Program Partners:

- United Nations Development Program
- Coca-Cola China
- Ministry of Water Resources
- China International Centre for Economic and Technical Exchanges (CIETE)

REFERENCES

Power Point presentation provided by Gongchen Li titled "Replenishment Calculations for Water Programme" dated September 11, 2012

UNDP. 2012 Coca-Cola programs in Guangxi Autonomous Region.

PROJECT NAME: Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim River Basin
PROJECT ID #: 100

DESCRIPTION OF ACTIVITY: Water for productive use (irrigation water supply)

LOCATION: Yuli County in Xinjiang Autonomous Region

PRIMARY CONTACTS:

Jasmine Tian	Gongchen Li	Weidong Zhang
KO/PAC China	United Nations Development	
KO Project Leader, UNDP	Program (UNDP)	
jatian@apac.ko.com	gongchen.li@gmail.com	Weidong.zhang@undp.org

OBJECTIVE:

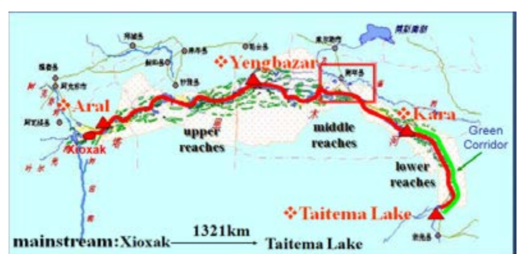
- Provide water for irrigation

BACKGROUND & ACTIVITY DESCRIPTION: The Tarim River basin (1.02 million km^2) is one of the longest inland river basins in China and home to a population of roughly 10 million. It is also one of the most arid and fragile regions in western China and in central Asia. The Tarim River relies heavily on water from snowmelt in high-altitude areas to provide flow through the desert. This river suffers from severe and frequent water shortages that have impacted ecosystems and contributed to significant poverty in villages that rely on the river for water supply.

This project involved several activities including: 1) pilot water resource management and allocation; 2) water provided for productive use through increased irrigation; and 3) decreased water use through the implementation of water saving irrigation techniques. This pilot approach may be extended to other similar arid/semi-arid areas in western China and central Asian countries in the future.

This fact sheet describes the benefits related to the second activity, water provided for productive use.

Tarim River Basin



Main Stem of the Tarim River Basin

The project was designed to address major conflicts between farmers over the fairness of irrigation water allocations that have led to injuries and deaths. The project involves improved irrigation water management, reasonable water quota management, and provision of more irrigation of lower order streams. During the project, 8.5 km of anti-leakage channels were installed, which substantially reduced water loss during delivery. At the same time, water quotas were established, thereby providing increased irrigation in the lower order streams. Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified.

SUMMARY OF REPLENISH BENEFIT

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 172.9 ML/YR

ACTIVITY TIMELINE:

- October 2007 - December 2010

COCA-COLA CONTRIBUTION: 10%

Total project cost: $1.5 million USD

- Coca-Cola: $150,000 USD
- Other Partners: $1.35 million USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Volume of water provided for farmland irrigation

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1. VOLUME OF WATER PROVIDED FOR FARMLAND IRRIGATION

Approach & Results

The quantity of water provided for productive use (irrigation) was estimated as the difference in irrigation water provided for 427 ha farmland during pre-project and post-project conditions.

- Pre-project: (conflict with water allocation in lower order streams)
    - Irrigation water provided = 5,400 m3/ha/yr x 427 ha = 2,305.8 ML/yr
- Post-project: (increased water allocation in lower order streams)
    - Irrigation water provided = 9,450 m3/ha/yr x 427 ha = 4,035.2 ML/yr

The total (ultimate) water quantity benefit is: 1,729.4 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 172.9 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 1,729.4 ML/yr and TCCC's benefit (adjusted for cost share) is 172.9 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	1,729.4	172.9
2014	1,729.4	172.9
2015	1,729.4	172.9
2016	1,729.4	172.9
2017	1,729.4	172.9
Ultimate Benefit:	1,729.4	172.9

<u>Data Sources:</u>

- All data were provided by UNDP

<u>Assumptions:</u>

- The area irrigated and quantity of irrigation water in 2012 and beyond equals the amount in 2010. No information was available regarding an expansion of this project.

OTHER BENEFITS NOT QUANTIFIED

- Social and economic benefits

NOTES

- This factsheet updates the November 2011 factsheet, based on information provided by UNDP in September 2012. The major difference is in the description of the project activity. The 2012 replenish benefit reported in this update is 44.7 ML/year less than those reported in the previous fact sheet. This revision to the fact sheet also provides updated contact information.

REFERENCES

- Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012

PROJECT NAME: Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim River Basin
PROJECT ID : 100

DESCRIPTION OF ACTIVITY: Conversion from flood irrigation to drip irrigation

LOCATIONS: Yuli County in Xinjiang Autonomous Region

PRIMARY CONTACTS:

Jasmine Tian	Gongchen Li	Weidong Zhang
KO/PAC China	United Nations Development	
KO Project Leader, UNDP	Program (UNDP)	
jatian@apac.ko.com	gongchen.li@gmail.com	Weidong.zhang@undp.org

OBJECTIVES:
- Support government efforts to improve water resources management

BACKGROUND & ACTIVITY DESCRIPTION: The Tarim River basin (1.02 million km^2) is the longest inland river basin in China and is home to a population of roughly 10 million. It is also one of the most arid and fragile regions in western China and in central Asia. The Tarim River relies heavily on water from snowmelt in high-altitude areas to provide flow through the desert. This river suffers from serious water shortages that have impacted ecosystems and caused many counties and villages to become the most poverty-stricken in the country.

This project activity involves introduction of drip irrigation kits to improve water-use efficiency on 226.7 ha of farmland which was previously irrigated with flood irrigation (Figure 1). The type of crop affected by this project activity is cotton, which is the major crop in the region.

Figure 1. Water gates and canals on left and drip irrigation on right

SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE - 50.8 ML/YR

ACTIVITY TIMELINE:

- 2007 – 2011 (completed in 2011)

COCA-COLA CONTRIBUTION: 10%

WATERSHED FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Decrease in consumption

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1. DECREASE IN CONSUMPTION

Approach and Results

The replenish benefit was estimated based on the reduction in water consumption due to conversion to drip irrigation. The irrigation water requirements for the pre-and post-project conditions were based on the crop water requirement for cotton and irrigation efficiencies of flood and drip irrigation.

Irrigation requirement with flood irrigation = 9,450 m3/ha

Irrigation requirement with drip irrigation = 5,100 m3/ha

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a 'return flow' to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as 'return flow' to the freshwater aquifer when water is applied for irrigation. Reasonable assumptions of return flow for flood irrigation and micro-irrigation are 25% and 5% of the applied water, respectively. The calculations are as follows.

- Pre-project: (flood irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 9,450 m3/ha
    - Consumed fraction = (1-fraction of return flow) x water applied

      = (1-0.25) X 9,450 m3/ha = 7,088 m3/ha
- Post-project: (drip irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 5,100 m3/ha
    - Consumed fraction = (1-fraction of return flow) x water applied

      = (1-0.05) X 5,100 m3/ha = 4,845 m3/ha
- Water savings = (7,088 – 4,845) m3/ha = 2,243 m3/ha
- Area of cultivation = 226.7 ha

Total benefits = Water savings (m3/ha) x Area (ha) of cultivation

= 2,243 m3/ha x 226.7 ha = 508,375 m3 = 508.4 ML

The total (ultimate) benefit is: 508.4 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 50.8 ML/yr.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 508.4 ML/yr and TCCC's benefit (adjusted for cost share) is 50.8 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quality Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	508.4	50.8
2014	508.4	50.8
2015	508.4	50.8
2016	508.4	50.8
2017	508.4	50.8
Ultimate Benefit:	508.4	50.8

Data Sources:

- All data used in the calculations are provided by UNDP China.
- Water applied for irrigation was estimated based on local monitoring.

Assumptions:

- Return flow is assumed to be 25% for flood irrigation and 5% for drip irrigation

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OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to sugarcane farmers
- Increased yields due to conversion from flood irrigation to drip irrigation.
- Reduced flooding due to improved drainage
- Reduced vulnerability to droughts and climate change
- Benefits of scaling the demonstration sites for replication throughout China.

NOTES

- Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified

REFERENCES

Foster, S.S.D and Perry, C.J. 2010. Improving ground water resource accounting in irrigated areas: a prerequisite for promoting sustainable use. Hydrogeology Journal, 18: 291 – 294.

Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012

PROJECT NAME: Conserving water usage through improved irrigation techniques
PROJECT ID #: 104

DESCRIPTION OF ACTIVITY: Laser leveling activities and conversion to drip irrigation

LOCATION: Locations throughout India

PRIMARY CONTACT:
Dr. MVRL Murthy
Senior Manager, Hydrogeology
Coca-Cola India
Gurgaon, India
dmurthy@coca-cola.com

OBJECTIVES:

- Improve ground water availability

BACKGROUND & ACTIVITY DESCRIPTION:

Laser Leveling
Laser leveling is a new but very cost effective technology being deployed to ensure appropriate and scientific leveling of the land to be irrigated. Once leveled precisely with the help of laser guided equipment, the field is rendered flat thereby ensuring that the water is uniformly applied. The bottlers have collaborated with technology providers and local farmers in the northern state of Punjab and provided use of this technology on many farms, totaling more than 2,515 acres. Figure 1 shows a typical laser leveling operation at a farm. The crops cultivated in the laser-leveled fields include wheat and paddy.

Figure 1. Laser guided precision leveling activity of field in India

Drip Irrigation

Promoting water efficient agriculture in the village of Kaladera, located in the district of Jaipur, Rajasthan is the main focus of the drip irrigation initiatives. Drip irrigation, also known as micro-irrigation, is a method that minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants through a network of valves, pipes, tubing, and emitters. Drip irrigation projects are executed in partnership with the Government of Rajasthan by way of financial subsidy, *Krishi Vigyan Kendra* which provides training and insights to the farmers to carry out drip irrigation-based farming. Starting with one pilot project in 2005 and followed by 27 drip-irrigation projects installed in 2008 in an area of 14 hectares, this initiative has been widely adopted in the community, and drip irrigation is currently employed by approximately 523 farmers on more than 645 acres of agricultural land. Crops cultivated under drip irrigation include onions and a variety of other vegetables.

Figure 2. Drip irrigation system on an onion field in India

SUMMARY OF REPLENISH BENEFIT:

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 3,763 ML/YR

ACTIVITY TIMELINE:

- Drip irrigation initiatives began in 2005 and laser leveling initiatives began in 2008.
- As of the end of 2012, laser leveling and drip irrigation activities have been implemented on 2,515 and 645 acres, respectively.

COCA-COLA CONTRIBUTION: 100%

- Projects are fully funded by Coca-Cola

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Decrease in ground water consumption

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1. DECREASE IN GROUND WATER CONSUMPTION

Approach and Results:

Water savings for both drip irrigation and laser leveling were computed as the difference in the consumed fraction of water applied for irrigation between pre- and post-project conditions. The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a 'return flow' to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as 'return flow' to the freshwater aquifer when water is applied for irrigation.

Laser Leveling:
The crops that are cultivated in the laser-leveled field include wheat and paddy. The India Division has determined that research studies conducted by Punjab Agricultural University, Ludhiana indicate an approximate 25–30% reduction in water application (Agarwal et al., 2009; Sidhu et al., 2007). For benefit calculations, it was assumed that laser leveling would result in 25% less water applied compared to non-laser leveled field conditions. The India Division suggested that for paddy crops, a reasonable estimate of the return flow is 30% of the water applied for irrigation. During pre and post-laser leveling activities, the method of irrigation is traditional flood irrigation. The calculations are as follows.

Pre-project:

- Water applied for irrigation = 8,000 cubic meters/acre
- Consumed fraction = (1- fraction of return flow) X water applied
  = (1-0.3) X 8,000 cubic meter/acres = 5,600 cubic meters/acre

Post-project:

- Water applied for irrigation = 6,000 cubic meters/acre
- Consumed fraction = (1- fraction of return flow) X water applied
  = (1-0.3) X 6, 000 cubic meters/acre = 4,200 cubic meters/acre

Water savings = (5,600 – 4,200) cubic meters/acres = 1,400 cubic meters/acre
Area of cultivation = 2,515 acres

Total benefits = Water savings x Area of cultivation
= 1,400 cubic meters/acres X 2,515 acres =3,521,000 cubic meters = 3,521 ML/yr

Drip Irrigation:
Crops cultivated under drip irrigation include predominantly onions (> 85%) and some vegetables. For the purpose of calculations, it was assumed that onions are grown in the entire project area. Using available data sources, the crop water requirement for onions in the Rajasthan region was estimated to be 989 m3/ha (Mekonnen and Hoekstra, 2009; FAO). Assuming an irrigation efficiency of 40%, the

irrigation water requirement using traditional flood irrigation was estimated to be 2,473 m3/ha. According to the India Division, installing drip irrigation results in a 50% reduction in irrigation water application. The India Division also estimates that for vegetables including onions, a reasonable estimate of 'return flow' is 15% of the water applied for flood irrigation. Under drip irrigation, the 'return flow' component is usually a small to negligible fraction of the total irrigation water applied. A 'return flow' fraction of 5% based on literature (Foster and Perry, 2010) was assumed in the calculations. The calculations are as follows:

Pre-project:

- Method of irrigation: flood
- Water applied for irrigation = 2,473 cubic meters/hectare = 1,001 cubic meters/acre
- Consumed fraction = (1- fraction of return flow) X water applied
  = (1-0.15) X 1,001 cubic meters/acre = 851 cubic meters/acre

Post-project:

- Method of irrigation: drip
- Water applied for irrigation = 1,236 cubic meters/hectare = 501 cubic meters/acre
- Consumed fraction = (1- fraction of return flow) X water applied
  = (1-0.05) X 501 cubic meter/acres = 476 cubic meters/acre

Water savings = (851 – 476) cubic meters/acres = 375 cubic meters/acre
Area of cultivation = 645 acres

Total benefits = Water savings x Area of cultivation
= 375 cubic meters/acres X 645 acres = 241,875 cubic meters = 242 ML/yr.

The total benefit of all irrigation projects is calculated by summing the benefits of the laser leveling and drip irrigation projects. Until data become available for future years it is assumed that the total (ultimate) benefit will remain the same as the 2012 benefit.

The total (ultimate) benefit = 3,521 + 242 = 3,763 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 3,763 ML/yr.

The current (2012) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2012 in each future year.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 3,763 ML/yr and TCCC's benefit (adjusted for cost share) is 3,763 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Projected Water Quantity Benefits Summary

Year	Total Benefit (ML/yr)	Adjusted for TCCC Cost Share (ML/yr)
2013	3,763	3,763
2014	3,763	3,763
2015	3,763	3,763
2016	3,763	3,763
2017	3,763	3,763
Ultimate Benefit:	3,763	3,763

Data Sources:

- Land areas were provided by India Division
- Water use values are based on documents cited

Coca-Cola India has provided the following text related to data validation:

"Coca-Cola India has developed comprehensive requirements and guidelines for approaching the water replenishment (WR) initiatives, technically pre-validating the proposed intervention, maintaining the developed structures/projects and establishing efficiency of the developed WR initiatives. These guidelines are applicable to all operations present in the India South West Asia Business Unit (INSWA BU) including manufacturing/bottling entities. A brief summary of guidelines and requirements setup by Coca-Cola, India to approach water replenishment initiatives is provided in Water Replenish Requirements (WRR) document (2011). The document contains appendices that provide sample template of data needed to develop various WR initiatives. The existing WR initiatives are required to undergo field validation. The elements of field validation include documentation status review; design record sufficiency review; ownership record status review; maintenance record status review; and field level physical verification. The field validation involves a score based Data Quality Assessment (DQA) process. If the overall DQA score resulted in less than 60% for any particular project location, then the replenish benefits are not accounted. An example DQA calculation is provided by Coca-Cola, India as an appendix to the WRR document."

Assumptions:

- All projects have been field validated.
- Water applied does not exceed the estimated irrigation water requirement for flood and drip irrigations.

OTHER BENEFITS NOT QUANTIFIED

- Reduced energy usage
- Increased crop yields and incomes
- Reduced fertilizer application and reduced pollution surface runoff and ground water
- Reduced weed, pest, and disease problems

NOTES:

- This factsheet updates the 2011 factsheet, as additional farms were added to the program in 2012. For the irrigation projects in Rajasthan, the irrigation water requirement for flood irrigation was revised from 900 m3/ha to 1,236 m3/ha based on updated information.

REFERENCES

Foster, S.S.D and Perry, C.J. 2010. Improving ground water resource accounting in irrigated areas: a prerequisite for promoting sustainable use. Hydrogeology Journal, 18: 291 – 294.

Aggarwal, R., Kaushal, M., Kaur, S., and Farmaha, B. 2009. Water resource management for sustainable agriculture in Punjab, India. Water Science and Technology, 60(11): 2905 – 2911.

Sidhu, H.S., Mahal, J.S., Dhaliwal, I.S., Bector V., Singh, M., Sharda, A., and Singh, T. 2009. Laser land leveling: a boon for sustaining Punjab agriculture. Punjab Agricultural University, Ludhiana.

Water Replenish Requirements (2011). Document provided by Dr.Murthy on November 02 2011, describing the requirements of approaching developing, maintaining and understanding efficiency of the WR interventions initiated by INSWA BU.

India Division estimates are summarized within the spreadsheet entitled: *water-replenishment_update_revised_with_tccc_obs.xlsx.*

Supporting information regarding laser leveling projects are provided by the India Division in the spreadsheet entitled: *Approach to laser_leveling_fmt_amritsar_example.xlsx*

Supporting information regarding drip irrigation projects are provided by the India Division in the spreadsheet entitled *Approach to drip_kaladera_revised_post_inputs-from_Limnotech_PS.xlsx*

Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. http://www.waterfootprint.org/?page=files/Publications

FAO. http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor

Appendix F

Summaries of Water Access and Sanitation Projects

Appendix F

Summaries of Updated and New Activities Quantified: Water Access Projects

557. **Democratic Republic of the Congo: Kinshasa Bopeto**

Summary: This access to water and sanitation project is being implemented by CARE International.
Phase: This project will be complete in 2012.
Beneficiaries: This project will provide 75,000 community members with access to clean water.
Quantification: This full access to water project will provide 547.50 million liters of water each year starting in 2013.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 547.50 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

39. **Angola: Water Supply Access for the Urban Poor**

Summary: This access to water and sanitation project is being implemented by CARE Angola.
Phase: This project will be complete in 2008.
Beneficiaries: The project gave 27,600 people full access to water through construction of nine community water tap stands. It also provided sanitation and hygiene training and education to 120 people. 3,000 school children also received limited access to water.
Quantification: This full access to water project will provide 201.48 million liters of water each year starting in 2009.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 100.74 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

406. **Cameroon: Water and Sanitation for Schools and Communities in Akonolinga and Gaschiga Councils**

Summary: This access to water and sanitation project is being implemented by Plan Cameroon.
Phase: This project will be complete in 2011.
Beneficiaries: The project gave 5,400 people full access to water.
Quantification: This full access to water project will provide 39.42 million liters of water each year starting in 2012.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 39.42 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

242. **Kenya: Mara River Basin Water & Development Alliance**

Summary: This access to water and sanitation project is being implemented by Florida International University, World Vision.
Phase: This project will be complete in 2010.
Beneficiaries: The project gave 8,704 people full access to water.
Quantification: This full access to water project will provide 63.54 million liters of water each year starting in 2011.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 31.77 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

244. **<u>Kenya: Water and Sanitation Improvement Program</u>**
Summary: This access to water and sanitation project is being implemented by Aga Khan Foundation.
Phase: This project will be complete in 2010.
Beneficiaries: The project gave 16,000 people full access to water.
Quantification: This full access to water project will provide 116.80 million liters of water each year starting in 2011.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 58.40 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

648. **<u>Angola: Improvement of Drinking Water and Sanitation Services in the Angolan Communities of Bom Jesus and Funda</u>**
Summary: This access to water and sanitation project is being implemented by Development Worskhop (Angola).
Phase: This project will be complete in 2014.
Beneficiaries: The project gave 8,500 people full access to water.
Quantification: This full access to water project will provide 62.05 million liters of water each year starting in 2015.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 31.03 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

650. **<u>Argentina: Improvement of Conditions for Drinking Water Access at 3 Localities in the Province of Entre Rios</u>**
Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 6,260 people full access to water.
Quantification: This full access to water project will provide 45.70 million liters of water each year starting in 2013.
TCCC Financial Contribution: 53%
TCCC Contribution Quantification: 23.99 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

651. **<u>Argentina: Access to Water for Family Consumption and Production in the Household Environment, by Means of the Construction of Rain Water Catchment Modules in Cordoba</u>**
Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 150 people full access to water.
Quantification: This full access to water project will provide 1.10 million liters of water each year starting in 2014.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 0.55 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

652. **Argentina: Extension of the Drinking Water Natwork, at EFA Neighborhood, Villa Ocampo, Santa Fe.**
Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 200 people full access to water.
Quantification: This full access to water project will provide 1.46 million liters of water each year starting in 2013.
TCCC Financial Contribution: 53%
TCCC Contribution Quantification: 0.77 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

653. **Burundi: Water Supply, Sanitation, and Hygiene Education in Peri-Urban Bujumbura (WADA)**
Summary: This access to water and sanitation project is being implemented by Betraco-Mesodi.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 8,253 people full access to water.
Quantification: This full access to water project will provide 60.25 million liters of water each year starting in 2014.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 30.12 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

654. **Cambodia: Community Clean Water Supply and Sanitation 2011**
Summary: This access to water and sanitation project is being implemented by Cambodian Women for Peace and Development.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 2,800 people full access to water.
Quantification: This full access to water project will provide 20.44 million liters of water each year starting in 2013.
TCCC Financial Contribution: 97%
TCCC Contribution Quantification: 19.83 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Bui Thi Ngoc Diem on 3 Oct.

608. **Cambodia and Vietnam: Mekong Region Water and Sanitation Initiative**
Summary: This access to water and sanitation project is being implemented by UN Habitat.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 12,481 people full access to water.
Quantification: This full access to water project will provide 91.11 million liters of water each year starting in 2013.
TCCC Financial Contribution: 20%
TCCC Contribution Quantification: 17.86 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Bui Thi Ngoc Diem on 1 Oct.

658. **<u>Chile: Loss Reduction and Network Connection to Contribute to Guarrntee Access Water at the San Pedro Commune</u>**

Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 1,354 people full access to water.
Quantification: This full access to water project will provide 9.88 million liters of water each year starting in 2014.
TCCC Financial Contribution: 38%
TCCC Contribution Quantification: 3.71 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

659. **<u>Chile: Expansion and Connection of Networks to Guarantee Access to Quality Water at Guangualí, Coquimbo Region</u>**

Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 850 people full access to water.
Quantification: This full access to water project will provide 6.21 million liters of water each year starting in 2014.
TCCC Financial Contribution: 65%
TCCC Contribution Quantification: 4.03 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

660. **<u>Chile: Collection and Installation of Acessories for Water CONNECTION (use of fog collectiors and water care) at Quilimari. Coquimbo Region</u>**

Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 945 people full access to water.
Quantification: This full access to water project will provide 6.90 million liters of water each year starting in 2014.
TCCC Financial Contribution: 45%
TCCC Contribution Quantification: 3.10 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

482. **<u>China: Non-point Pollution Control and Drinking Water Safety in the Rural Areas</u>**

Summary: This access to water and sanitation project is being implemented by UNDP.
Phase: This project will be complete in 2008.
Beneficiaries: The project provided for a water treatment plant that has a treatment capacity of 3×104 tons per day (30 ML per day).
Quantification: This monitored access to water project will provide 10,950.00 million liters of water each year starting in 2009.
TCCC Financial Contribution: 20%
TCCC Contribution Quantification: 2,190.00 million liters per year until 2015.
Verification: Information on this project was originally quantified and validated by LimnoTech.

483. **China: Water treatment and waterborne disease control**

Summary: This access to water and sanitation project is being implemented by UNDP.
Phase: This project will be complete in 2008.
Beneficiaries: This project involved development of a sewage pipe network to collect and route sewage from rural areas of Chongzhou City to a wastewater treatment plant to improve water quality in the Jinma River.
Quantification: This monitored access to water project will provide 432.50 million liters of water each year starting in 2009.
TCCC Financial Contribution: 6%
TCCC Contribution Quantification: 25.52 million liters per year until 2015.
Verification: Information on this project was originally quantified and validated by LimnoTech

657. **Colombia: Drinking Water Project**

Summary: This access to water and sanitation project is being implemented by Colombia Humanitaria.
Phase: This project will be complete in 2012.
Beneficiaries: The Coca-Cola System with the FEMSA Foundation donated 10 modern water treatment plants to provide drinking water to 10 municipalities.
Quantification: This full access to water project will provide 429.64 million liters of water each year starting in 2013.
TCCC Financial Contribution: 50%
TCCC Contribution Quantification: 214.82 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Erick Remirez on 6 Jan.

656. **Egypt: Raising Healthy Children with Safe Household Water Supply and Sanitation**

Summary: This access to water and sanitation project is being implemented by .
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 4,700 people full access to water.
Quantification: This full access to water project will provide 34.31 million liters of water each year starting in 2014.
TCCC Financial Contribution: 52%
TCCC Contribution Quantification: 17.84 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

40. **Egypt: Environmental Services for Improving Water Quality Management**

Summary: This access to water and sanitation project is being implemented by IRG.
Phase: This project will be complete in 2010.
Beneficiaries: The project gave 54,000 people access to water through wastewater treatment.
Quantification: This monotored access to water project will provide 492.75 million liters of water each year starting in 2011.
TCCC Financial Contribution: 33%
TCCC Contribution Quantification: 162.61 million liters per year until 2015.
Verification: Information on this project was originally quantified and validated by LimnoTech

578. **India: Creation of Protected Water Supply in Atmakuru, Andhra Pradesh**

Summary: This access to water and sanitation project is being implemented by Atmakuru Village Panchayat.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 8,900 people access to water through wastewater treatment.
Quantification: This monitored access to water project will provide 328.50 million liters of water each year starting in 2013.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 328.50 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Dr. Murthy on 15 Nov.

655. **Madagascar: Water & Sanitation for the Urban Poor (WSUP)**

Summary: This access to water and sanitation project is being implemented by Water & Sanitation for the Urban Poor (WSUP).
Phase: This project will be complete in 2014.
Beneficiaries: The project gave 84,750 people full access to water.
Quantification: This full access to water project will provide 618.68 million liters of water each year starting in 2015.
TCCC Financial Contribution: 92%
TCCC Contribution Quantification: 569.18 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

610. **Malaysia: Water for Humanity**

Summary: This access to water and sanitation project is being implemented by Yayasan Kemanusiaan Muslim Aid Malaysia.
Phase: This project will be complete in 2012.
Beneficiaries: Instillation of 2 underground water supplies with 4-step filtration processes.
Quantification: This monitored access to water project will provide 17.52 million liters of water each year starting in 2013.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 17.52 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Kadri Taib on 11 Sept.

63. **Maldives: Island Sanitation in the Maldives**

Summary: This access to water and sanitation project is being implemented by UNDP Maldives.
Phase: This project will be complete in 2008.
Beneficiaries: The project gave 526 people full access to water.
Quantification: This monitored access to water project will provide 11.52 million liters of water each year starting in 2009.
TCCC Financial Contribution: 39%
TCCC Contribution Quantification: 4.49 million liters per year until 2015.
Verification: Information on this project was originally quantified and validated by LimnoTech

18. **Mexico: TCCC-WWF Partnership: Rio Grande/Rio Bravo River Basin**

Summary: This access to water and sanitation project is being implemented by WWF.
Phase: This project will be complete in 2010.
Beneficiaries: A pilot cost-effective wastewater bio-treatment plant with a capacity to serve approximately 200 people.
Quantification: This monitored access to water project will provide 1.97 million liters of water each year starting in 2011.
TCCC Financial Contribution: 60%
TCCC Contribution Quantification: 1.18 million liters per year until 2015.
Verification: Information on this project was originally quantified and validated by LimnoTech

666. **Morocco: Potable Water Supply and Small-Scale Irrigation (WADA)**

Summary: This access to water and sanitation project is being implemented by CARE.
Phase: This project will be complete in 2011.
Beneficiaries: The project gave 1,024 people full access to water.
Quantification: This full access to water project will provide 7.48 million liters of water each year starting in 2012.
TCCC Financial Contribution: 47%
TCCC Contribution Quantification: 3.51 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

663. **Peru: Improvement of Waste Water Treatment Plants in Rural Communities at the Black and White Andean Mountain Range, Ancash Region**

Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2012.
Beneficiaries: The project wastewater treatment project gave people access to water.
Quantification: This monitored access to water project will provide 49.00 million liters of water each year starting in 2013.
TCCC Financial Contribution: 57%
TCCC Contribution Quantification: 27.69 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

664. **Peru: Improvement of Access to Safe Water in Rural Communities at the Black and White Andean Mountain Ranges, Ancash Region**

Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 2,945 people full access to water.
Quantification: This full access to water project will provide 21.50 million liters of water each year starting in 2013.
TCCC Financial Contribution: 47%
TCCC Contribution Quantification: 10.00 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

665. **<u>Peru: Improvement of Water Quality at Three Populated Centers at Chincha Baja Disctrict, Ica Region</u>**
Summary: This access to water and sanitation project is being implemented by AVENA.
Phase: This project will be complete in 2013.
Beneficiaries: The project gave 1,734 people full access to water.
Quantification: This full access to water project will provide 12.66 million liters of water each year starting in 2014.
TCCC Financial Contribution: 56%
TCCC Contribution Quantification: 7.09 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Emilio Lopez on 7 Nov.

552. **<u>Philippines: Community-based Potable Water System Management Project</u>**
Summary: This access to water and sanitation project is being implemented by Nortehanon Access Center , Inc.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 3,875 people full access to water.
Quantification: This full access to water project will provide 28.29 million liters of water each year starting in 2013.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 28.29 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Victor Manlapaz on 9 Sept.

553. **<u>Philippines: Community Managed Potable Water Supply through Creek Development and Rain Harvesting in Barangays San Fernando and Dumuyog, Del Carmen, Surigao del Norte</u>**
Summary: This access to water and sanitation project is being implemented by SUNGCOD, Inc. .
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 1,173 people full access to water.
Quantification: This full access to water project will provide 8.56 million liters of water each year starting in 2013.
TCCC Financial Contribution: 67%
TCCC Contribution Quantification: 5.74 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Victor Manlapaz on 9 Sept.

555. **<u>Philippines: AGOS Hydraulic Ram Pump Project</u>**
Summary: This access to water and sanitation project is being implemented by Earth Day Network Philippines, Inc..
Phase: This project will be complete in 2014.
Beneficiaries: The project gave 8,595 people full access to water.
Quantification: This full access to water project will provide 62.74 million liters of water each year starting in 2015.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 62.74 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Victor Manlapaz on 9 Sept.

411. **Senegal: Millennium Water and Sanitation Program in Senegal**

Summary: This access to water and sanitation project is being implemented by Millennium Promise.
Phase: This project will be complete in 2014.
Beneficiaries: The project gave 19,050 people full access to water.
Quantification: This full access to water project will provide 139.07 million liters of water each year starting in 2014.
TCCC Financial Contribution: 29%
TCCC Contribution Quantification: 40.33 million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

662. **Tunisia: Local Governance of Drinking Water in Rural Areas in Tunisia**

Summary: This access to water and sanitation project is being implemented by United Nations Development Programme.
Phase: This project will be complete in 2014.
Beneficiaries: The project gave 11,249 people full access to water.
Quantification: This full access to water project will provide 82.12 million liters of water each year starting in 2015.
TCCC Financial Contribution: 52%
TCCC Contribution Quantification: million liters per year until 2015.
Verification: Information on this project was provided by GETF staff member Ariel Sayre.

661. **Vietnam: Clean Water for School and Communities 2012**

Summary: This access to water and sanitation project is being implemented by CEFACOM.
Phase: This project will be complete in 2012.
Beneficiaries: The project gave 1,986 people full access to water.
Quantification: This full access to water project will provide 14.50 million liters of water each year starting in 2013.
TCCC Financial Contribution: 100%
TCCC Contribution Quantification: 14.50 million liters per year until 2015.
Verification: Information on this project was provided by TCCC staff member Bui Thi Ngoc Diem on 1 Oct.