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IMPLEMENTATION COMPLETION AND RESULTS REPORT

ON A GRANT

IN THE AMOUNT OF

US$ 6 MILLION EQUIVALENT

TO THE

REPUBLIC OF NICARAGUA

FOR THE

ADAPTATION OF NICARAGUA'S WATER SUPPLIES TO CLIMATE CHANGE PROJECT

December 30, 2018

Environment & Natural Resources Global Practice
Latin America And Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective 30 June 2018)

Currency Unit =	Nicaraguan Cordoba
NIO 31.54 =	US$1

FISCAL YEAR
July 1 – June 30

Regional Vice President:	Jorge Familiar Calderon
Country Director:	Yayo Seynabou Sakho
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ABBREVIATIONS AND ACRONYMS

ANA	National Water Authority *Autoridad Nacional del Agua*
CAPs	Water Supply and Sanitation Committees *(Comites de Agua Potable y Saneamiento)*
CES	Compensation for Environmental Services
FISE	Emergency Social Investment Fund (*Fondo de Inversión Social de Emergencia*)
FONADEFO	National Forestry Development Fund (*Fondo Nacional de Desarrollo Forestal*)
GEF	Global Environment Facility
GEO	Global Environment Objective
GoN	Government of Nicaragua
ICR	Implementation Completion and Results
INAFOR	National Forestry Institute (*Instituto Nacional Forestal)*
INETER	Nicaraguan Institute for Territorial Studies (*Instituto Nicaragüense de Estudios Territoriales*)
IRI	Intermediate Results Indicator
ISR	Implementation Status and Results
M&E	Monitoring and Evaluation
MARENA	Ministry of Environment and Natural Resources (*Ministerio del Ambiente y los Recursos Naturales*)
MEPAS	Implementation Manual for Water and Sanitation Projects (*Manual de Ejecución de Proyectos de Agua y Saneamiento*)
MTR	Mid-Term Review
NHDP	National Human Development Plan
NECCS	National Environmental and Climate Change Strategy (NECCS)
PACCAS	Adaptation of Nicaragua's Water Supplies to Climate Change Project *(Proyecto de Adaptación al Cambio Climático en el Sector de Agua y Saneamiento)*
PDO	Project Development Objective
PGC	Community-Led Projects (*Proyectos Guiados por la Comunidad*)
PMPAFCC	Municipal Plan for Environmental Protection in the Face of Climate Change (*Plan Municipal de Protección Ambiental de las Familias ante el Cambio Climático*)
SiAGUA	National Water Resources Information System (*Sistema de Información Nacional de los Recursos Hídricos)*
SICPRO	Project Management System *(Sistema de Control de Proyecto)*
SISGA	Environmental Management System (*Sistema de Gestión Ambiental*)
WASH	Water Supply, Sanitation, and Hygiene
WSS	Water Supply and Sanitation

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P127088	Adaptation of Nicaragua's Water Supplies to Climate Change
Country	**Financing Instrument**
Nicaragua	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Ministry of Finance and Public Credit	Ministry of Environment and Natural Resources (MARENA), Emergency Social Investment Fund (FISE), National Water Authority (ANA)

Project Development Objective (PDO)

Original PDO

To enhance climate resilience of investments made in Nicaragua’s rural water supplysector in order to cope with: (i) increasing climate variability; (ii) expected adverse impacts of climate change in selected areas.

Revised PDO

To pilot water resources protection and drinking water supply systems with an integrated and participatory approach in selected climate vulnerable communities in Nicaragua.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
TF-13410	6,000,000	6,000,000	5,971,435
Total	**6,000,000**	**6,000,000**	**5,971,435**
Non-World Bank Financing			
Borrower	0	0	0
Total	**0**	**0**	**0**
Total Project Cost	**6,000,000**	**6,000,000**	**5,971,435**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
13-Nov-2012	29-Jan-2013	21-Jul-2015	30-Jun-2018	30-Jun-2018

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
27-Jul-2016	2.90	Change in Project Development Objectives Change in Results Framework Change in Components and Cost Reallocation between Disbursement Categories Change in Legal Covenants Change in Institutional Arrangements Change in Financial Management
28-Feb-2018	5.19	Change in Results Framework

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Moderately Satisfactory	Substantial

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	31-Dec-2012	Satisfactory	Satisfactory	0
02	10-Jul-2013	Satisfactory	Satisfactory	.78
03	29-Dec-2013	Satisfactory	Moderately Satisfactory	.90
04	05-May-2014	Satisfactory	Moderately Satisfactory	1.13
05	06-Dec-2014	Moderately Satisfactory	Moderately Satisfactory	1.37
06	29-Jun-2015	Moderately Satisfactory	Moderately Satisfactory	1.82
07	31-Dec-2015	Moderately Unsatisfactory	Moderately Satisfactory	2.47
08	21-Jun-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	2.76
09	20-Dec-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	3.08
10	05-May-2017	Moderately Unsatisfactory	Moderately Unsatisfactory	3.18
11	08-Dec-2017	Moderately Unsatisfactory	Moderately Satisfactory	4.48
12	14-May-2018	Moderately Unsatisfactory	Moderately Satisfactory	5.92

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Public Administration	**2**
Other Public Administration	2
Transportation	**2**
Other Transportation	2
Water, Sanitation, and Waste Management	**96**
Sanitation	10
Water Supply	53
Public Administration – Water, Sanitation, and Waste Management	25
Other Water Supply, Sanitation, and Waste Management	8

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)

Finance	**0**
Finance for Development	5
Disaster Risk Finance	5
Urban and Rural Development	**0**
Rural Development	19
Rural Infrastructure and Service Delivery	19
Disaster Risk Management	15
Disaster Response and Recovery	5
Disaster Risk Reduction	5
Disaster Preparedness	5
Environment and Natural Resource Management	**0**
Climate Change	55
Mitigation	55
Water Resource Management	7
Water Institutions, Policies, and Reform	7

ADM STAFF

Role	At Approval	At ICR
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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. Among the most critical climate-related impacts affecting the rural water supply and sanitation (WSS) sector in Nicaragua are the increasing frequency and severity of droughts, floods, and hurricanes, whose effects tend to be greatest in areas that rely on springs, streams, and shallow wells.[1] In addition, there is growing pollution from untreated wastewater, agricultural runoff, and other sources, adversely affecting public health. A 2012 sector diagnostic study on climate impacts indicated that water availability would likely further decrease in most river basins and concluded that the net effect would be negative by 2050 and that Nicaragua needed to address rural WSS to reduce the vulnerability of the rural poor.

2. The World Bank has supported the WSS (FISE) and Environmental (MARENA) sector of Nicaragua for several decades. As the world's largest multilateral source of financing for water in developing countries, the World Bank is working closely with governments to achieve "A Water-Secure World for All," by investing in water solutions that enable universal access, promote water security, and build resilient societies.[2] At the time the Adaptation of Water Supplies to Climate Change (PACCAS) Project was prepared, the Bank was already financing the Greater Managua Water and Sanitation Project (PRASMA-P110092) and the Nicaragua Rural Water Supply and Sanitation Project (PRASNICA-P106283). PACCAS was expected to complement these operations by piloting innovative climate change adaptation initiatives in rural water supply systems. Bank support was requested due to its comparative advantage at the national and global context and the likelihood that it could help to replicate and scale up the pilot approaches. The comparative advantage of the WB for this particular project were related to these dimensions: i) global expertise in water resources, environment and climate change; ii) the national experience to have worked in Nicaragua and financially supported projects in the environment and water sectors; iii) the convening power to bring together different sectoral institutions (like this project required), donors, and local communities; and iv) the ability to link water issues to other sectors and to influence policies to integrate better climate change and environmental sustainability. The Adaptation of Water Supplies to Climate Change (PACCAS) Project was designed to support the objectives and key strategic areas[3] of Nicaragua's 2010–2015 National Environmental and Climate Change Strategy (NCCS) and Climate Change Action Plan for Critical Watersheds. Although the project was aligned with broader rural water supply, sanitation, and hygiene (WASH) investments in the country, the project's main objective was to support climate change adaptation in the water supply sector of communities vulnerable to climate change. Sanitation was not an objective of the project but more a co-benefit to support some (a) sanitation (through installation of latrines, solid waste collection campaigns, and education) and (b) hygiene (installation of hand washing points, formation of local community groups focused on water issues, education, and monitoring of the quality of water sources) interventions at the household and community level.

[1] The water supply system in Corn Island, for example, is more vulnerable to climate change pressures than those in other parts of the country because of increasing population density, rising sea levels, and saline intrusion.
[2] http://www.worldbank.org/en/topic/water/overview#2
[3] Key strategic areas were water sources protection, wetland management in pilot areas with high vulnerability to climate change, climate education, and information systems.

Theory of Change (Results Chain)

3. The theory of change (ToC), as reflected in the Project Appraisal Document (PAD), was to help achieve enhanced climate resilience in Nicaragua's rural WSS sector in five municipalities (Juigalpa, Murra, San Ramon, San Juan de Limay, and Corn Island) having diverse ecological and socioeconomic characteristics. The mainland communities were situated in drought-prone areas (the *Corredor Seco*) in the Mayales, Jicaro-Susucayan, Upa-Wuabule, and Negro River sub-basins, while Corn Island was chosen because of the vulnerability of its water resources. The project also sought to positively influence the Emergency Social Investment Fund (FISE) to (i) consider climate change in its WSS investments, (ii) work with the Ministry of Environment and Natural Resources (MARENA) and other agencies to apply conservation and protection measures to surface and subterranean water sources, and (iii) pilot innovative and sustainable approaches for greater climate resilience of rural water supply systems. The main climate adaptation measures to be introduced were aimed at protecting water sources and included reforestation, natural regeneration, vegetation backfire buffer strips, agroforestry, silvo-pastoral systems, overland flow retention dikes, and training to reduce pollution and increase local climate resilience. The project also planned to invest in enhancing technical information, education, and incentives to promote the protection and sustainable use of critical water resources of the selected communities.

4. To achieve its objective, the project would pilot supply-and-demand-side interventions to strengthen climate adaptation and improve drinking water availability and water use efficiency in selected rural communities. This would entail construction and rehabilitation of rural WASH systems incorporating climate change adaptation measures to increase water resource resilience in the beneficiary localities as well as piloting a Compensation for Environmental Services (CES) mechanism to promote more-sustainable land use at the micro-catchment level and protect vulnerable watersheds. The project would also seek to enhance coastal wetland protection and reduce vulnerability to sea-level rise in Corn Island by upgrading wells, wetland and mangrove restoration, environmental and climate change education, and technical assistance to improve water resource management and the operation of water supply systems. Finally, the project would strengthen central and local government institutions (FISE, MARENA, National Water Authority-ANA, and municipalities) by enhancing their knowledge, including through weather and oceanographic monitoring stations (Corn Island); detailed hydrogeological studies, guidelines, and manuals; training; incorporating climate change data in the national water information system; and technical support to FISE and ANA on climate change issues. Several assumptions were considered. These included (i) engagement of local communities and municipalities will lead to conservation and management of vulnerable water resources, (ii) technical studies and incentives will help define programs to better protect water sources, and (iii) cross-sectoral coordination of institutions is needed to address water supply and climate changes challenges (see Annex 12).

Project Development Objectives (PDOs)

5. The Project's Development Objective, as stated in the respective Grant Agreement, was to enhance climate resilience of investments made in the Recipient's rural water supply sector in order to cope with: (i) increasing climate variability; and (ii) expected adverse impacts of climate change in selected areas.

Key Expected Outcomes and Outcome Indicators

6. The expected outcomes and PDO-level results indicators were (i) Improved climate change adaptation capacity of rural water supply and sanitation infrastructure of the beneficiary communities in pilot areas; (ii) adoption of land uses that improve resilience to climate change in areas that provide water supply to rural communities; and

(iii) climate change adaptation mainstreamed in rural water supply sector's development frameworks, policies, and investment tools in Nicaragua at the national level.

Components

7. The project had three components:

Component 1: Pilot adaptation initiatives to enhance climate resilience in the selected municipalities (Appraisal cost: US$3.6 million; Actual cost: US$3.6 million). This component was designed to support WASH[4] integrated adaptation projects to be implemented in four pilot municipalities. It had two subcomponents:

1.1 Demand-and-supply-side measures to enhance climate resilience and improve the efficiency of water use: support activities to reduce climate vulnerability in drinking-water supplies based on criteria included in the operational manual.

1.2 Protection of water sources and the use of economic instruments to strengthen water-supply resilience to climate variability and change: implementation of a pilot program of Compensation for Environmental Services (CES) to protect micro-watersheds. The areas to be protected were to be identified by Municipal-Level Climate Change Adaptation Plans (PMACC), supported under Component 3.

Component 2: Coastal wetland protection and reduction of vulnerability to sea-level rise in the municipality of Corn Island (Appraisal cost: US$ 0.9 million; Actual cost: US$ 0.83 million). It also had two subcomponents:

2.1 Environmental protection and climate change adaptation program: (i) implementation of a Wetland Protection and Mangrove Restauration Program; (ii) establishment of an Environmental and Climate Change Monitoring Program; and (iii) development of an education program on adaptation to climate change and protection of the island's natural capacity to withstand climate pressures and protect its waters.

2.2 Strengthening climate resilience of water supply and sanitation systems and water sources in Corn Island: (i) implementation of a Ground Water Climate Resilience Program; and (ii) technical assessments of groundwater aquifer hydrology and the additional pressures for climate variability and rising sea level. Activities included: the construction and upgrading of wells; rehabilitation of water supply infrastructure and provision of training and technical assistance to municipal personnel.

Component 3: Institutional strengthening, project management and monitoring (Appraisal cost: US$ 1.50 million; Actual cost: US$ 1.57 million): This component aimed to strengthen institutional capacity and coordination mechanisms at national and municipal levels to facilitate the integration of climate change adaptation into the country's water supply and sanitation and water resources management sectors. It had three components:

3.1 Climate-change water-resources knowledge base: improvements in monitoring-information system for water resources and specific technical studies to improve the planning of investments in the sector considering climate risks.

[4] When referring to pilot investments by the project, it includes water supply, sanitation and hygiene (WASH).

3.2 Institutional Capacity for climate change adaptation: development the PMACCs into broader multi-annual municipal development plans and programs. It also supported training on climate change adaptation to Water Supply and Sanitation Committees (CAPs) and other community-based water associations in project areas.

3.3 Project Management: project implementation management, monitoring, reporting, and coordination.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

8. The project underwent two restructurings: (i) Level I Restructuring (July 2016) — The first restructuring included changes in the PDO, Results Framework, Components, Costs, Disbursement Categories, Legal Covenants, and Institutional and Financial Management Arrangements. At that time, US$ 2.9 million, or 48 percent, of the grant had been disbursed. (ii) Level II Restructuring (February 2018) — The second restructuring sought to further improve some of the performance indicators in the Results Framework. At this time, US$ 4.66 million, or 78 percent, of the grant had been disbursed.

Revised PDOs and Outcome Targets

9. Annex 7 includes the detail changes in the PDO and intermediate indicators as result of the two restructurings of the project. In the first restructuring, the PDO was changed to better reflect the Project's pilot scale, as the original objective appeared to apply to the entire national rural water supply sector[5] as well as to highlight the strong integrated and community participation approaches it employed, which were likewise not adequately reflected in the initial version. The revised PDO was "to pilot water resources protection and drinking water supply systems with an integrated and participatory approach in selected climate vulnerable communities in Nicaragua"[6]

Revised PDO Indicators

10. At the first restructuring, the revised PDO indicators were changed to: (i) integrated and participatory pilot investment projects completed in selected climate-vulnerable communities; (ii) people in rural areas provided with access to improved water sources under the project; (iii) Water Source Protection Index (WSPI)[7] in water recharge areas of selected climate-vulnerable communities that benefit from a CES program, disaggregated by municipality; and (iv) number of Project beneficiaries, of which 50 percent were expected to be female (details in Annex 7).

[5] According to the PAD (para. 12, pg. 4 and para. 22, pg. 10), this Project had originally been intended and designed as a complement to the ongoing Bank-financed Nicaragua Rural Water Supply and Sanitation Project (PRASNICA), approved in June 2008, whose objective was sector-wide in scope (i.e., "to increase access by project beneficiaries to sustainable water supply and sanitation services in rural areas") and thus this may have initially influenced the way the original PDO was stated. In any case the two projects were later delinked due to implementation timing issues which was one of the factors that prompted the Level 1 restructuring.

[6] Even though the revised PDO only explicitly referred to "drinking water supply systems," it also continued to include rural sanitation (latrines) and hygiene interventions in the beneficiary communities. However, these interventions were less directly related to the primary target: to strengthen resilience to increasing climate variability and change in the selected rural water supply systems.

[7] The Water Source Protection Index measures the applied land use benefit to downstream communities as a result of the Subcomponent 1.2 on the CES program and was defined in detail in the program´s Manual of Technical and Administrative Procedures.

11. The first two of these indicators were again revised at the second restructuring and changed as follow: (i) Percent progress in the development of pilot drinking water supply systems following an integrated and participatory approach in selected climate-vulnerable communities; (ii) Number of people in selected communities provided with access to improved water sources with adaptation measures under the Project. The third and fourth indicators were not changed. A new indicator was added: (iii) Number of hectares conserved, reforested, and restored to increase protection of water sources of selected vulnerable communities[8] (details in Annex 7).

Revised Components

12. **During the first (Level 1) restructuring the following changes were introduced in the components:**

Component 1. Pilot adaptation initiatives to enhance climate resilience in the selected municipalities: (i) At the MTR, it was concluded that the water supply project pilots needed to cover full design of climate resilient water supply, sanitation, and hygiene services. The original pilot projects only covered water and sanitation supply infrastructure. As a result of the restructuring, the hygiene dimension was added. The Government had been working on consolidating national strategy[9] and programs[10] to achieve more-integrated and sustainable results in the water supply and sanitation sector (which included hygiene) and has received support from different agencies including the World Bank. (ii) Due to the increased cost of the pilot investment projects, the target number of beneficiary communities for Subcomponent 1.1 activities was reduced from 15 to 7, and the estimated number of direct beneficiaries from 4,500 to 1,329 people. (iii) Component costs were also to account for adjustments in planned activities.

Component 2. Coastal wetland protection and reduction of vulnerability to sea-level rise in the municipality of Corn Island: Due to uncertainties in the water quality reports of Corn Island, the connection of existing wells to the island water system was not pursued. Strengthening the municipal planning and management capacity of water resources, incorporating climate change adaptation measures and an investment project to improve the quality of the water. Component cost was revised slightly downward from US$ 0.9 million to US$ 0.83 million.

Component 3. Institutional strengthening, project management, and monitoring: Works were added as an eligible expenditure category, under Subcomponent 3.1. The allocated budget for this subcomponent was slightly increased (from US$ 1.5 million to US$ 1.57 million).

Other Changes

13. Institutional arrangements: The National Forestry Development Fund (FONADEFO) was included as a cooperating agency in charge of the external field monitoring and related payment to overcome implementation challenges in MARENA for implementing the Compensation for Environmental Services (CES) program (Subcomponent 2.1). The Nicaraguan Institute for Territorial Studies (INETER) was included as a cooperating agency to collaborate and provide technical guidance to Ministry of Environment and Natural Resources

[8] This was a new indicator to link better to the revised PDO in the protection of local water sources due to the combination of: (i) mitigation measures during construction of the new rural water systems; (ii) the area under the CES program; (iii) restoration efforts on Corn Island; (iv) municipal and project reforestation campaigns; and (v) reforestation by MARENA delegations under the Project.

[9] Improving rural water supply, sanitation and hygiene is one the main pillars of Nicaragua's 2018-2021 National Plan for Human Development.

[10] *Programa Integral Sectorial de Agua y Saneamiento Humano*, PISASH

(MARENA), the Emergency Social Investment Fund (FISE), and ANA on preparing an environmentally focused territorial planning that integrated climate change considerations on Corn Island, in response to the findings of the technical studies carried out on Corn Island.

14. Financial management: Adjustment of the budget allocations per subcomponent and across disbursement categories to address specific budgetary prioritization of project activities and include works as an eligible expenditure category under Subcomponent 3.1.

Rationale for Changes and Their Implication on the Original Theory of Change

15. The changes under the restructurings did not have implications for the original ToC. None of the project's activities was altered. The only modification was a reduction in the number of communities proposed for pilot interventions under Subcomponent 1.1. However, this subcomponent accounted for only around one quarter of total project costs, and a much larger number of communities (35) benefitted under Subcomponent 1.2.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

Rating: High

16. The original PDO was highly relevant at the time of appraisal and was revised following the Mid-Term Review to more adequately reflect the pilot nature of the project. Both objectives remain relevant today since reducing the vulnerability of water resources to climate change continues to be critical for Nicaragua's future rural economic growth and resilience to extreme weather-related risks.[11] The project was part of a broader Bank-supported investment program for the rural WSS sector to help achieve the goals established in the 2008–2012 National Human Development Plan (NHDP).[12] It was also in line with the 2010–2015 National Environmental and Climate Change Strategy (NECCS) and its associated action plan. The project was likewise aligned with FISE's strategic priorities for 2012–2018, as indicated in the National Policy for Social Development.

17. Thus, the PDO remains very relevant to GoN's commitment to sustainably provide safe water to the rural poor by protecting critical water sources and reducing climate-related impacts. Through the project, FISE's incorporation of climate change adaptation measures, it has initiated significant changes in the mindset among its engineers and in the institution. The new PROSASR Project has incorporated activities to support plans for selected municipalities to reduce their vulnerability to climate change and will invest in ten new rural WASH projects that incorporate adaptation measures such as those implemented in PACCAS for the first time. The Government is also now preparing a strategy for the *Corridor Seco*, which, because of its drought-prone nature, is a priority region for increasing watershed protection and resilience to climate change. With Bank support, it is likewise preparing a REDD+ strategy[13] to reduce forest degradation and implement a program of payment for environmental services like the CES that was pioneered under PACCAS. The PDO, finally, remained highly relevant

[11] See Considering Climate Change and Disaster Resilience for Decision Making in Nicaragua and Honduras (P153847)
[12] The NHDP has two strategic policy areas with which the PDO is aligned: (i) Environmental and Natural Resource Protection Policy and (ii) Climate Change Policy. www.pndh.gob.ni.
[13] Nicaragua Forest Carbon Partnership Facility, REDD Readiness (P120657)

despite the reduction in the number of WASH pilot communities under Subcomponent 1.1 at the time of the first restructuring, since the impact of other subcomponents and components reached a total of 42 communities (Annex 1 and Annex 10).

18. The PDO is highly relevant to the current World Bank Group FY18–22 Country Partnership Framework (CPF) for Nicaragua, whose Pillar III focuses on improving institutions for resilience and sustainability and Objective 6 is Improved Natural Resource (including water) Management and Reduced Vulnerability to Natural Hazards. The CPF clearly reflects and supports the Government's priorities regarding climate change mitigation and adaptation, which is also reflected in the country's endorsement of the Paris Climate Agreement in 2018.

B. ACHIEVEMENT OF PDOs (EFFICACY)

19. Because the original statement of the PDO in the Grant Agreement and many of the results indicators were revised in the first restructuring, a split-evaluation methodology was applied to determine the project efficacy and overall outcome ratings. A review of the original and revised performance indicators is presented below and more details on Annex 8.

Original project: Before the First Restructuring (Level 1), July 2016 (48% of disbursed resources)
Rating: Modest

20. **Slow implementation due to detailed planning and hydrogeological information needed.** The first three years of implementation were marked with a limited achievement of the Project Development Indicators (PDO) and low disbursement while enabling actions (social and technical) were conducted to proceed with the planned investments. During Project preparation, a technical diagnostic revealed that climate resilient solutions would require hydrogeological or catchment area assessments prior to construction, so the infrastructure planned to be developed under the project to be resilient required detailed hydrological, water balance, land use and social demand studies (Some of these studies required more than nine months). Thus, the project invested this period in the development of these studies, preparation of the methodologies and manuals to implement the CES program, definition of criteria for selection of beneficiaries' communities, investigation of vulnerabilities of water sources and social organization.

21. **PDO Indicators:** Of the three original PDO indicators, two had not yet been achieved during this period and the third – "climate change adaptation mainstreamed in rural water supply sector's development frameworks, policies, and investment tools in Nicaragua at the national level"- was only partially achieved (38% percent, see Table below).

Table 1. Assessment of achievement of original PDO indicators

Original PDOs	Unit of measurement[14]	Targets	Outputs
Indicator One: Improved climate change adaptation capacity of rural water supply and sanitation infrastructure of the beneficiary communities in pilot areas.	# of beneficiaries with access to new or rehabilitated water supply systems, resulting from the implementation of the PMACCs (Municipal Climate Change Adaptation Strategies)	Target: 1250 Actual at July 2016: 0	
Indicator Two: Adoption of land uses that improve resilience to climate change in	Increase in the value of water sources protection index (%)	Target: 20% Actual at July, 2016: 0	

[14] In the PAD, the PDO indicators were erroneously stated as unit of measurements

areas that provide water supply to rural communities.			
Indicator Three: Climate change adaptation mainstreamed in rural water supply sector's development frameworks, policies and investment tools in Nicaragua at the national level.	% of relevant instruments developed by the national institutions in the sector integrating climate change in water sector policies and investment programs	Target: 90% (13 instruments) Actual at July 2016: 50%	5 instruments of 13 -1 Water Resources Policy with climate change adaptation dimension included - 4 Municipal Plans for the protection of families to cope with climate change.

Assessment of Achievement of Each Objective/Outcome

Objective 1. To enhance climate resilience of investments made in the Recipient's rural water supply sector in order to cope with increasing climate variability.

22. **Key outputs generated under this objective were**: i) Water Resources Policy with a climate change adaptation dimension prepared by ANA and ii) four Municipal Plans for the protection of families to cope with climate change of the selected municipalities (San Juan de Limay, Juigalpa, San Ramon, Murra) (both represents 38% of the target of PDO Indicator 3); iii) "Analysis of the Climate Change Vulnerabilities with scenarios and water balance of the four selected municipalities;[15]iv) guideline to develop and systematize implementation of Municipal Plans for Environmental Protection in face of Climate Change[16]; v) methodology to determine vulnerability of water sources and delimitation of water recharge areas for the drinking water supply sector; vi) Manual of Technical procedures and management for implementation of the Compensation of Ecosystem Services (CES) Program[17]; vii) launching of the CES program and first payment to participant farmers.

23. **Some of the outputs were achieved or partially achieved, as follow:** i) selected communities benefitting from the Compensation for Environmental Services (CES) program (target: 100%; achieved 100%) which aims to protect water sources important for waters supply and by using economic instruments to strengthen water supplies' resilience to climate variability and change. A total of 270 farmers were receiving payments for their participation in the program; importantly women were also participating, despite of challenges to include women as beneficiaries due to issues on land ownership (target 35%; achieved 29%).

24. **Outcomes achieved include:** i) improvement on the water resources and climate variability knowledge which will later lead the design of the planned resilient WASH systems to be developed under the project; ii) the improvement of municipal planning and investments plan in the rural water supply sector by the incorporation of adaptation to climate change for the short, medium and long term scenarios; iii) improve water resources policy to lead to sectorial approaches of the WSS sector to adaptation to climate change; iv) increased knowledge on the water resources vulnerabilities and increasing climate variability of the selected project areas (4 municipalities and Corn Islands); v) Piloted the first CES program in Nicaragua that economically benefited poor rural farmers (270) and their families for the compensation in 2,135 hectares of better land use practices that contribute in the protection of 56 water sources of 34 communities.

[15] Análisis de Vulnerabilidad de las Fuentes de Agua en comunidades rurales de los municipios de Murra, San Juan de Limay, Juigalpa y San Ramón ante el Cambio Climático. 2014. PACCAS.

[16] Planes Municipales de Protección Ambiental de las Familias ante el Cambio Climático, PMPAFCC

[17] Manual de Procedimientos Técnicos y Administrativo del Programa de Protección de Fuentes de Agua para la compensación ambiental.

Objective 2: To enhance climate resilience of investments made in the Recipient's rural water supply sector in order to cope expected adverse impacts of climate change in selected areas

25. **Key outputs generated under this objective were:** (i) hydrological Study on the availability of water resources for human consumption in communities vulnerable to climate change in the municipalities of San Juan de Limay, Juigalpa, San Ramon and Murra, which will become the baseline study for the designs of the later WASH investments; ii) definition of criteria to select beneficiary communities, selection and consultation processes; iii) hydrological and hydrogeological studies on the risks and vulnerabilities of the water resources of Corn Islands which they will later guide the design of the pilot intervention in the recharge areas of the Corn island; iii) wetland recharge areas in Corn Islands recovered from human establishments (10 families were resettled following WB policies);

26. **Outputs were achieved or partially achieved, as follow:** i) establishment the first climate (rainfall) monitoring system in Corn Islands and implemented a climate change education program (target: Y; achieved: Y) and in both cases the project supported specialized training (climate change evaluations, weather monitoring tools, water risk assessments) to local government staff and from the water municipality agency; ii) education and training programs on climate change and adaptation were formulated and implemented which helped strengthening local capacities on order to cope with the expected adverse impacts of climate change in the selected communities (target:500 people; achieved: 1553 people).

27. **Outcomes achieved include:** i) increase in local planning capacities to implement WASH solutions taken into consideration adaptation to climate change; ii) improvement in the water resources and climate variability knowledge which will later lead the design of the planned resilient WASH systems to be developed under the project; iv) increased understanding of the water resources demands and climate change risks for the selected project areas (4 municipalities and Corn Islands); strengthening of local capacity in the topic of climate change and water resources management (for community leaders, technical teams of municipal governments and public institutions).

28. **Assessment of performance of the original project:** On balance, the project's efficacy toward stated objectives of the initial project is rated Modest based on achievement of the outcomes.

Revised project (after Level 1 restructuring to June 2018 -78% percent of disbursed resources)

29. The substantive change brought by the 2016 Level 1 restructuring was the revision of the PDO statement and indicators, a light reallocation of resources and adjustments in targets of the indicators (Annex 7).

Objective 1: To pilot water resources protection with an integrated and participatory approach

30. **Key outputs generated under this objective were:** i) Successful implementation of the first economic Compensation for ecosystem services (CES) program for the protection of critical water sources in Nicaragua (CES) in climate-vulnerable rural communities. This was measured through pioneering the application of a Water Source Protection Index developed under the project to measure farmer implementation of climate change

adaptation measures and better land use practices[18] to protect water sources (target: 73,241; achieved: 85,045). Under the CES program 354 farmers benefited financially and from the technical assistance provided by the project. The CES program was arguably the project's most innovative and noteworthy contribution for the enhancement of local resilience to increasing climate variability and change. ii) Another key output was the Number of hectares conserved, reforested and restored to increase protection water sources of the selected vulnerable communities (target: 3,0000 ha; Achived 3,028 ha), composed of: (a) adaptation measures during construction of the WASH systems (195 ha); b) the implementation of the CES program (2,496 ha); (c) wetlands protection in Corn Island (26.6 ha); and (iv) spillover protection by the CES program (311 ha).

31. **The participatory approach for this objective was essential.** MARENA, the municipalities, and local leaders coordinated workshops and *Asambleas* (communal meetings) to discuss local water resource vulnerability, defined the criteria for selection of beneficiary communities and agreed on the priority interventions per community and per water sources (rivers, streams, wells, springs). Local participants provided critical information for the hydrogeological studies in each locality and contributed to the design of the CES (Compensation for Environmental Service) program and selection of its beneficiaries as well as to reforestation campaigns, the monitoring of regeneration efforts, and other project activities. The project supported capacity building at the central government, municipal, and community levels by providing increased technical knowledge[19]on climate change adaptation, hydrology, water quality, and forest conservation together with planning and management tools to improve water resource use.[20] The need to increase resilience in climate-vulnerable communities required FISE to work more closely with MARENA and ANA. PACCAS provided the first example in Nicaragua of an operation interconnecting rural water, sanitation, and hygiene services with water resource planning and management, protection of water sources and recharge areas, adaptation to climate change, and local environmental education. Coordination among these agencies, together with the National Forestry Development Fund (FONADEFO), the National Forestry Institute (INAFOR), and the Nicaraguan Institute for Territorial Studies (INETER), under the project has been innovative in Nicaragua.

32. **Other outputs achieved were as follow:** i) as result of the CES program, a total of 59 drinking water supply sources and their recharge areas were protected (target: 56, achieved: 59); ii) implamentation of an Index for wetlands protection developed by the project to increase protection of recharge areas of aquifiers to support adaptation capacity of water supply in Corn Islands (Target: 70% of the index, achieved: 100%); iii) development of the Climate Information Module for water and climate change integrated and functioning in the National Water Resources Information System (SiAGUA) of ANA (target: Y; achived: Y).

33. **Outcome achieved include:** i) reduced degradation around water sources; ii) citizens and municipal engagement in protecting water resources; iii) improved technical knowledge on vulnerability of water resources; iv) improved Land and water use planning through the incorporation of the climate change dimension in municipal investments plans, FISE operational manuals, MARENA environmental programs and ANA policies and information systems.

Objective 2: To pilot drinking water supply systems with an integrated and participatory approach

[18] As anticipated, among the measures supported by the project in this regard were: reforestation, natural regeneration, installment of vegetation backfire buffer strips, agroforestry and silvo-pastoral systems, overland flow retention dikes, together with training to reduce pollution, improve basic sanitation and basic hygiene, and to strengthen rural community resilience to climate change more generally.
[19] Technical studies on hydrogeology, risk assessment to climate change were carried out for the first time in the subproject areas.
[20] For instance, PACCAS supported the preparation and implementation of Municipal Plans for Adaptation to Climate Change for their rural water and sanitation investment projects in the four Component One municipalities

34. **Key outputs generated under this objective were:** i) complete development of pilot WASH systems following an integrated and participatory approach in selected vulnerable communities[21](target: 1005; achieved 100%); that includes planning, social organization, design, supervision and deliveries; ii) provided access of improved water sources with adaptation measures to 338 rural households (target: 1329 people; achieved: 1786 people (including 821 females).[22] The WASH systems were implemented through a community-led (PGC) process[23] that involved direct participation of local leaders and beneficiaries in the planning, design, construction and future operation of the infrastructure developed, This approach incorporated community members, community organizations (CPAs), municipalities, service providers, and FISE and ensured efficient execution of the pilot investments. It strengthened local capacities and empowered communities for the administration, operation, and maintenance of the local water systems.

35. **All outputs were achieved, as follow:** i) completion of the construction of seven WASH systems in the agreed communities of San Juan de Limay, Juigalpa, San Ramon y Murra (see Map Annex 13), (target 100%; achieved 100%) which includes: construction of 7 water supply systems from subterranean or superficial water sources, 87 household connections to drinking water systems; 51 public water outposts; 45 rainfall harvesting systems; 345 sanitation units; 347 hand washing stations. ii) completion of the first Pilot in the country on artificial groundwater recharge in Corn Island; ii) achieved the needed organization of vulnerable communities to manage and operate the delivered WASH systems and to protect water resources (target 100%, achieved: 100%). The project also strengthened local capacities and empowered communities for the administration, operation, and maintenance of the local water systems. Seven CAPS (*Comités de Agua Potable* – Water Supply, Sanitation and Hygiene Committees) (formed by a total of 35 members, of whom 21 are women) were created in conformance with existing legislation for water resource protection activities and will assumed responsibility for O&M of the WASH community systems.

36. **Also, PACCAS generated extensive outputs** (analytical work on adaptation for the water sector (Assessments, Diagnostics, Guidance notes, Strategic Plans, Protocols, Methodologies) to build institutional capacity and strengthen rural WASH implementation at both central government and community levels.[24] These outputs will now allow citizens, agencies, and donors to access technical information to help improve water resource management elsewhere in Nicaragua.

37. **Outcomes achieved include:** i) Implementation of WASH solutions lead by citizen participation; ii) Organization of vulnerable communities to manage and operate their WASH investments; iii) developed policy and operational tools to incorporate climate change adaptation in WSS sector (MARENA, FISE, ANA).[25]

38. **Assessment of performance of the revised project:** on balance, the project's efficacy toward the revised

[21] El Olingo, San Juan, Las Animas (Murra municipality), El Terreno, La Danta (San Juan de Limay), Piedras Grande 2 (Juigalpa municipality) and Sabana Grande (San Ramon municipality).
[22] A reduction of scope from the original PDO indicator of 4500 target beneficiaries from water and sanitation infrastructure was adjusted in the Level 1 restructuring to 1329 beneficiaries.
[23] PGC (*Proyectos Guiados por la Comunidad*) are rural water supply systems whereby the municipality and local beneficiaries leads the overall construction and supervision of the works to be done under the supervision of FISE staff. Under this modality, they also review the designs, prepare the contracts, manage the funds, and supervise the contractors and provide the counterpart funding.
[24] See Annex 1- B Key outputs per component.
[25] This was achieved by: (i) considering current and future water demands; (ii) reducing the vulnerability of project areas to climate change; (iii) incorporating adaptation measures in water system designs; and (iv) strengthening knowledge and technical capacities to better plan, use, and manage scarce water resources.

objectives of the project is rated Substantial based on the achievements of all PDO indicators and outputs targets.

Justification of Overall Efficacy Rating

39. The Efficacy Rating for the original project is rated as **Modest** and for the revised project as **Substantial**. Despite of very detailed technical and social achievements by the project during the period prior to the First restructuring (Level 1), the achievements of outcomes was limited. In contrast, the project accomplishments after the first restructuring were significant, indicating that the revisions introduced at that time were appropriate and contributed to the subsequent successful delivery of its revised outputs and outcomes and achievement of its objectives.

C. EFFICIENCY

Assessment of Efficiency and Rating

Rating: Substantial

40. No economic-financial evaluation was undertaken at appraisal for Component 1, despite that this component represented 80 percent of the project's estimated investment costs. While the design option selected for Component 2 was reported to be the most cost effective among the options considered. Thus, it is not possible to directly compare actual project economic costs and benefits with those estimated prior to approval. While there was a shortfall in appraisal target number of communities where pilot water systems were expected to be installed under Subcomponent 1.1, this was due to an increase in the costs for these systems compared with appraisal estimates.[26] A comprehensive ex post economic and financial analysis carried out for this ICR, which is presented in Annex 4, however, reveals that investment subproject net benefits are positive and that water tariffs are expected to cover post-project Operation and Maintenance (O&M) costs for the community water supply systems. In addition, 35 communities benefited by protection of their water sources under Subcomponent 1.2.

41. PACCAS generated the following benefits, among others, as indicated in beneficiary surveys: (i) improvement in hygiene habits; (ii) improvement of health outcomes due to greater access to better quality water; (iii) time savings for women and children that could be used for work or to attend school due to closer access to water sources; (iv) improved local capacity to execute projects and manage water systems; and (v) additional income for participating farmers due to the CES program. The beneficiary communities are now also paying tariffs for drinking water, agreed among themselves, which has contributed to improved management and maintenance of the systems and better use of vulnerable local water resources. Because of these benefits and the fact that the project did not require an extension, despite to the initial implementation delays, Efficiency is rated Substantial.

[26] The increase in the WASH costs under Subcomponent 1.1 was due to several factors. By mid-2016 (that is, after four years of implementation), the final designs for the water supply systems had still not been completed and civils works did not start until 2017. In addition, average costs of the pilot drinking water systems proved were inadequately estimated at appraisal due to: (i) the characteristics of the selected communities (that is, their geographic remoteness and the dispersion of their houses), which were unknown at the time of appraisal because these communities had not yet been identified; (ii) inclusion of climate change adaptation, which had not been costed before; and (iii) inclusion of rural sanitation and hygiene elements in the pilot community subprojects.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

42. The overall outcome of the PACCAS Project is rated Moderately Satisfactory in accordance with application of the split rating methodology where the scope was reduced in a restructuring. The results of this analysis are indicated in Table 1, more details in Annexes 4 and 8.

Table 2. Split Rating Analysis

Ratings	At the First Restructuring (July 2016)	At Completion (June 2018)
Relevance	High	
Efficacy	Modest	Substantial
Outcome Ratings	Moderately Unsatisfactory	Satisfactory
Numerical Value of Outcome Ratings	3	5
Efficiency	Substantial	
Disbursement	2.9 (48.3%)	3.1 (51.7%)
Weighted Value of the Outcome Rating	1.4	2.6
Final Outcome Rating	Moderately Satisfactory 1.4+2.6 = 4.0	

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

43. The participation of women in project implementation activities was monitored in detail by the implementing agencies, both by activity and community. They directly benefitted from capacity building and educational activities as well as from training to execute project activities. The seven water, sanitation, and hygiene investment subprojects provided significant benefits for women and children as the main water fetchers and carriers.[27] Women participated in local meetings to design the WASH systems and are part of the CAPS that will operate the water systems and protect water resources. Participation of women in CAPS was 60 percent. They were also equal participants in capacity building activities under the CES (Compensation for Environmental Services) program. In addition, 11,951 community members (47 percent were women) participated in 273 environmental education and sensitization events. Also, a total of 133 environmental education and sensitization activities were carried out in Corn Islands and of 6,702 participants, 64 percent were women. The contribution of the project despite in a limited country scale, contribute to equity efforts in WSS access and service delivery which is a core element of SDG 6.

Institutional Strengthening

44. Knowledge on climate change adaptation was enhanced by the completion of technical studies in the targeted municipalities to identify the communities most vulnerable to climate change and the most vulnerable water sources. The project also fostered interinstitutional coordination for preparation and implementation of the pilot investment subprojects and conducted training in technical issues.[28] Communities also received training

[27] Of a total of 1,782 beneficiaries, 821 were female, under Subcomponent 1.1.

[28] This included use of a modeling tool Resource Investment Optimization System (RIOS) and its potential application for formulation of municipal climate change adaptation plans and other methods and instruments that contributed to design of the CES program.

and education on environmental and climate change issues, contributing to successful execution of project activities and their future sustainability. The CAPs were strengthened through their participation in the pilot investment projects. Four Municipal Plans for Environmental Protection in the Face of Climate Change (PMPAFCCs) were completed and adopted. Capacity building was also achieved with development of the Climate Change Information Module that ANA successfully integrated into SiAGUA. Several rounds of consultations among ANA, FISE, MARENA and other stakeholders and experts took place to develop this module. The Water Supply Agency of Corn Island (*Empresa Municipal de Agua de Corn Island* – EMACI) likewise benefited from technical training and project-supported monitoring of water quality.

Mobilizing Private Sector Financing

45. Beneficiary communities provided in-kind contributions for pilot investment subprojects. They were empowered throughout the project (that is, pre-investment, execution, and post-construction), which resulted in designs that were appropriate for the communities' contexts and savings.

Poverty Reduction and Shared Prosperity

46. The project improved the quality of life of people in the rural communities that it supported. The pilot subprojects for rural water, sanitation, and hygiene systems increased access to reliable and improved water supply and included household connections, latrines, public water outposts, and washing stations. The project also improved the resilience of the local WASH systems that are critical to the well-being of the rural population as increased access to clean water contributes to better health. The project also fostered organization of vulnerable communities to manage and operate the new water systems and protect water sources without external assistance.

47. The impacts on the population's daily life has been significant, especially for women and children, as captured in surveys carried out by MARENA and FISE.[29] The CES (Compensation for Environmental Service) program also directly contributed to poverty reduction in the project area since it provided monetary incentives to poor farmers to apply better land use practices as climate change adaptation measures.[30] Beneficiary farmers have used CES payments to improve productivity of their farms and plant subsistence crops such as corn, beans, tomatoes, or cash crops (for example, oranges, mangos, and coffee) that also contribute to better household nutrition.

Other Unintended Outcomes and Impacts

[29] The surveys showed, for example, that beneficiaries are using the latrines and reported improved hygiene habits, such as regularly washing hands before daily tasks such as cooking, latrine use, and so forth

[30] Many of these farmers are under the poverty line in Nicaragua. Due to the project about 345 famers collected a total of U$$ 827,606, because of their participation in the CES program.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

48. **Substantial sector work preceded the project**. During 2010 and 2011, the Bank helped the Government to carry out studies on water resources, lake health, and pollution, and to develop an environmental evaluation program. These studies, however, had not included adaptation to climate change. It was, therefore, decided to seek the support of the Global Environment Facility's Special Climate Change Fund to design a project to pilot approaches for climate change adaptation measures in the rural WSS sector. The limited amount of available grant resources imposed the need to set geographic priorities. Hydrogeological studies were carried out before appraisal to help define priority municipalities. However, additional information was needed during implementation to identify the pilot communities for interventions under Subcomponent 1.1.

49. **Project design was influenced by ongoing Bank operations.** The Nicaragua Rural Water Supply and Sanitation Project (PRASNICA) was already working with FISE and ANA. PACCAS also opted to work with both institutions, thereby continuing Bank support for ANA which was a relatively new agency. FISE's work under PRASNICA impacted preparation by influencing the inclusion of integrated community water supply and sanitation interventions. Project design assumed that it would build on prior knowledge and investment preparation under PRASNICA. However, FISE experienced problems with the PRASNICA designs that were late, had technical issues, and were not based on a solid assessment of the water resource availability and vulnerability in the subproject areas. The project also required a new study on the availability and vulnerability of water resources on Corn Island due to uncertainty as to which factors were affecting the salinity intrusion identified in some wells. In addition, the actual costs of the investment subprojects during preparation subsequently proved to be way too low.

50. **Other aspects of project design and poor readiness for implementation**. At the time it was prepared, the project was expected to complement the ongoing PRASNICA operation, which had a broader sector wide objective.[31] This intended complementarity influenced how the original PDO of the present operation was framed. However, due to timing difficulties, the two projects later became delinked, which was one of the reasons for the decision revise the PDO at the time of the Level 1 restructuring. The Results Framework was also inadequately designed as it set a target for the number of communities to be benefitted under Subcomponent 1.1 based on inadequate information regarding the average costs of such systems, considering that the pilot communities had not been identified at the time of appraisal. This too required a change at the first restructuring and contributed to significant implementation delays for the first component of the project. Thus, the project was only partly ready for implementation at the time it was approved. The overall risk rating in the PAD (Substantial), including that for design, however, was appropriate and, aside from the problems with the Results Framework mentioned above, the proposed monitoring and evaluation (M&E) arrangements were generally acceptable.

[31] PRASNICA PDO: "to increase access by project beneficiaries to sustainable water and sanitation services in rural areas."

B. KEY FACTORS DURING IMPLEMENTATION

51. **Adequacy of supervision.** Despite of limited funding for supervision, the Bank teams were able to provide adequate support to the implementing agencies in periodic missions to the project areas. The Bank supported two restructuring of the project to improve project performance. The project was supervised at the beginning together with the water global practice, but this was discontinued; it could have been better to maintain this arrangement to enhance FISE on adopting the PACCAS lessons. There were important delays on the payments of the CES program which could have been resolved earlier if Bank technical support could have been provided earlier to the borrower. More supervision support to the borrower was needed in relation to several technical studies prepared prior of the preparation and development of the WASH investments which were difficult to contract, took several years, evaluated areas that were not priority and at the end influenced the delay on achieving progress towards the PDO and overall project implementation. During the last two years of supervision, support in M&E, technical and financial management helped the project achieved the final results.

52. **Adequacy of reporting.** The Bank adequately reported key issues of implementation and delay on achieving project outputs and outcomes at both the Bank and the government (through ISRs, aide memoires and technical reviews reports). It reported action plans and agreements with the borrower that were put in practice to improve project implementation. In the last two years of the project, periodic meetings with the Ministry of Finance were held and this ministry also supported a high-level monitoring and reporting of the project achievements.

53. **Slower than anticipated implementation of some activities**. While grant effectiveness was timely, launching the activities was considerably slower than foreseen at design. It proved necessary to carry out water resource inventories and hydrogeological assessments in the four selected municipalities as a first step to launch its activities. Working in these municipalities, moreover, was very challenging due to their geography and capacities. During the analyses carried out in 2013 and 2014, significant work was required to define and strengthen the processes and methodologies to assess water resources vulnerabilities and prioritize the communities.[32] Building on FISE's work as a baseline, a methodology to assess vulnerability was prepared, which expanded the criteria to be considered. However, interinstitutional coordination was challenging but has contributed in the integration of climate adaptation measures in water resource planning in all participating institutions. In addition, considerable progress was also made in implementing educational and training activities, building capacity, strengthening commitment, and achieving greater involvement and participation in the communities involved in the project. During the first two years of implementation and there were numerous workshops for participants in the CES program and other beneficiaries on adaptation to climate change.

54. **Higher than anticipated costs for Subcomponent 1.1.** The cost of the hydrogeological studies proved to be higher than the amount budgeted. As a result, the initial call for proposals was declared deserted and had to be rebid. The costs of the actual investment projects were likewise higher than estimated in the PAD. The reasons were (i) the time lapsed before the investments could start; (ii) the decision to support more integrated water, sanitation, and hygiene project following FISE's practice at the time; and (iii) improved integration of climate adaptation measures which had to be tailored designed for each community. Designs for rural well construction, however, were financed with local funds. This was critical in achieving completion of the works and the agreed targets after the Level 2 restructuring in February 2018.[33]

55. **Subcomponents 1.1 and 1.2 were linked but had to start implementation independently.** As the preparatory work for the investment projects to be carried out by FISE was delayed and there was a need for at least three cycles for the participants in the CES program, GoN proposed and the Bank agreed to separate the implementation timing for the activities under the two subcomponents. As a result, the work to protect water sources through the CES program under Subcomponent 1.2 did not proceed in parallel with that of Subcomponent 1.1 and took place in different areas than those for Subcomponent 1.1. The National Forestry Development Fund (FONADEFO) and the Nicaraguan Institute for Territorial Studies (INETER), however, became collaborating agencies to further enhance interinstitutional cooperation in project implementation.

56. **Changes in methodology for Subcomponent 1.2.** Due to issues with the CES methodology agreed and approved by the Bank, its implementation initially stalled, and the participating farmers were not receiving all the promised payments. They complained to MARENA and some left the program. However, in 2017 the compensation methodology was revised to permit valuation of farmer implementation of best land use practices contained in the respective approved "Plans de Finca" (Farm Land Use Improvement Plans) based on the increase in "vegetation cover" rather than in "tree coverage" and other adjustments. These modifications facilitated CES implementation and resulted in the inclusion of more farmers as beneficiaries.

57. **Interinstitutional coordination posed challenges, as anticipated at appraisal, but was ultimately successful. The need for strong interagency coordination added complexity to the project.** However, this coordination occurred at the highest level at each institution and occurred in the Project Steering Committee, which met twice a year and approved the annual Implementation Plans. Continuity of key actors in their positions during the first four years of project implementation was key in this regard. In addition, MARENA delegated its regional offices to work closely with the four mayors for Component 1. The Mayors of all five participating municipalities remained in their positions during the last three years of implementation, providing continuity in local support for the project. During the final year and a half additionally, the Ministry of Finance also supervised project implementation on a regular basis, which helped to move project activities forward.

58. **Organizational Changes in FISE and MARENA in January 2018.** On the other hand, significant staff turnover occurred during the final year of project implementation. FISE's President changed several times, while in MARENA, the Minister, Vice Minister, several Directors, and the financial and procurement officers were also substituted. In addition, the Climate Change Unit, which had hosted PACCAS since its design, was closed. As a result, MARENA created a new Project Management Division to coordinate external projects including PACCAS. However, the new team worked closely with the Bank to complete the remaining activities on time and budget.

59. **Conflict and instability**. Nicaragua entered a political crisis in 2018 which affected the last 4 months of the project to the closing date. The completion of the WASH solutions and civil works in Corn Island were affected since contractors faced difficulties in the transportation of materials and roads were closed. Also, the last CES payment was very difficult to complete since reaching the beneficiaries was not possible by the project team. Despite of these final challenges, the Bank team and the project team from MARENA, FISE and ANA worked together to resolve all issues and completed the project activities and reached the expected outcomes on the agreed closing date.

[32] The studies underlying the selection of beneficiary communities were finalized by December 2013.
[33] The choice of the Community Executed Projects modality to implement the water subprojects, instead of opting for the contracting of construction firms, likewise contributed to the successful achievement of the revised target while keeping the costs under control.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

60. M&E was to be undertaken by tracking the indicators included in the Results Framework and utilizing existing FISE and MARENA systems to monitor rural WASH investments together with indicators in Municipal Climate Change Adaptation Plans and Strategies. The project also expected to include an impact evaluation of activities under Subcomponent 1.2, whose framework was to be designed prior to effectiveness and include a baseline survey and periodic follow-up surveys in a sample of participating communities together with a control group. M&E arrangements were generally realistic in considering the use of existing monitoring systems to assess progress towards achievement of the PDO. However, M&E design is considered modest since the initial PDO indicators did not sufficiently capture and measure progress towards realization of the original PDO. The establishment of Steering Committee at the institutional level worked very well during implementation.

M&E Implementation

61. The Results Framework was revised to ensure more adequate M&E of project activities and achievement of intended outcomes. The Level 2 restructuring sought to reinforce the ability of the M&E system to properly show project results. The project was monitored regularly, using the targets and outcomes agreed upon at appraisal and in the restructurings to guide its implementation plan and actions on the ground. The manuals and tools developed by the project established transparent methodologies and clear processes to define vulnerability among communities and contributed to the prioritization exercise to determine where to concentrate project interventions. The M&E system was later adapted to include FONADEFO as the institution responsible for on-the- ground monitoring of Subcomponent 1.2 activities, thus allowing for an evidence-based assessment of the progress of the results of the CES program. With interagency collaboration and project support, the module for SiAGUA was designed and established to define relevant indicators for ANA to carry out its responsibilities for water resource regulation. By project completion, ANA was incorporating information from different agencies (municipalities, MARENA, INETER, MINSA, and so forth) to populate the M&E system. It also performed quality control of water resources in Corn Islands. The anticipated evaluation of the impact of the project was implemented for Subcomponent 1.2 where a sample of the participants (10%) in the program were consulted and the results of the study confirmed the benefits and positive impacts of the project in these communities. Local communities also participated in the monitoring of the project by holding meetings with FISE, MARENA and ANA to discuss progress or delays on the project. The Steering Committee was very active in the last 1.5 year of implementation where the Ministry of Finance took and active role in the follow up of milestones agreed after missions with the Bank.

M&E Utilization

62. M&E utilization was significant in view of the use of tools developed with project support to guide decision making and adjust activities during implementation. The findings of studies (inventory of water resources and hydrogeological studies, which helped to identify the availability of water/hydrological resources and their

quality, quantity, and vulnerability) were used to design detailed project activities. Analyses of water quality on Corn Island were also utilized to guide project activities.[34] Monitoring reports from FISE, MARENA and ANA were prepared on their respective activities. Guidelines to develop and systematize implementation of Municipal Plans for Environmental Protection in the Face of Climate Change and the Land Use Plan in Corn Island were instrumental to guide project activities and capacity building. FONADEFO monitored the CES subcomponent by undertaking the required measurements and field work, upon which the payment of incentives was based. MARENA in turn, used FONADEFO's measurements and inventories to calculate the amount of these payments.

Justification of Overall Rating of Quality of M&E

Rating: *Substantial*

63. The overall quality of M&E is rated Substantial based on: (i) the adjustments introduced in the two restructurings to overcome the shortcomings in the initial design; and (ii) the development and utilization of planning, monitoring, and evaluation tools with project support, which were crucial to its decision making and efficient implementation following the initial delays. This contributed to the effective integration of climate adaptation in the planning and management of rural WASH interventions and application of a more holistic approach to water resource management in Nicaragua.

[34] For example, a decision not to connect the sources of water to the drinking water system was based on the results of the water analysis quality and the project carried out a successful pilot instead to increase water infiltration.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

Environmental and Social Compliance

64. **Environmental**. This Category B project triggered environmental safeguard policies (OPs) 4.01, 4.04, 4.36, 4.09. During project implementation, performance with respect to safeguards was rated Moderately Satisfactory, but all environmental and social safeguard policies were complied with. A comprehensive Environmental and Social Management Framework (ESMF) was developed during preparation and guided implementation. Bank environmental staff provided constant supervision and the PIU had a permanent environmental specialist, who monitored and supervised project construction works and forest, farm, and wetlands interventions. Bank safeguards specialists visited Corn Island and provided guidance for mangrove restoration and management of construction sites, while also providing safeguard training to FISE staff. Detailed water monitoring of wells and superficial water sources were likewise reviewed by safeguards specialists. Project investments had positive results in terms of environmental and water resource protection and landscape restoration. Disclosure of project information was not as efficient as it could have been at first because MARENA and FISE had different rules regarding management of their websites. However, during the final year of implementation the website improved, leading to better dissemination of project results.

65. **Social.** At appraisal, the project triggered both OP 4.11 and 4.12. For the Corn Islands, Component 2 was treated as an Indigenous Peoples Project because most residents were either Afro-Nicaraguan or Miskito.[35] A total of 10 families (57 people) were resettled from living within the wetlands recharge areas and a resettlement plan was reviewed by Bank social development specialists and implemented at the beginning of the project implementation. The resettlement allowed to liberate important wetland areas from human pollution that serve as recharge area for the aquifer serving the island. No other resettlement or indigenous peoples' issues occurred during implementation. The project team maintained a full-time social specialist in the core PIU, who provided oversight to ensure that national legislation and Bank policies were followed. In addition, 10 social development specialists were hired to support the project's participatory and integrative approach, community consultations (*Asambleas*), CAP formation, and dissemination of water, hygiene, and water resource protection measures. The Bank team also maintained a social specialist to supervise implementation and monitor gender targets.

Fiduciary Compliance

66. **Procurement.** The procurement arrangements and plans carried out by the Procurement Divisions of FISE and MARENA were adequate throughout most of the implementation period. These units were generally adequately staffed and equipped to undertake the standard procurement activities routinely carried out by these Divisions. FISE hired two additional procurement analysts and MARENA contracted a qualified procurement specialist for project procurement activities. Even though both procurement units were experienced and familiar with Bank procedures, delays occurred due to insufficient capacity, a heavy work load, and the greater complexity of some of the procurement activities required by the project, particularly with respect to the consultant selection process for the designs of the community water systems. FISE's procurement plans improved after a

[35] During project preparation, all seven wetlands on Corn Island (large island) where there would be interventions under PACCAS were analyzed for the presence of inhabitants. Ten 10 families were living in one of these wetlands ("Swamp Coe"). A census with a cut-off date of February 9, 2012 was carried out with these families and a Resettlement Action Plan (RAP) was prepared by the Municipality of Corn Island with the support of FISE.

reorganization, completion of an independent review, and Bank provision of additional training. The country's complicated political situation also affected the final bidding process.

67. **Financial Management.** The project generally had adequate FM arrangements, which provided assurance that grant proceeds were used for the intended purposes. FM arrangements were complied with throughout most of the implementation period.[36] MARENA was responsible for overall consolidation of the project's FM arrangements and the fiduciary environment was bolstered by the recruitment of a FM specialist and accountants, as well as by the training of key staff. However, for about five months MARENA's FM staff was an issue due to high staff rotation. Over time, project FM ratings ranged from Moderately Unsatisfactory to Moderately Satisfactory. FM units experienced delays in preparing financial statements, bank reconciliations, and submissions of Statement of Expenses (SOEs) to the Bank, as well as in submitting external audit reports. Lack of adequate software to consolidate project financial information was likewise an issue. Thus, MARENA and FISE needed to work in a coordinated fashion to address the lack of information and prepare the required financial reports.[37] As performance improved over time, a Moderately Satisfactory rating is justified. However, audit reports sent to the Bank in the past were overdue from one to three months although most were unqualified and no internal control issues were identified. With Bank support, the project fulfilled its FM requirements, and both MARENA and FISE project staff were proactive in complying with the action plan to improve audit quality.

C. BANK PERFORMANCE

Quality at Entry

Rating: *Moderately Unsatisfactory*

68. The Bank put together a team with diverse skills to carry out the analysis and guide project design. It built on existing sector studies and ongoing operations, in the process linking the project to other Bank-financed operations in the rural WSS sector. The design adopted an integrated approach that remained relevant throughout the life of the project. Given the complexity of climate change, this approach was appropriate and involved the need to work closely in the field with key stakeholders and beneficiaries with the aim of inducing a change in their behaviors. Additional work was undertaken during preparation including elaboration of the Operational Manual.

69. However, there were also some significant shortcomings during preparation, the most important of which were: (i) the original PDO was too broad in view of the pilot investment activities involved, the limited grant resources, and existing institutional capacity weaknesses; (ii) cost estimates for the investment subprojects were significantly lower than proved to be the case due the lack of knowledge about the pilot communities and their respective water supply improvement and resilience requirements; (iii) the method to determine payments for the CES program were overly complex, and (iv) the need for additional technical studies was not sufficiently recognized. In addition, there had been no previous experience with the integration of climate change adaptation measures in the rural WSS sector in Nicaragua and thus there was lack of understanding regarding the specific water resource-related vulnerabilities in the selected municipalities at the time of project approval. This led to the need for additional technical studies to be completed before the pilot

[36] From an FM perspective, there were two Executing Agencies, MARENA and FISE, as ANA executed through FISE. Their PIUs included financial staff overseen by their Administrative and Financial Divisions and the pertinent data was registered in their Integrated Financial Management Systems (IFMSs), where the respective accounts were reconciled

[37] In addition, both entities had to adjust their accounting records for 2013-2016 to correct inappropriate classification of expenses in order to present adequate financial information to the Bank through the Project Interim Financial Reports (IFRs).

investment subprojects could be designed and implemented. Thus, the quality at entry was not satisfactory, and strongly contributed to the implementation delays experienced by the project.

Quality of Supervision

Rating: *Satisfactory*

70. The Bank carried out timely and well-staffed supervision missions throughout the life of the project. Even though there were five TTLs (the first two of which being co-TTLs during preparation, appraisal, and early implementation), the transitions between them were smooth even though this required close work with the counterparts to ensure a collective understanding of the project's activities. Throughout implementation, the Bank closely accompanied the project agencies to monitor and support implementation and progress towards achievement of the PDO. The Bank's supervision and extensive efforts during the last year of implementation to help the Recipient complete all project activities, even at a time of considerable political turbulence, were particularly noteworthy. Supervision reporting was candid and clearly identified the implementation challenges and there was strong collaboration between the Global Practice and the Country Management Unit (CMU)

71. The Bank, in agreement with the Government, restructured the project twice, contributing to a revised PDO that was more precise and measurable. It also adjusted the Results Framework by introducing revised indicators to better capture the activities, outputs, and outcomes that were expected to contribute toward the PDO. The Bank was particularly supportive of the Government's efforts during the last year and a half of implementation and worked hand-in-hand with the implementing agencies to define a detailed action plan with clear milestones, monitor progress, and, together with the Ministry of Finance, encourage the country to move forward in a timely manner. The Bank also displayed flexibility, including helping to overcome challenges that were beyond the control of the implementing agencies, ensuring that the community water supply works were finished, that the last payments of the CES incentives occurred, and that the works of Corn Islands could be completed.

Justification of Overall Rating of Bank Performance

Rating: *Moderately Satisfactory*

72. On balance, Bank performance is rated Moderately Satisfactory. Despite the Moderately Unsatisfactory quality at entry, the Bank played a proactive and constructive role in adapting to and correcting the preparation and appraisal shortcomings during implementation through close supervision and two restructurings, which contributed directly to the project's ability to deliver its revised outputs and achieve its revised intended outcomes and PDO within the original budget and time horizon despite initial delays.

D. RISK TO DEVELOPMENT OUTCOME

73. **Several factors are likely to determine the risk to the project's positive outcome, including the failure to include climate change adaption in rural water supply.** The overall intention of PACCAS was to help promote institutional change in the rural WSS sector by bringing the climate change dimension within core water sector investment programs based on several pilot investments. Despite FISE continuing to invest in water supply to poor communities, it has been reluctant address climate change considerations in project design despite the water-related risks because its main goal has been to provide water at minimal cost. It has thus sought to avoid adding costs to its traditional rural water supply projects such as those required to increase their resilience to

climate change. However, the Bank is now supporting the US$ 30 million PROASAR Project, which includes two activities that incorporate provisions to address climate risks and thus aligned with PACCAS's objectives: (i) connecting two existing wells to the water system on Corn Island that have been extensively evaluated by PACC; and (ii) development of municipal plans to increase resilience to water climate change risks. In addition, a proposal to finance 10 WASH pilots with climate change adaptation measures is under discussion.

74. Potential lack of future funding for the CES water protection is also a concern. According to MARENA, no financial resources are presently available from the national budget to provide continuity for the CES program. However, the World Bank has been supporting the GoN in developing a REDD+ strategy, which, if approved, this can provide payments for reducing emissions from forest degradation and deforestation. Additionally, a GEF operation, which would involve US$ 10.3 million for a Resilient Landscape Project (P160688) likewise under preparation, is planning to implement a similar Payment for Ecosystem Services (PES) program to protect forest land in the Caribbean region. This project will utilize lessons from PACCAS and include MARENA and INAFOR as implementing agencies, thus further strengthening their experience and that in Nicaragua more generally with climate change adaptation and forest and water resource protection.

75. During its last five months of implementation, moreover, the project faced a significant institutional crisis. New authorities assumed command of MARENA and significant staff turnover occurred, including the climate change, procurement and financial management staff that supported the project. Starting in March 2018, moreover, political turmoil at the national level affected project civil works still under construction, payments to CES program beneficiaries, and conclusion of the works on Corn Island. Despite this, PACCAS was able to finish the civil works and meet all revised project results targets. Sustainability of project outcomes in terms of capacity building and institutional strengthening for climate change adaption in FISE and ANA, however, will depend on political decisions. Project achievements regarding education and awareness in the participating local communities and municipalities, on the other hand, are expected to help ensure proper O&M and sustainability of the community water, sanitation, and hygiene benefits. Interinstitutional collaboration in developing and utilizing technical manuals for climate change adaptation also provided greater transparency, inclusiveness, and regular monitoring of activities and processes, thus contributing to better accountability and results in the sector, which are expected to continue in the future.

V. LESSONS AND RECOMMENDATIONS

76. **When attempting to pilot an innovative approach, other project elements should be kept as simple as possible.** The present project introduced important innovations in the overall approach to the installation of rural water supply systems by taking measures to strengthen their resilience to climate change. However, because of the participatory community selection process, the sites selected for the pilots were geographically remote and/or consisted of houses that were dispersed, which contributed to the increase in actual costs for installation of these systems compared with those assumed at appraisal. Had communities to which there was more ready access and/or lower dispersion of houses been selected, some of these additional costs could have been avoided and a larger number benefitted.

77. **Piloting new and innovative approaches to climate change adaptation is a feasible way to test and learn how to strengthen community resilience.** The project supported innovative pilot interventions to adapt rural WASH investments to increasing climate variability and change. It also supported relevant technical studies to underlie policy and project investment design decisions and, thus, more sustainable water resource management and

related interventions in Nicaragua. These studies provided critical knowledge on the definition of the recharge area of local aquifers which lead to the definition of action to better protection and integration of climate change adaptation measures in local rural water supply investments.

78. **Participatory approaches are key for successful implementation.** One of the project's principal strengths was the participatory approach it followed throughout implementation. MARENA and FISE involved the municipalities, community organizations, and final beneficiaries from the early stages, including by organizing workshops, sharing information, and training and educating stakeholders along the way. The technical work that was developed and used during the initial years was shared with a broad range of actors, and their feedback was incorporated in subproject designs through a learning-by-doing process. The project, in fact, achieved more in terms of education on climate change adaptation and environmental management than initially envisaged due to its participatory approach, which helped to build stronger adaptation capacity and thus resilience to climate change impacts at the rural community, municipal, and national levels.

79. **Strong Financial Management oversight is critical especially in a project with more than one implementing agencies.** As result of close Bank supervision missions, fiscal management issues were detected that dated back to the beginning of project implementation and had initially passed unnoticed by other Bank team, the external auditors, and the GoN. It took almost four months to clear the financial books and clarify the budget remaining for each institution which was unclear. As a result, closer FM supervision was done by the Bank and borrower. This experience generated important lessons for both project management and the Bank with respect to financial supervision and performance during the final year of implementation.

80. **Adaptive management is essential.** Finally, the project exemplifies the critical importance of adaptive management by both Government and the Bank for successful implementation. The decisions both to change the methodology for the CES Program that helped activate payments to participating farmers and to utilize the Community-Guided Project (CGP) approach as the modality for implementing local water supply systems illustrate this point. These modifications were crucial for the project's ability to achieve an on-schedule, on-budget, inclusive, and more-sustainable completion of the community subprojects than would otherwise have been the case.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

Revised PDO: *To pilot water resources protection and drinking water supply systems with an integrated and participatory approach in selected climate vulnerable communities in Nicaragua.*

A. RESULTS INDICATORS

A.1 PDO Indicators

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
1-Percent progress in the development of pilot drinking water supply systems following an integrated and participatory approach in selected vulnerable communities	Percentage	0.00 13- Nov- 2012	0.00 13- Nov- 2012	100.00 28- Feb- 2018	100.00 30- Jun-2018

Comments (achievements against targets): Achieved (100%). This indicator was introduced in the First restructuring of 2016 and the unit of measurement and wording was revised in the Second restructuring of 2018 (Annex 7). The indicator before measured only absolute number of WASH systems finalized/ constructed and no the whole process from planning, social engagement to operations; thus percent progress was selected as a better measure. The project achieved the construction of all seven WASH systems in the communities of La Danta y El Terrero N° 2, municipio de San Juan de Limay – Estelí; Sabana Grande, municipio de San Ramón – Matagalpa; Piedras Grandes N° 2, municipio de Juigalpa – Chontales; San Juan de Murra, Las Animas y El Olingo, municipio de Murra – Nueva Segovia. The Project is now benefiting 1,786 people, in 338 households in 7 communities.

Linkage to PDO: This indicator contributes in measuring the progress to achieve the development of pilot drinking water supply systems with an integrated and participatory approach in the selected climate vulnerable communities of the project area.

Main activities: Preparation of baseline technical studies; consultations and selection of communities in participatory approach; signing of agreements between government and five municipalities for PGC (community lead projects); groundwater and superficial water testing; hiring of social experts for community participation and organization (for project design, formation of CAPS, management of WASH); contracting of contractors, execution and supervision of works by communities and municipalities

Definitions: "integrated" refers both to packages of Water supply, Sanitation, and Hygiene (WSH) solutions/works as well as combining said works with" climate change adaptation measures" aimed to increase water resources conservation and protection. The latter refers to: reforestation of micro-watersheds and surroundings of water

sources and wells, including environmental education and conscious raising on climate change impacts and related resilience measures. The whole aims at reliable provision of safe drinking water in terms of continuity, quantity and quality, considering the specific social and environmental conditions of each community.

"Participatory" refers to the participation of beneficiary communities and municipalities in leading the planning, construction and future operation of the WASH systems, their participation in the design and engagement in the CES program and wetlands conservation on Corn Islands and on training, environmental and restoration efforts through the different project interventions. The latter aiming to lead ownership of the communities and municipalities on the WASH investments and subsequent care for its maintenance and protection of water resources.

Source data: PIU progress reports; FISE social and technical supervision and monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
2-Number of people in selected communities provided with access of improved water sources with adaptation measures under the project	Number	0.00 13-Nov-2012	4,500.00 13-Nov-2012	1329.00 27-Jul-2016	1786.00 30-Jun- 2018

Comments (achievements against targets): Surpassed (134%). This indicator was revised in 2016 and 2018 restructurings. See Annex 7 for details. The original number was reduced in the Level 1 2016 restructuring, as the number of communities was reduced from 15 in the PAD to 7 (Annex 7). Community members include women and children who are the main water carriers (see Annex 11). Of the total beneficieries, 821 were females (45%) Thus, the Project has a significant positive impact on women and vulnerable communities to climate change such as La Danta y El Terrero N° 2, municipio de San Juan de Limay – Estelí; Sabana Grande, municipio de San Ramón – Matagalpa; Piedras Grandes N° 2, municipio de Juigalpa – Chontales; San Juan de Murra, Las Animas y El Olingo, municipio de Murra – Nueva Segovia. In addition, the CES program contributed to improve protection of water sources through the application of climate change adaptation measures in 59 sources of 35 additional communities (benefiting 15,093 inhabitants from the 4 selected municipalities).

Linkage to PDO: This indicator contributes in measuring the number of direct beneficiaries from the pilot drinking water supply systems with the inclusion of adaptation measures.

Main activities: social, topographical and technical studies developed; evaluations and mapping of water sources climate change vulnerabilities; communities census; consultations with communities and municipalities; elaboration of municipalities climate change adaptation plans; selection of beneficiary communities.

Definitions: adaptation measures refer to: i) protection water sources and its recharge areas thorough fencing, reforestation, natural regeneration, vegetation backfire buffer strips, agroforestry, others; ii) education and training to reduce pollution, manage and store water; iii) planning of water use based on technical information on water resources vulnerability.

Source data: PIU progress reports; FISE social and technical supervision and monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
3-Water Source Protection Index in water recharge areas of selected climate-vulnerable communities that benefit of a CES program supported by the project, disaggregated by municipality	Index value (number)	0.00 13- Nov- 2012	0.00 13-Nov- 2012	73,241.00 30- Jun- 2018	85,045.00 30- Jun-2018

Comments (achievements against targets): Surpassed (116%). The wording for this indicator was revised in the 2016 restructuring to clarify the measured target. The result changed to be measured in terms of an index value instead of a percentage unit. A total of 354 farmers (men and women) and their families benefited under the CES program in order to protect 59 water sources (*fuentes de abastecimiento de agua*) of 35 communities, vulnerable to Climate Change. For each participant farmer a land use water protection plan was designed and monitored to measure the behavioral change and land use practices implemented to increase resilience and protection of the water sources. Among the measures implemented to protect water resources and that were compensate by the Program includes: reforestation; natural regeneration; installment of vegetation backfire buffer strips; agroforestry and silvo-pastoral systems; overland flow retention dikes; and training to reduce pollution and increase local resilience to climate change.

Linkage to PDO: This indicator contributes in measuring behavioral change towards the protection of water sources and recharge areas for drinking water supply in selected climate vulnerable communities of four municipalities.

Main activities: Survey and studies hired to define the recharge areas for local aquifers; identification of priority water sources for communities; CES technical and payment methodology prepared; community consultations and invitation to participate in in the CES program; land use changes monitoring surveys, payment to farmers.

Definitions: CES program: Compensation of Ecosystem Services program implemented payments to farmers who voluntary agreed to improve land use practices in their farms to increase protection of water sources important to downstream communities. ***Water Source Protection Index***: measures the protection achieve of selected water recharge areas of the water supply sources of selected 35 climate vulnerable communities using different scores and criteria that includes, slope, vegetation cover, vulnerability, among other factors; ***adaptation measures*** refer to: i) protection water sources and its recharge areas thorough fencing, reforestation, natural regeneration, vegetation backfire buffer strips, agroforestry, others; ii) education and training to reduce pollution, manage and store water; iii) land use planning at the farm level to protected water sources

Source data: PIU progress reports; FONADEFO and MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
4-Direct project beneficiaries	Number	0.00 13- Nov- 2012	0.00 13- Nov -2012	23,801.00 27- Jul- 2016	25,929.00 30-Jun- 2018
Female beneficiaries	Percentage	0.00 13- Nov-2012	0.00 13- Nov- 2012	50.00 27-Jul- 2016	50.00 30- Jun-2018

Comments (achievements against targets): Surpassed (109%). This World Bank core indicator was added in the 2016 restructuring. The direct beneficiaries from this Project includes: permanent Inhabitants of Corn Island (8,000); 354 Farmers benefited from payments the water source protection program – which protected 55 water sources; beneficiaries from the WASH interventions (1,783); 35 communities representing about 15,093 people benefited from the water source protection by the CES program and other water resources protection measures; and public officers trained on water protection, WASH, climate change, micro-basin conservation, etc. (700), see (Annex 10).

Linkage to PDO: This indicator contributes in measuring the total direct beneficiaries on the overall project interventions; it also measures the impact of the project in bringing equality of benefits to rural female beneficiaries.

Main activities: Includes all interventions by Component 1, 2 and 3, particularly the benefits generated by the development of the WASH interventions; the implementation of the CES Program, the artificial groundwater recharge pilot in Corn Island, training and educational activities.

Definitions: Direct beneficiaries are considered as part of: (i) total population of the two Corn Islands; ii) number of farmers receiving cash payments under the CES

program; iii) number of persons benefited from the WASH works of Subcomponent 1.1; iv) population of the 35 downstream communities whose 59 water sources benefit of
the CES program under Subcomponent 1.2; and (v) local and technicians from public institutions trained in the area of water resources and climate change adaptation.

Source data: PIU progress reports; FONADEFO and MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
5-Number of hectares conserved, reforested and restored to increase protection water sources of selected vulnerable communities	Hectare(Ha)	0.00	0.00 13- Nov-2012	3,000.00 28-Feb -2018	3,028.00 30-Jun- 2018

Comments (achievements against targets): Surpassed (100.9%). This indicator was added at the 2018 restructuring. It measures the number of hectares protecting water sources from different interventions of the Component 1 and 2: (i) adaptation measures during construction of the WASH systems (195 ha); (ii) CES program (2,496 ha); (iii) wetlands protection in Corn Island (26.6 ha); and (iv) spillover protection by the CES program (311 ha).

Linkage to PDO: This indicator contributes in measuring the progress to achieve the development of pilot drinking water supply systems with an integrated and participatory approach in the selected climate vulnerable communities of the project area.

Definitions: This indicator measures the number of hectares protecting water sources, among these: (i) mitigation measures during construction of water systems; (ii) as part of the CES program; (iii) restoration efforts in Corn Islands; (iv) municipalities and project reforestation campaigns; (v) reforestation done by MARENA delegations.

Source data: PIU progress reports; FONADEFO and MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

A.2 Intermediate Results Indicators

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at

				Target	Completion
1.1 Percent progress in the construction of drinking water supply systems.	Percentage	0.00 13-Nov-2012	0.00 13-Nov-2012	100.00 28- Febr-2018	100.00 30-June- 2018

Comments (achievements against targets): Achieved (100%). This indicator was added in 2016 restructuring and its unit of measurement and wording revised in the 2018 restructuring. As WB core sector indicator, it was being monitored as a PDO indicator before being added to the result framework. The 2016 restructuring changed it to an IRI. All 7 WASH systems targeted were 100% completed and delivered to the agreed communities (see Map Annex 13) at the closing date:

- La Danta y El Terrero (Municipality San Juan de Limay, Estelí);
- Piedras Grandes 2 (Municipality of Juigalpa, Chontales);
- Sabana Grande (Municipality of San Ramón, Matagalpa);
- El Olingo, San Juan de Murra and Las Animas (Municipality of San Juan de Murra, Nueva Segovia).

The project achieved 100% installation of WASH Systems solutions to the selected communities which included:

- 7 water supply systems from subterranean or superficial water sources.
- 87 household connections to drinking water systems;
- 51 public water outposts;
- 45 rainfall harvesting systems;
- 345 sanitation units;
- 347 hand washing stations.

Linkage to PDO indicators: This IRI is connected to the PDO indicator 1-Percent progress in the development of pilot drinking water supply systems following an integrated and participatory approach in selected vulnerable communities.

Activities: preparation and finalization of designs with community participation, organizing the community for the counterpart in kind support, socialization of works with the communities and municipalities, monitoring of water quality, hiring construction teams, transportation of materials in very isolated areas, water production and quality testing, financial management, implementation of mitigation and adaptation measures, technical and social supervision by FISE and MARENA, among other tasks.

Definitions: This indicator measures the Project progress in the construction of the water supply systems. The proposed unit change “percent progress” is defined as the total average progress in the construction of all seven WASH solutions.

Source data: PIU progress reports; FISE and Municipalities monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
1.2 Drinking water sources with climate adaptation measures in their recharge areas	Number	0.00 13-Nov-2012	0.00 13-Nov-2012	56.00 27- Jul-2016	59.00 30- Jun-2018

Comments (achievements against targets): Surpassed (105%). This indicator was revised in the 2016 restructuring, the indicator measured the number of water sources where the project was to invest to improve protection of these water sources and their recharge areas through promoting sustainable land use practices under the CES program (payment for results). The project surpassed the target by including 3 more water sources from additional communities of the four targeted municipalities.

Linkage to PDO indicators: This IRI contributes to **PDO indicators 3**-Water Source Protection Index in water recharge areas of selected climate-vulnerable communities that benefit of a CES program supported by the project.

Activities: Survey and studies hired to define the recharge areas for local aquifers; identification of priority water sources for selected communities; CES technical evaluation methodology prepared; land use monitoring surveys.

Definitions: The indicator measures the drinking water sources (36 wells and 20 rivers) in which recharge areas 80% of the respective CES program participants comply with at least 80% of the annual activities defined in their farm's land use plan.

Source data: PIU progress reports; FONADEFO and MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
2.1 Index of wetlands protection measures implemented by the project to improve adaptation capacity of water supply in Corn	Percentage	0.00 13-Nov-2012	0.00 13-Nov-2012	70.00 27- July- 2016	100.00 30- Jun-2018

Islands					

Comments (achievements against targets): Surpassed (142%) This indicator was revised in the 2016 restructuring, to measure the progress in five key project activities in the 27 wetlands of two Corn Islands. The target was to achieve 70% of the index, but the project achieved 100%, 30% more than planned.

Linkage to PDO indicators: This IRI contributes to **the PDO indicator: 5-**Number of hectares conserved, reforested and restored to increase protection water sources of selected vulnerable communities.

Activities: Hydrogeological studies in Corn Island hired; community organization implemented; technical training to water company of Corn Island; water quality testing in Corn Island; restoration and cleanup of wetlands; Environmental education programs and technical capacity training implemented to citizens and municipality staff.

Definitions: The wetlands protection index comprised five dimensions: (1) delimitation (150 hectares of wetland improved protection), (2) labeling and (3) reforestation of wetlands, (4) elaboration of a land use plan on the Corn Islands, and (5) environmental awareness-raising actions to maintain the wetlands clean.

Source data: PIU progress reports; MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
2.2 Environmental and climatic monitoring stations established and functioning in Corn Island	Number	0.00 13-Nov-2012	0.00 13-Nov-2012	2.00 27- Jul- 2016	3.00 30- Jun-2018

Comments (achievements against targets): Surpassed (150%). This indicator was revised in the 2016 Level 1 restructuring. The original target was to at least monitor rainfall in Corn Islands, but the project achieved no 2, but 3 weather and oceanographic monitoring stations. These monitoring are providing important information for the water resources management of the island. The stations collect real time weather and oceanographic data on precipitation, temperature, atmospheric pressure, solar radiation and sea level.

Linkage to PDO indicators: This IRI is contributes to the PDO indicator 4-Direct project beneficiaries since climate and weather monitoring is essential for identify the advserse impact of climate change to vulnerable communiites such as those living in the Islands of Corn Islands.

Activities: Hiring of technical studies to determine best locations for monitoring stations; purchase of equipment, building of stations; contracting of equipment

installation; training of Municipality staff by INETER; data collection and dissemination thorough INETER and ANA websites.
Definitions: The two-referenced oceanographic and weather stations collect monitoring data on precipitation, temperature, sea level and other parameters.
Source data: PIU progress reports; MARENA monitoring reports.

Quality of data: adequate, reviewed by INETER.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
3.1 Climate Information Module for water and climate change developed and integrated in the National Water Resources Information System (SiAGUA)	Yes/No	N 13-Nov-2012	Y 13-Nov-2012	Y 27- Jul-2016	Y 30-June-2018

Comments (achievements against targets): Achieved. This indicator was revised in the 2016 restructuring. The module has been developed and it was fully integrated in SiAGUA hosted in ANA. *http://www.cambioclimatico.ana.gob.ni/*

Linkage to PDO indicators: This IRI is contributes to the PDO indicator 4-Direct project beneficiaries since climate and weather monitoring is essential for identify the advserse impact of climate change to vulnerable communiites such as those living in the Corn Islands.

Activities: hiring of technical experts to collect data and prepare the computer system; purchased of equipment; training to ANA and INETER staff on the operation of the module; dissemination activities.

Definitions: The SiAGUA Climate Information Module bases on 22 climate related indicators defined through a process of inter-institutional consultations and collaboration with sectoral institutions (FISE, MARENA, INETER). The Module will record and analyze information on water resources and climate change generated by the Project and other similar projects and related institutions. The system will facilitate digital hydrologic and climate change information to be used in planning.

Source data: PIU progress reports; ANA monitoring reports.

Quality of data: adequate; monitored by FISE and MARENA.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
3.2 Technicians of key public institutions trained in the area of water resources and climate change, percentage of which female	Number	0.00 13-Nov-2012	300.00 13-Nov-2012	300.00 27- Jul- 2016	700.00 30-Jun-2018
Female technicians trained	Percentage	0.00 13-Nov-2012	0. 13-Nov-2012	40.00 27- Jul- 2016	43 30-Jun-2018

Comments (achievements against targets): Surpassed (233%). This indicator was revised to include adequate language for an intermediate outcome indicator. The indicator targeted the capacity building of public staff linked to management and protection of water resources, water supply, climate change and wetland conservation. The institutions targeted and that participated (700) in the trainings lead by the project included MARENA, FISE, ANA, INETER, Nicaraguan Water and Sewerage Enterprise (ENACAL), Ministry of Agriculture (MAG), Ministry of Energy and Minerals (MEM), universities and public departments at national level, environmental authorities of the South Caribbean Autonomous Region (RACCS), among others. The project made efforts to attract female technicians to the trainings achieving a 43% participation rate.

Linkage to PDO indicators: This IRI is contributes to the PDO indicator 4-Direct project beneficiaries since capacity building, training and education on water resources management and climate change adapation is critical for increasing resilience of project vulnerable communiites.

Activities: preparation of manuals; organization of workshops, courses and events (23) to support training of local governments, public official from different sectoral institutions (43% women).

Definitions: Training to benefit public officials from MARENA, FISE, ANA, INETER, Nicaraguan Water and Sewerage Enterprise (ENACAL), Ministry of Agriculture (MAG), Ministry of Energy and Minerals (MEM), universities and public departments at national level, environmental authorities of the South Caribbean Autonomous Region (RACCS).

Source data: PIU progress reports; MARENA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at

				Target	Completion
3.3 Tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE	Number	0.00 13-Nov-2012	0.00 13-Nov-2012	10.00 27-Jul-2016	10.00 30- Jun-2018

Comments (achievements against targets): Achieved (100%). This indicator resulted from the revision of one of the original PDO indicators (3) during the 2016 restructuring to adjust it as an IRI. The 2018 restructuring maintained the wording of the indicator and substituted two of the ten tools for more relevant tools for the country. The ten tools, manuals and plans completed are:

1. Technical manual to protect water sources with climate change adaptation approach
2. Guideline to develop and systematize implementation of Municipal Plans for Environmental Protection in face of Climate Change (*Planes Municipales de Protección Ambiental de las Familias ante el Cambio Climático*, PMPAFCC)
3. Methodology to determine vulnerability of water sources and drinking water systems
4. Methodology to delimit water recharge areas in the drinking water supply sector
5. Guidelines of good practices for wetlands protection with a focus on climate change
6. Land use plan for the Corn Islands
7. Improved Environmental Management System (*Sistema de Gestión Ambiental*, SISGA) to incorporate key considerations and methodologies for environmental management in water and sanitation works to help enhance climate resilience
8. Improved manual of implementation for water and sanitation projects (*Manual de Ejecución de Proyectos de Agua y Saneamiento, MEPAS*) to integrate key considerations and methodologies for enhanced climate resilience of the developed projects
9. Technical guide for water harvest in rural areas
10. Manual for climate change Adaptation of the rural water and sanitation sector of Nicaragua.

Linkage to PDO indicators: This IRI is contributes to the PDO indicator 4-Direct project beneficiaries since capacity building, training and education on water resources management and climate change adapation is critical for increasing resilience of project vulnerable communiites.

Activities: hiring of consultants, recompilation of data; consultations; publication and dissemination.

Definitions: Ten tools (methodologies, manuals and technical guidelines) will be developed and fine-tuned during Project implementation for potential adoption by the responsible agencies for replication and scale-up.

Source data: PIU draft reports; MARENA and FISE monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
1.3 Percent progress in the organization of vulnerable communities to manage and operate the new water system and to protect water resources	Percentage	0.00 13-Nov-2012	0.00 13-Nov-2012	100.00 28-Feb-2018	100.00 30-Jun-2018

Comments (achievements against targets): Achieved (100%). This indicator was included in the 2018 restructuring to measure progress in: (i) coordination and organization of water community groups for the future management and operation of the drinking water systems; and (ii) community organization for the protection of water sources, wetland restoration, application of adaptation measures, forest protection and erosion control.

Linkage to PDO indicators: This IRI contributes to PDO indicators 1- Percent progress in the development of pilot drinking water supply systems following an integrated and participatory approach in selected vulnerable communities since local communities were organized into CAPs (local water management groups) to manage and operate the project WASH investments

Activities: hiring of social experts to develop with the communities the social intervention plan (communication, assemblies, consultations, agreements); development of social surveys and census; technical training to operate and manage the WASH works and to protect water resources; organization and officialization of CAPs in FISE;

Definitions: This indicator measures the progress in reaching the following: i) the coordination and organization of water community groups for the future management and operation of the drinking water systems; ii) community organization for the protection of water sources (CAPS), wetland restoration, application of adaptation measures, forest protection and erosion control.

Source data: PIU progress reports; MARENA, FISE and ANA monitoring reports.

Quality of data: adequate; monitored by the Ministry of Finance.

B. KEY OUTPUTS BY COMPONENT

Component 1 - Piloting Drinking Water Systems in Selected Vulnerable Communities, following an integrated and participatory approach	
Outcome Indicators	1. Development of pilot drinking water supply systems following an integrated and participatory approach in selected vulnerable communities (Percent progress): 100 percent completed; 2. Number of people in selected communities provided with access to improved water sources with adaptation measures under the project. 3. Water Source Protection Index in water recharge areas of selected climate-vulnerable communities that benefit from the CES program, supported by the project, disaggregated by municipality; 4. Number of hectares conserved, reforested and restored to increase protection of water resources of selected vulnerable communities. 5. Direct project beneficiaries. Female project beneficiaries
Intermediate Results Indicators	1. Percent progress in the *construction* of drinking water supply systems; 2. Drinking water sources with climate adaptation measures in their recharge areas. 3. Percentage progress in the organization of vulnerable communities to manage and operate the new water systems ad to protect water resources.
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	**Component 1.1** • Preparation and signing of agreements with five municipalities (listed below) to carry out 7 pilot investment water, sanitation and hygiene projects in rural communities. • Seven design studies for seven investment projects for rural water and sanitation systems in the communities of: - La Danta y El Terrero (Municipality San Juan de Limay, Estelí); - Piedras Grandes 2 (Municipality of Juigalpa, Chontales); - Sabana Grande (Municipality of San Ramón, Matagalpa); - El Olingo, San Juan de Murra and Las Animas (Municipality of San Juan de Murra, Nueva Segovia). - Corn Island: investment project to expand the corn island drinking water system (creation an area to capture rain water to increase the recharge capacity of the aquifer- (this is the first time this is been tested in the country) • Seven Social Facilitators hired, and Seven construction supervisors hired;

- Seven integrated water and sanitation systems built and rehabilitated, tested and functioning in selected vulnerable rural communities. The systems were built following a participatory approach, using a modality known as Community Guided Projects (*Proyectos Guiados por la Comunidad -PGC*), including Adaptation to Climate Change measures. (Component 1.1) This meant:
  - 87 household connections to drinking water systems established;
  - 51 public water outposts established;
  - 45 water capturing systems installed;
  - 345 sanitation units built and
  - 347 washing stations (*lavaderos*) built and installed.
- A total of 1,782 beneficiaries (versus a target of 1,329 after the 2016 restructuring). Of these, 961 were men and 821 were women. This represents a reduction of vulnerability for a total of 352 beneficiary families.

Component 1.2

- Action plan prepared and executed (for the restoration of water recharge areas of the water sources feeding the WAS investment projects.
- Incentives paid to 354 individuals under the CES program related to 59 water sources (*fuentes de abastecimiento de agua*) in 35 communities, vulnerable to Climate Change. (Component 1.2): implemented by 354 beneficiaries in 35 communities.
- Property Action Plans (*Planes de Fincas*) prepared by each beneficiary.
- Operational Manual for the CES program (*Manual de Procedimientos Técnico-Administrativo del Programa de Protección de Fuentes de Agua para la Compensación Ambiental*).
- A total 195 hectares benefited with environmental measures in the Seven Pilot projects for rehabilitation and construction of integrated water and sanitation systems (Component 1.1)
- A total of 311.75 hectares benefited with environmental protection measures, as an indirect benefit (*Efecto Derrame*) of the CES program (downstream areas).
- Technical assistance and training for 354 beneficiaries.
- A total of 273 sessions on environmental education and sensitization in the 4 selected municipalities where the CES took place, with participation of 11,951 community members (5,594 women (47 percent) and 6,357 men (53 percent)).
- A total of 26.6 hectares restored of wetlands (*Humedales)* in Corn Island

	• Baseline Technical Studies: "Análisis de Vulnerabilidad de las Fuentes de Agua en Comunidades Rurales en los Municipios de Murra, San Juan de Limay, Juigalpa y San Ramón ante el Cambio Climático"; "Diagnostico de la Infraestructura de Abastecimiento de Agua Potable de las Comunidades más Vulnerables ante el Cambio Climático" (2013). FISE: Análisis de Vulnerabilidad y de Escenarios Climáticos (Baseline study on the hydrology and hydrogeology of Corn Island)
Component 2 – Coastal Westland Protection and Reduction of Vulnerability to Sea-level rise in the Municipality of Corn Island	
Outcome Indicators	1. Number of people in selected communities provided with access to improved water sources with adaptation measures under the project. 2. Number of Hectares conserved, reforested and restored to increase protection water sources in selected vulnerable communities: 3,022.25 hectares conserves, restored, reforested. 3. Direct project beneficiaries. Female project beneficiaries.
Intermediate Results Indicators	1. Index of wetlands protection measures implemented by the project to improve adaptation capacity of water supply in Corn Island: 100 percent achieved 2. Environmental and climatic monitoring stations established and functioning in Corn Island
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	• For Corn Island: three studies carried out: "*Diagnósticos Temáticos en Hidrología, Suelos, Socio-económicos e Infraestructura social"; "Analisis de Amenazas y Riesgos" y "Caracterizacion de Humedales"* (used for environmental planning by municipalities and are the baseline for future research). • Environmental Management and Territorial Plan with Adaptation measures for Climate Change for Corn Island: Approved. • A total of 26 wetlands in Corn Island and Little Island demarcated: meaning a protection of 150 hectares. These are sources of water for the 8,000 inhabitants of the islands. Within these wetlands, a total of 26.6 hectares reforested with red mangle. • 32 signs in English and Miskito language. • Plan on Environmental Education and sensitization prepared and implemented: 133 environmental education and sensitization activities, with participation of 6,702 people (4,263 or 64 percent were women and 2,439 or 36 percent were men).

Component 3. Institutional Strengthening, Project Management, and Monitoring	
Outcome Indicators	1. Direct project beneficiaries. Female project beneficiaries
Intermediate Results Indicators	1. Climate Information Module for water and climate changes developed and integrated in the National Water Resources Information Systems (SiAGUA); 2. Technicians of key public institutions trained in the area of water resources and climate change; Female technicians trained; 3.Tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE; 4. Percent progress in the organization of vulnerable communities to manage and operate the new water systems and to protect water sources.
Key Outputs by Component (linked to the achievement of the Objective/Outcome 3)	• Design and implementation of a web module on Water and Climate Change to integrate in SiAGUA developed in three phases. Workshops to validate the module's design with citizen participation and key institutions. • Acquisition of hardware, software to render the module operative in connection and integrated in SiAGUA**.** • Technical Assistance to strengthen the capacity of the Water Company of Corn Island (EMACI): Preparation of an Action Plan to strengthen plan implemented to strengthen capacity on integrated management of water resources for drinking water supply systems. This included: (i) acquisition of equipment to continue monitoring the quality of water resources; (ii) Inventory of private water wells; (iii) Acquisition of 12 volume measurer (*medidores volumétricos*) to measure the volume of water being extracted from the wells; (iv) workshops to present results; (v) training of EMACI staff; (v) promotion of legalization of users; (vi) accompanying activities for the water quality monitoring plan. • Two technical studies completed "Hydrological and hydrogeological Study of Corn Island" and "Study of Water Availability in Prioritized Vulnerable Communities in the context of Climate Change in the municipalities of Murra, San Juan de Limay, San Ramon and Juigalpa." • 700 hundred technical staff in public institutions trained (397 men and 303 women (43%)) on water resources management and adaptation to climate change; • 413 activities for environmental education, environmental awareness and sensitization: of these, 290 activities were focused on capacity building and 123 focused on environmental sensitization. A total of 19,858 participants in these activities: 10,570 women and 9,288 men.

	• Revised Project PACCAS Operational Manual: including annexes on methodologies for the selection of consultant to monitor projects, for social facilitators and the methodology for Community-Led Projects and their supervision, methodology to measure green coverage in the CES program and the economic calculation of the incentive under CES. • 7 Committees for Water, Sanitation and Hygiene (CAPS) organized; • A total of 35 Workshops organized for CAP members and community members: a total of 274 people trained on environmental issues and adaptation to climate change and 160 people trained on water management issues. • Updating the content of MARENA's website; regular monitoring of MARENA's website; Preparation and implementation of a Communications and Disseminations Plan to capture and disseminate the main achievements of the project. <u>*Corn Island and Little Island*</u> • Municipal Environmental Plan with Adaptation Measures to Climate Change (*Plan de Ordenamiento Ambiental and Territorial con Medidas de Adaptación al Cambio Climático para Corn Island*) approved and implemented. • Establishment of a Municipal Cabinet for Environmental Management and of a Municipal Technical Unit to support and monitoring of the implementation of the Municipal Environmental Management Plan. • A total of 40 environmental community workers (*Promotores Ambientales*) trained and hired by the Municipality of Corn Island. • Three environmental and climate monitoring stations established and functioning. • Two studies completed: "*Densificación geodésica y cartografía*" and "*Estudio de Batimetría and Estudio de Levantamiento del Relieve de Superficies Subacuáticas*." • Building the meteorological shed and equipment to measure barometric pressure in Corn Island. • Ten environmental management tools (Manuals, Methodologies and technical guides) developed, used and adapted during use (See list in Annex 9)

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role at time of preparation
Preparation	
Irina Klytchnikova	Senior Economist, Task Team Leader
Lilian Peña	Water Supply and Sanitation Specialist, Co-Task Team Leader
Rita Cesti	Senior Rural Development Specialist
Stefano Pagiola	Senior Environmental Economist
Abdelaziz Lagnaoui	Senior Envrionmental Specialist
Ruth Tiffer-Sotomayor	Senior Environmental Specialist
Enrique Roman	Financial Management Specialist
Francisco Rodríguez	Procurement Specialist
Cristian D'Amelj	Counsel
Patricia Hoyes	Sr. Finance Oficer
Augusto García	Operations Officer
Nelson Medina Rocha	Water Supply and Sanitation Specialist
Julie Biau	JPA
Hector Alexander Serrano	JPA
Margaret Isaac	Program Assistant
Linda Castillo	Program Assistant
Ximena Traa-Valerezo	Social Development Specialist - Consultant
Claudia Lucia Brockman Mendoza	Financial management - Consultant

Supervision/ICR	Role at time of Supervision/ICR
Irina Klytchnikova	Senior Economist Task Team Leader
Lilian Peña	Water Supply and Sanitation Specialist Co-Task Team Leader
Abdelaziz Lagnaoui	Senior Envrionmental Specialist Task Team Leader
Tuuli Bernardini	Environmental Specialist Task team Leader

Stefano Pagiola	Senior Environmental Economist
Cristina Elizabeth Coirolo	Social Safeguards Specialist
Chris Fisher	Senior Water Resource Specialist
Ximena Traa-Valerezo	Social Development Specialist - Consultant
Ruth Tiffer-Sotomayor	Senior Envrionmental Specialist Task Team Leader
Veronica Yolanda Jarrin	Operations Officer
Enrique Antonio Roman	Financial Management Specialist
Carlos Lago Bouza	Procurement Specialist
Nelson Antonio Medina Rocha	Water Supply and Sanitation Specialist
Elena Strukova	Senior Economist, Consultant
Alvaro Campy	Water resources Engineer, Consultant
Edgar Ortiz	Forest Engineer and PES expert, Consultant
Anna Gueorguieva	Senior Economist
Norman Russel Howard Taylor	Senior Social Development Specialist
Luis Velez	Operational support, Consultant
Mayela Murillo	Program Assistant
Karina Elizabeth Rodríguez	Environmental Specialist, Consultant
John Redwood III	ICR main contributor, Consultant
María Rosa Puech	ICR main contributor, Consultant

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY12	23.771	188,108.11
FY13	4.858	20,638.29
Total	**28.63**	**208,746.40**
Supervision/ICR		
FY13	8.235	53,473.82

FY14	8.372	57,022.90
FY15	40.337	142,585.71
FY16	9.385	64,955.62
FY17	5.119	57,703.08
FY18	3.650	46,123.74
Total	**75.10**	**421, 864.87**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Revised Amounts (US$M)	Actual at Project Closing (US$M)	Percentage of Approval (%)
Pilot adaptation initiatives to enhance climate resilience in the selected municipalities	3.60	3.60	3.60	100.0
Coast wetland protection and reduction of vulnerability to sea-level rise in the municipality of Corn Island	0.90	0.83	0.83	92.2
Institutional strengthening, project management, and monitoring	1.50	1.57	1.57	104.7
Total	**6.00**	**6.00**	**6.00**	**100.0**

ANNEX 4. EFFICIENCY ANALYSIS

1. According to the Project Appraisal Document (PAD) (pp. 11–12 and Annex 8), the pilot projects for Subcomponent 1.1 were to be selected through a prioritization process with the participation of municipalities and according to a range of criteria that would be included in the Project's Operational Manual. Over 60,000 people—the rural population of the five municipalities to be benefitted under the project was expected to benefit directly and indirectly from the project. Based on the experience of the ongoing PRASNICA Project and the associated economic and financial analysis of the investment costs for upgrading rural water supply and sanitation infrastructure, a minimum of US$40,000 per community was anticipated to partially meet local needs. However, in the case of the present project, piloting of client-resilient rural water supply solutions would be more expensive. As revealed by the Diagnostic Study carried out as part of project preparation, climate-resilient solutions require hydrogeological or catchment area assessments prior to construction, as well as infrastructure that is more resilient to climate impacts, both of which are also likely to increase the average cost of these solutions (for example, the wells may need to be made deeper, or with the metal casing to cover the head, together with more advanced systems that rely on pumping).

2. However, the exact extent of these additional costs was not yet known at the time of appraisal because the specific communities to be benefitted had not yet been selected. For this reason, technical assessments, financed partly by Component 1 and partly by funds additional to the project, would be undertaken as part of the preparation of the individual investment subprojects in the four pilot municipalities. These studies would provide additional information on the vulnerability of water sources to climate change and the investment needs to make them more resilient. Their results, in turn, would provide the basis for the detailed subproject designs and the associated economic and financial analysis will be prepared for the works. Thus, no ex ante economic evaluation of Component 1, which accounted for 80 percent of its investment costs and 60 percent of its total costs, was undertaken at the time of appraisal. For Component 2, which represented the other 20 percent of project investment costs and 15 percent of its total estimated costs at appraisal, in turn, an evaluation of alternative designs was reportedly carried out and the most cost-effective options were chosen and further described in Annex 8 of the PAD.

3. The project succeeded in carrying out Component 2 as initially anticipated with slightly less resources (US$7,000) and Component 3 with slightly more resources (also US$7,000) than originally envisaged. However, it was not able to do the same with Subcomponent 1.1, whose target number of communities to be benefitted needed to be reduced at the time of the first restructuring following the Mid-Term Review in mid-2016. The main reasons for this were the initial implementation delays and the higher than originally anticipated costs of the community drinking water systems, which are further described in the paragraphs below. On the other hand, Subcomponent 1.2, which was designed to improve the protection of local water sources to make them more resilient to climate variability and change, was implemented as expected (although again with some delays) ultimately benefitting 35 rural communities.

4. **Implementation delays**: PACCAS managed to complete the agreed revised activities under Component 1 by the original loan closing date. Despite this achievement, implementation delays

affected project performance. By mid-2016 (that is, after four years of implementation), designs for the community water supply systems sill had not been completed, (Subcomponents 1.1 and 2.1). CES payments for the participating farmers also stalled (Subcomponent 1.2) until certain changes were made. As a result, at the end of 2016, the Bank team and the PIU agreed on a detailed action plan with specific milestones that enabled the completion of all remaining project activities without going over budget and within the original time schedule. However, this also required a reduction of the number of pilot communities to be supported from the appraisal target of 15 to 7 as the unit costs (see the next paragraph) proved to be substantially higher than assumed at appraisal.

5. **Higher investment costs than envisaged for one subcomponent:** The actual costs of both the technical studies and the individual pilot investment subprojects under Subcomponent 1.1 proved to be much higher than foreseen in the PAD.[38] This was primarily due to (i) the particular characteristics of the selected pilot communities (that is, their geographic remoteness and the dispersion of their houses) that, as observed above, were not known at the time of appraisal; (ii) the aforementioned delay in starting the designs of the pilot investment projects, which were not initiated until June 2015, and of the associated civil works (2017); (iii) inclusion of measures to adapt to climate change that had not been costed before; and (iv) inclusion of sanitation and hygiene dimensions, together with water supply *per se,* in the pilot projects.

6. The above issues notwithstanding, by project closing the number of direct PACCAS beneficiaries reached 25,929, exceeding the revised target established at the time of the first restructuring (23,802) by 8.9 percent (see Annex 10). In addition, in terms of project economic benefits, PACCAS activities achieved the following outcomes and impacts as indicated in surveys carried out by the Nicaraguan Government: (i) improvement in hygiene habits among beneficiaries; (ii) improvement of health outcomes due to greater access to better quality water; (iii) time savings among beneficiaries due to closer access to water, particularly for women and children and that could be used for work or to attend school; (iv) improved local capacities to execute projects and manage improved drinking systems; (v) additional income for local farmers as a result of their participation in the CES program, generating monetary incentives and producing crops while protecting water resources. It is also noteworthy that the beneficiary communities are now paying affordable quotas for the improved drinking water provided by the pilot investments. This has contributed to improved management and use of scarce water resources and maintenance of the rural water systems.

7. In addition to these considerations and despite the fact (as indicted in para. 1 above) that no such assessment was undertaken at the time the project was appraised because the definitive community investment subproject costs were not yet known, a detailed ex post cost-benefit analysis was carried out for purposes of this ICR. This analysis shows that the project is generating substantial economic returns even under conservative assumptions and different scenarios (see Table 1 and Annex 4.1 below for details). This analysis compares the actual subproject costs with their estimated economic benefits for the first 25 years, both discounted to 2013 (the baseline year). The benefits from Subcomponent 1.1 originate from health benefits and time savings after building new drinking water supply and sanitation systems following an integrated and participatory approach in seven rural communities vulnerable to climate change. The benefits from Subcomponent 1.2 include incremental agricultural and forestry benefits from landscape restoration and water sources protection on 2,496

[38] The PAD has estimated a budget of US$240,000 for the technical studies but the offers were higher than that.

hectares. The protected water sources ensure better water recharge on 11,508 hectares with 5,375 farms. Benefits from Component 2 on the Corn Islands, in turn, include health benefits from the new water supply and sanitation system alongside with incremental ecoservice values provided by 150 hectares of coastal wetland improvements due to 26.6 hectares of critical wetlands restoration for water infiltration and to combat saline water intrusion into the associated aquifer. Financial sustainability of the water supply components is expected to be guaranteed by introduction of the system of water tariffs to cover the operational and maintenance costs of the water supply systems built by the project.

8. Costs are presented by the actual financial project costs discounted by 6 percent—US$ 4.7 million. Realized investment costs (for Components 1 and 2) are estimated at US$ 3.12 million. The Net Present Value for the entire project is estimated to be US$ 0.7 million (at a discount rate of 6 percent), and the Internal Rate of Return is 7 percent, with health benefits, time saving from water supply and sanitation system and landscape restoration benefits from Components 1 and 2 considered equally important in terms of their overall contribution to project benefits. The Net Present Value of the investment Components 1 and 2 is estimated at US$ 3.1 million, and the Internal Rate of Return of the investment components is 14 percent. The robustness of these results is verified by sensitivity analysis. Different discount rates (3, 6, and 10 percent) and a reduction of the economic benefits by 5 and 10 percent are applied. The benefits are larger than the costs in almost all scenarios even though this analysis did not include full benefits. Ecosystem services benefits provided by the protected wetlands, for example, were estimated at the minimum values. In addition, some benefits cannot be quantified, such as those of improved water availability on the schooling of children, the effect of climate change education on adaptation behavior, and the long-term benefits of policy changes.

9. Thus, the project benefits may, in fact, be even greater, as this analysis disregards benefits from new policies, monitoring tools, capacity building and new guidelines, which are all likely to have triggered—or will trigger in the future—further positive developments in terms of more sustainable water resource management and community-educated adaptation to climate change. Based on these substantial benefits realized in the project alone, efficiency of the restructured project can be rated Substantial. In addition, this analysis supports the broader Global Environmental Objective (GEO) in terms of advancing country efforts for sustainable natural resource-based economic development more generally. In this regard, the literature indicates that environmental degradation in Nicaragua reduces its Gross National Income (GNI). Net forest depletion is 5.6 percent of GNI according to the World Bank's 2016 *Little Green Data Book* compared with an average for Latin America and the Caribbean of 0.3 percent. The project's efforts to reduce (albeit by a small percentage) this forest loss through its landscape restoration, water source protection, and vegetation cover improvements in addition to the other benefits accrued with respect to climate adaptation, increased resilience, and direct income generated by productive investments, all contribute to this broader objective.

Table 1. Results of Cost-Benefit Analysis for all Project Costs between 2013 and 2038 (US$)

	Baseline incremental scenario	Incremental scenario with 5% benefits reduction	Incremental scenario with 10% benefits reduction
	NPV	NPV	NPV
Discount Rate 3%	$3,368,417		
Discount Rate 6%	$729,681	$406,175	$82,669
Discount Rate 10%	-$954,563		
IRR	7%	7%	6%

Note: NPV = Net Present Value; IRR = Internal Rate of Return.

10. **Project impact on beneficiaries**. The project positively impacted the socioeconomic conditions of beneficiary households. It also brought health benefits to their communities by decreasing diarrheal disease burden by 20–40 percent. The health benefits of water supply and sanitation works were approximately three and a half times greater than communal expenses for improved water supply. Beneficiary savings because of the new water systems also included decreased time for fetching water and obtaining sanitation services.

11. **Landscape restoration and protection of 57 water sources** from 35 communities through the Program for the Compensation for Environmental Services (CES) were critical for water recharge in an area 4.6 times larger than the actual landscapes restored by the project. Considering also the environmental services provided, the value of these private conservation commitments is in the thousands of dollars. Provisional ecosystem services increased, and the Beneficiaries' Satisfaction Survey confirmed agricultural productivity improvements as well. Restoration of the wetlands on the Corn Island, in turn, ensured sustainable use of the aquifer and undisturbed water supply to 8,000 people among the local population, while also providing with other wetland ecoservices for the community.

12. The CES program, moreover, **contributed to poverty reduction** in the project area since it provided additional funds to poor farmers. Many of these farmers are under the poverty line in Nicaragua (making less than the equivalent of US$ 5 a day or US$ 100 a month). As a result of the project, 354 famers collected an equivalent of 6 months income (about US$ 600 each) because of their participation in the CES program. Farmers have used the CES payments to improve productivity in their farms (through more stable water sources, better fire control, and so forth) and to plant other subsistence crops such as corn, beans, tomatoes, or cash crops (oranges, mango, coffee), thereby also likely improving their nutrition. Such farmers could potentially also receive future payments for environmental services from the GoN's REDD+ Program and the GEF Resilient Landscapes Project based on lessons learned from PACCAS.

13. Due to these positive results, because the project was completed on budget during the originally anticipated time horizon, and accounting the positive economic benefits detailed in Annex 4.1 below, Efficiency is rated Substantial.

ANNEX 4.1. DETAILED ECONOMIC AND FINANCIAL ANALYSIS

1. This Annex provides a more detailed presentation of the analysis summarized above, including economic analysis of project investment costs required to reach its target indicators. While many of the benefits of the project cannot be quantified, the quantifiable economic benefits substantially outweigh the costs. Benefits of the project include reducing public health risks (Subcomponent 1.1 and Component 2), agricultural and ecosystem services from restoring of water sources and landscapes in the Central and North Zone (Subcomponent 1.2) and wetlands restoration on the Corn Islands (Component 2), which in turn positively affects water supply for the local population. Since all the target indicators are achieved, these benefits are expected to materialize and bring positive net economic return. Financial sustainability of project-built water supply systems is guaranteed by the system of water tariffs that are introduced by the project to cover operational and maintenance cost of these systems.
2. The cost benefit analysis shows the net benefits generated by each component on an incremental basis. The overall project benefits are equal to the difference between the incremental benefits and the incremental costs of the “with project” and “without project” scenarios. The “with project” scenario considers actual achievements obtained by project interventions. The results of this economic analysis, however, cannot be compared with those at Appraisal since, at that time, no cost-benefit analysis was conducted.

3. Economic analysis for investment Components 1 and 2

Subcomponents 1.1 and 2.2. Providing water supply for 1,437 people and sanitation for 1,581 people in in seven communities vulnerable to climate change and ensuring sustainable water supply to 7,626 of the local population on the Corn Island.

4. Because of uneven water distribution in the country, accessing safe water was a difficult daily challenge for many families in the project area. This challenge becomes even greater during the dry season. The communities selected for project interventions did not have potable water and improved sanitation. Many households were dependent on shallow hand-dug wells or natural springs and rivers, streams, and lakes that were not protected. However, many of these rivers, streams, and lakes were polluted with pesticides, residential sewerage, and livestock waste. Sewerage coverage was also limited, and the condition of many sewerage collection systems had deteriorated. Climate change is expected to aggravate the situation. The lack of safe water and sanitation treatment causes a public health problem.

5. A recent study assessed the health cost of inadequate WASH (water supply, sanitation, and hygiene) by region in Nicaragua. Annex Table 4.1 below presents high estimate of the health burden for those departments in Nicaragua where the project interventions were conducted. To value the health burden of inadequate WASH, a welfare-based method (VSL for annual mortality valuation) is applied. To estimate the cost of illness (COI) for diarrhea we added cost of medical treatment and value of income and time lost to illness. Annex Table 4.2 presents the estimated annual cost of inadequate WASH in Nicaragua

Annex Table 4.1. Health Burden from Unsafe WASH by Department in Nicaragua (Annual Cases)

	WASH mortality	WASH Morbidity
Central and North Zone	147	12,920
Chontales	10	843
Estelí	13	1,180
Matagalpa	39	3,411
Nueva Segovia	20	1,758
Atlantic zone	83	7,282
Atlántico Sur	30	2,623

Annex Table 4.2. Annual Cost of Inadequate WASH in the Selected Departments (Million US$)

Central and North Zone		Atlantic Zone	
Total, million US$	**Per capita, US$**	**Total, million US$**	**Per capita, US$**
35.6	29	13	35

6. Net project benefits include a 20 percent health cost reduction (WHO guidance) applied to water supply improvements for 1,437 people in the Central and North Zone, and 8,000 people on the Corn Island, and 40% health cost reduction due to sanitation improvement (WHO guidance) for the 1,581 Central and North Zone population in the communities participating in the project.

7. Additional net benefits for households with improved water supply in Central and North Zone include 1.5 hours per day/household for saving of water fetching time, and 20 min per capita daily for improved sanitation in each household. These benefits are valued at 50 percent of rural income per capita in Nicaragua in 2016 (US$ 0.6 per hour). A 3 percent growth rate to health cost and GDP/capita is applied (10 years average GDP per capita growth in Nicaragua).

8. Results of the economic evaluation of the Project's water supply and sanitation subcomponents are presented in annex table 4.3 below.

Annex Table 4.3. Economic Results of the Implemented Work

	NPV, 000 US$, 3% discount rate	NPV, 000 US$, 6% discount rate	NPV, 000 US$, 10% discount rate	IRR, %
Component 1.1: Water and sanitation improvements	3,132	1,702	694	17
Component 2.2: Water improvements	1,076	710	162	18

9. Subcomponents 1.1 and 2.2 have positive economic results with an NPV at US $2.4 million and an IRR of 17–18 percent. The high internal rate of return is explained in reasons such as: (i) in general rural water projects generate higher returns than urban ones given the difficulties for accessing water sources suitable for consumption and hygienic uses. Main benefits from water interventions in Central and Northern Zone (Subcomponent 1.1) come from time savings obtained when population does not

have to fetch water from long distances, which in some municipalities was significant. Only health benefits are considered on the Corn Island. Higher IRR is explained by the importance of the achieved critical wetland restoration (Subcomponent 2.1) to prevent saline water intrusion and to ensure ground water recharge in the aquifer that supply water to wells. Net benefits could be even higher if an actual disbursement for Subcomponent 2.2 had started earlier. About 68 percent of all disbursements under this subcomponent occurred during the last year of the project implementation (2018).

Component 1.2. Water resource protection and restoration of landscapes on 2,496 hectares with the Program for the Compensation for Environmental Services (CES), in selected communities vulnerable to climate change

10. According to a vulnerability study by the National Clean Development Office (ONDL, Spanish acronym) on adaptation options for water resources and agriculture, 75 percent of harvest losses in Nicaragua were due to droughts and the remaining 25 percent due to floods. In addition, the lack of conservation practices in ranching and agriculture also promotes soil degradation. Cattle compact the soil and prevent rainwater absorption, increasing the volume of destructive runoff, while overgrazing increases erosion and decreases soil fertility. The project (Subcomponent 1.2) achieved water source protection through 2,496 hectares (ha) of landscape restoration. As a result, 31 water recharge areas were positively affected on 11,508 ha, including 5,375 ha of farmland. Project benefits include incremental agricultural and forestry benefits from landscape restoration attributed to water source protection by the CES program. Project Beneficiaries' Satisfaction Survey indicated that additional income had been generated as a result of participation in the CES program through the receipt of monetary incentives and generation of additional crops while also protecting water resources.

11. The economic analysis estimated the stream of benefits that originates from the landscape restoration activities in the selected municipalities. In Nicaragua, yields of temporary and permanent crops are among the lowest in LAC. However, successful project implementation led to an increase in agricultural production of 50 percent (that is, for milk, coffee, and maize) on the farmland and forest benefits also increased by 50 percent (in terms of timber and firewood production, carbon sequestration, and other ecosystem service benefits) on the restored forestland with about a 46 percent increase in vegetation cover. Milk production increased on all pasturelands on the farms, affected by water recharge improvement (on average, 45% of all farm lands).

Annex Table 4. Restored Landscapes and Net Incremental Benefits per Hectare of Restored Land

	Silvopastoral	Agroforestry	Forest
Total hectares	2,406[39]	468	911
Incremental benefits, US$/ha	US$ 50 increased milk production	US$ 181 coffee beans; US$ 67 maize; US$ 104 beans	US$ 40 timber; US$ 28 firewood; US$ 31 carbon sequestration; US$ 14.5 other services

12. The following parameters observed on the restored landscapes were applied to estimate post-

[39] Includes restored pastures on 5,375 ha of farmlands.

project incremental benefits:

(i) Improving temporal crop productivity by 50 percent, marginal profit increased for maize from US$ 134 to US$ 201 per hectare, for beans from US$ 209 to US$ 313 per hectare;[40]

(ii) Improving coffee productivity by 50 percent, from 11 to 16.5 bags per hectare (60 kg each bag);[41]

(iii) Increasing milk production by 50 percent per cow, with an animal stocking increase from 0.63 to 1.18 animal per hectare, and milk cows at 30 percent of the herd;[42]

(iv) Increased forest cover by 46 percent that corresponds to timber production, firewood production increase per hectare, annual carbon storage increase at US$ 5 per ton of CO2, and increase of other ecosystem services values.[43]

13. Results of the economic evaluation of Subcomponent 1.2 for water sources protection and landscape restoration are presented in Annex Table 4.5 below.

Annex Table 4.5. Economic Results of the Implemented Work, Subcomponent 1.2

	NPV, 000 US$, 3% discount rate	NPV, 000 US$, 6% discount rate	NPV, 000 US$, 10% discount rate	IRR, %
Incremental baseline scenario	2,192	1,103	334	13
Incremental scenario with 5% benefits reduction		975		13
Incremental scenario with 10% benefits reduction		848		12

14. Subcomponent 1.2 was economically viable with NPV in the range US$0.3–2.2 million, and an IRR of 12–13 percent. The highest benefits accrued with an increase of silvo-pastoral farming productivity, and with improved ecosystem services of the restored forest cover. Conservative estimations of incremental benefits and sensitivity analysis suggest even higher and robust economic results of this component implementation.

Subcomponent 2.1. Environmental protection and climate change adaptation program on Corn Islands including wetlands restoration to protect 150 hectares of wetlands.

15. In Corn Island, the problem of coastal ecosystems degradation (especially related to wetlands) poses a serious challenge to local population.[44] The island has a population of 8,000 people divided into

[40] Estimated using background socio-economic surveys in the project municipalities, FAOSTAT, 2018, FAO (2010), Tomo I. *Estudio de caracterizacion del Corredor Seco Centroamericano*.

[41] Estimated based on *https://www.perfectdailygrind.com/2018/07/this-is-how-much-it-costs-to-produce-coffee-across-latin-america/* and USDA (2017) Nicaragua Coffee Annual

[42] Estimated using background socioeconomic surveys in the project municipalities, FAOSTAT, 2018.

[43] Estimated using meta-analysis of the non-timber forest values presented in (Siikamäki et al, 2015) that provides the value of non-wood forest ecosystem services using a function of ecosystem services based on location-specific ecological (for example, ecosystem type) and socioeconomic factors (for example, income per capita or population density); Pinoargote *et al*.(2017) Carbon stocks, net cash flow and family benefits from four small coffee plantation types in Nicaragua. Forests, Trees and Livelihoods, 26(3), pp.183-198; and MARENA (2016) Emissions Reduction Program to combat climate change and poverty in the Caribbean Coast, BOSAWAS Biosphere Reserve and Indio Maíz Biological Reserve.

[44] MARENA, Reefmap, Nicaragua. 2003. Corn Islands and Pearl Cays Project Report.

five administrative districts. The population density of approximately 700 km2 is one of the highest in the Caribbean. With an annual population growth estimated at 3.9 percent, significant seasonal population movement, and increased urbanization on the island, near shore corals could be affected by subterranean discharges of sewage-contaminated groundwater originating from the island. The wetlands suffer from development pressure and are being deforested and used as dumpsites for domestic waste. Coastal protection works under Subcomponent 2.1 focused on restoration of critical wetlands and other coastal areas to protect them from storms and saline intrusion, as well as to ensure water infiltration into the aquifer that is used for water supply by local population. Project results sustainability is provided by the environmental and climate change monitoring system financed by the project.

16. A total of 26 wetlands in Corn Island and Little Island were demarcated to protect 150 hectares of wetlands on the islands. These are sources of water for about 8,000 inhabitants. Thus, Subcomponent 2.1 was necessary for a successful implementation of Subcomponent 2.2 on the Corn Island. Net benefits of Subcomponent 2.2 are evaluated in section 1. High net benefits of Subcomponent 2.2 reflect importance of coastal wetlands for a sustainable and climate resilient water supply on the island. However, wetlands provide other ecosystem services. They are estimated in studies summarized in Annex Table 4.6 below.

Annex Table 4.6. Ecosystem Services of Coastal Wetlands

Ecosystem services	Ecosystem structure and function	Examples of valuation studies
Coastal protection	Attenuates and/or dissipates waves, buffers winds	Badola and Hussein (2005), Barbier (2007), Costanza et al. (2008), Das and Vincent (2009), Bayas et al. (2011)
Erosion control	Provides sediment stabilization and soil retention	Sathirathai and Barbier (2001)
Flood protection	Water flow regulation and control	Brouwer and van Elk (2004)
Water purification	Provides nutrient and pollution uptake, as well as retention, particle deposition	Byström (2000), Yang et al. (2008), Jenkins et al. (2010)
Carbon sequestration	Generates biogeochemical activity sedimentation, biological productivity	Jenkins et al. (2010), Sikamäki et al. (2012)
Raw materials and food	Generates biological productivity and diversity	Sathirathai and Barbier (2001), Islam and Braden (2006)
Maintains fishing, hunting and foraging activities	Provides suitable reproductive habitat and nursery grounds, sheltered living space	Johnston et al. (2002), Barbier (2007), Smith (2007), Aburto-Oropeza et al. (2008), Sanchirico and Mumby (2009).
Tourism, recreation, education and research	Provides unique and aesthetic landscape, suitable habitat for diverse fauna and flora	Hammitt et al. (2001), Johnston et al. (2002), Carlsson et al. (2003), Othman et al. (2004), Brouwer and Bateman (2005), Birol et al. (2006), Birol and Cox (2007), Do and Bennet (2008), Jenkins et al. (2010).
Culture, spiritual and religious benefits, bequest values	Provides unique and aesthetic landscape of cultural, historic or spiritual meaning	Kwak et al. (2007)

Source: Based on Russi et al. 2013. *The Economics of Ecosystems and Biodiversity for Water and Wetlands*. IEEP, London and Brussels; Ramsar Secretariat, Gland.

17. In the absence of a specific valuation study for environmental services provided by the coastal wetlands on Corn Islands, this evaluation took a conservative approach of adopting minimum values

reflected in the studies from Annex Table 4.6 and adjusting them to Nicaragua, with PPP to US$, and with GDP deflator to 2013. Then the average value for wetland costal systems and inland wetlands adjusted to Nicaragua in 2013 estimated at US$ 156 ha/year, is used in this evaluation for the protected 150 hectares of wetlands. Note that maximum values from these studies are US$32,200–79,580 ha/year (Annex Table 4.7). The low estimations used in this evaluation are an additional consideration for the robustness of economic indicators of the project as implemented.

Annex Table 4.7. Monetary Values for Ecosystem Services Provided by Wetlands

	TEEB[45] min value (2007 Int.$/ha/year)	2013 Nicaragua value US$/ha/year	TEEB max value (2007 Int.$/ha/year)
Wetland coastal systems (habitat complexes—for example, shallow seas, rocky shores, and estuaries)	248	133	79,580
Inland wetlands other than rivers and lakes (floodplains, swamps/ marshes, and peatlands), cultural services excluded	333	178	32,200
Average value		156	

18. Results of the economic evaluation of Subcomponent 2.1 of coastal wetlands restoration on Corn Islands are presented in Annex Table 4.8 below.

Annex Table 4.8. Economic Results of the Work Implemented under Subcomponent 2.1

	NPV, 000 US$, 3% discount rate	NPV, 000 US$, 6% discount rate	NPV, 000 US$, 10% discount rate	IRR, %
Incremental baseline scenario	514	-33	-123	5

19. Subcomponent 2.1 was economically viable with up to 5 percent discount rate scenarios. The NPV of the implemented coastal restoration works is slightly below zero value (IRR at 5%). Note that the most conservative estimate of the ecosystem services benefits is used in the economic analysis. Subcomponent 2.2, which ensured sustainable and climate resilient water supply to the local population, is highly feasible with an IRR of 18 percent. Subcomponent 2.1 provided the necessary preconditions for successful implementation of Subcomponent 2.2. If Component 2 is evaluated in its entirety, without separation by subcomponents, the NPV of investments is positive for all scenarios (US$39–828 thousand) with an IRR of 11 percent, which makes it economically viable even with a conservative approach to the ecosystem service values provided by the restored coastal wetlands.
20. The Net Present Value for the entire project is estimated to be US$ 0.7 million (at the discount rate of 6 percent), and the Internal Rate of Return is 7 percent with health benefits, time saving from water supply and sanitation system and landscape restoration benefits from Components 1 and 2

[45] Russi et al. (2013) The Economics of Ecosystems and Biodiversity for Water and Wetlands. IEEP, London and Brussels; Ramsar Secretariat, Gland.

being equally important in terms of their overall contribution to the project benefits. The Net Present Value of the investment Components 1 and 2 is estimated at US$ 3.1 million and their Internal Rate of Return at 14 percent. The robustness of these results is verified through sensitivity analysis. Different discount rates (3, 6, and 10 percent) and a reduction of the economic benefits by 5 percent and 10 percent are applied. The benefits are larger than the costs for almost all scenarios even though this analysis did not include full benefits.

21. For example, ecosystem service benefits provided by wetlands protection were estimated at the minimal values. In addition, some benefits cannot be quantified (for example, benefits of improved water availability on schooling of children, the effect of climate change education on adaptation behavior, and the long-term benefits of policy changes. In short, project benefits might be far greater than shown, as this analysis disregards benefits from new policies, monitoring tools, capacity building or guidelines which are all likely to have triggered or will trigger in the future— further positive developments of sustainable resource management and educated adaptation to climate change.

Annex Table 4.9. Results of Cost-Benefit Analysis for all Project Costs between 2013 and 2038 (US$)

	Baseline incremental scenario	Incremental scenario with 5% benefits reduction	Incremental scenario with 10% benefits reduction
	NPV	NPV	NPV
Discount Rate 3%	$3,368,417		
Discount Rate 6%	$729,681	$406,175	$82,669
Discount Rate 10%	-$954,563		
IRR	7%	7%	6%

Financial analysis of the water supply and sanitation Subcomponents 1.2 and 2.2

22. The World Bank recommended the establishment of water tariffs for the local populations to cover the operational and maintenance cost for the improved community water supply systems. Households are also expected to maintain the installed sanitation equipment by themselves. The water tariffs below were estimated by the project team to ensure financial sustainability of the installed water supply systems. The proposed tariffs were also crosschecked with the financial viability analysis of the water supply system on the Corn Island (Annex Table 4.11).

Annex Table 4.10. Proposed Water Tariffs in the Communities with Installed Water-Supply Systems

Community	Municipality	System	Tariff/month/HH	US$/year
Piedras Grandes 2	Juigalpa	Solar water pumping	C.70	28
		Rainwater harvesting	C. 20	8
El Olingo	Murra	Gravity water supply	C. 94	38
Las Animas	Murra	Gravity water supply	C. 152	61
San Juan de Murra	Murra	Gravity water supply	C. 150	61
El Terrero 2	San Juan de Limay	Gravity water supply	C. 66	26
La Danta	San Juan de Limay	Gravity water supply	C. 66	26
Sabana Grande	San Ramón	Hybrid solar and conventional water pumping	C. 66	26

Annex Table 4.11. Financial Analysis of the Water-Supply System on the Corn Island

Water users EMACI	Monthly water consumption (m^3)	Base Monthly consumption (0–7 m^3)	Additional Monthly consumption (>7 m^3)	Base Rate Monthly (0–7 m^3) US$	Rate Additional m3) US$	Total income per month with 90% collection rate (US$)
Households	15	7	8	3.40	0.55	5,939
Hotels	63	7	56	3.40	0.55	1,047
Educational institutions	39	7	32	3.40	0.55	170
Hospital	525	7	518	3.40	0.55	259
Administration	92	7	85	3.40	0.55	1,128
Churches	11	7	4	3.40	0.55	66
Social projects	21	7	14	3.40	0.55	1,184
Subtotal	766					9,793
Annual	**9,188**					**US$117,515**
Cost of water production, US$ (EMACI) Per m3 = 12.15 US$/m3						**US$111,652 (annual)**

Note: EMACI information. The first 7 m^3 have a tariff of US $3.40 and for each additional m^3 the tariff is US $ 0.55.

23. Based on the EMACI information, even with the projected 82 percent collection rate (42 percent of households pay by the payment date, and 40 percent of households pay after the service suspension), the water supply system is financially viable, with FNPV estimated at US$ 44 thousand (12 percent discount rate). The system may get negative profitability if collection rate drops below 86 percent. The team recommended to design a more sustainable system of water tariffs with tariffs differentiation among different water consumers.

Component 3. Non-quantified benefits of institutional strengthening to facilitate integration of climate change adaptation into the country's water supply and sanitation and water resources management sectors

24. Probably one of the most important, though so far unstated, economic impacts of the project relates to the capacity building of government institutions at both the central and decentralized levels. Enhanced capacities of government institutions will contribute to improving public service delivery having numerous benefits and positive economic impacts. Especially with the continuing challenges of adaptation to climate change and integrated management of water resources, the importance of enhanced functioning of public institutions cannot be underestimated. The better functioning of government institutions will also facilitate the implementation of future projects and investments that will build on and continue the achievements of this project. The targeting of the most impoverished sector of the Nicaragua population, its rural small-scale farmers and Indigenous Peoples is likewise an achievement that has not been quantified in this analysis. The project reached rural communities in large numbers (19,858 participants, of which 10,570 were women) providing training on the sustainable use of natural resources and environmental awareness and sensitization. These activities will empower beneficiaries and create improved economic possibilities for these families, and thereby contribute to the elimination of poverty. The benefits of these activities are not considered in this analysis, even though they are important outcomes.

ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

1. Context

The Government of National Reconciliation and Unity implements point 12 of the National Human Development Plan (NHDP) with regard to "*The Protection of Mother Earth, climate change adaptation, comprehensive disaster risk management, and the National Environmental and Climate Change Strategy (ENACC)"* with the objective of improving the living conditions of all Nicaraguans.

Nicaragua's strategic water resources for current and future water supply are vulnerable to the effects of climate change due to the frequency of extreme climate events, drought, flooding, and hurricanes, as well as the pressure exerted by contamination from untreated waste water, agricultural runoff, and other sources. Climate variability and extreme events exact a high economic cost on Nicaragua, and a large percentage of this is due to water scarcity or excess.

A diagnostic study "Climate Change Impacts on Water Resources and Adaptation in the Rural Water Supply and Sanitation Sector in Nicaragua" that combined a review of hydrology models and global circulation projection models found that climate change projections indicated a likely decrease in water availability in most of Nicaragua's watersheds (World Bank 2012). A rapid field assessment confirmed that water supplies in rural areas are very vulnerable to drought and that increasingly frequent flooding is caused partly by unsustainable land use and watershed management and partly by climate change. The main conclusion of the assessment was that in 2050 the net effect of climate change on the water balance in Nicaragua will probably be negative. The diagnosis also indicated that the water supply's vulnerability to climate change is inseparable from that of sanitation.

In Nicaragua, climate change adaptation is implemented through measures articulated among various government institutions. This is also the case with the response to climate change impacts such as drought or extreme rainfall, which cause damage and human and material losses. In this context, the Adaptation of Nicaragua's Water Supplies to Climate Change Project (PACCAS) was implemented between 2013 and June 2018. Its goal was to develop pilot investments in the protection of water resources and water supply systems with a comprehensive and participatory approach in selected climate-vulnerable communities in the municipalities of San Juan de Limay-Estelí, Murra-Nueva Segovia, San Ramón-Matagalpa, Juigalpa-Chontales, and Corn Island-RACCS.

The PACCAS project was implemented with the institutions directly involved in the rural drinking water and sanitation sector, including the Ministry of the Environment and Natural Resources (MARENA), the Emergency Social Investment Fund (FISE), the National Water Authority (ANA), the National Forestry Development Fund (FONADEFO-INAFOR) and the Nicaraguan Institute for Territorial Studies (INETER). The project was financed by a grant from the Special Climate Change Fund, administered by the Global Environmental Fund (GEF) with the World Bank as the implementing body.

The direct beneficiaries of the project were 25,922 persons, specifically:

1. The entire population of the municipality of Corn Island: 8,000 persons.

2. The stakeholders of the Water Source Protection Program who receive Compensation for Environmental Services: 354 producers (250 men and 104 women), of whom 21 are members of the Chorotega ethnic group (12 men and 9 women).
3. The population with access to drinking water, sanitation and hygiene improvements due to the investments in drinking water, sanitation and hygiene subprojects with a climate change adaptation focus: 1,782 stakeholders.
4. The entire population of the 35 downstream communities served by the 59 water sources benefited by the Water Source Protection Program PPFA: 15,093 people.
5. The technical staff of key public institutions who received water resource and climate change training: 700 professionals.

2. PACCAS Project Components

Component 1: Pilot adaptation initiatives to enhance climate resilience in the selected municipalities (US$ 3.610 million) included the implementation of seven community-led pilot projects for investment in drinking water, sanitation and hygiene with climate change adaptation measures. A total of 1,782 persons (46% women) were served. A program was implemented to protect recharge areas for 57 water sources that supply 35 communities using a Compensation for Environmental Services (CES) mechanism with 354 stakeholders for the incorporation of agroforestry and silvo-pastoral systems, forest conservation, and natural regeneration management. As a result, vegetation coverage was increased by 2,496 hectares. These results were accomplished between 2016 and 2018 because the technical studies to determine the availability of water resources for human consumption were not concluded until 2015. This two-year delay was due to a project design mismatch between the scope and the budget allocated. In addition, the CES incentive delivery mechanism took longer than foreseen because it required several steps and initially lacked a clear incentive modality precedent. The validated methodology, however, will now be considered for other climate change adaptation projects.

Component 2: Coastal wetland protection and reduction of vulnerability to sea-level rise in the municipality of Corn Island (US$ 0.825 million) comprised the protection of coastal wetlands and reduction of vulnerability to rising sea level to reduce climate-related impact on the drinking water supply in the vulnerable areas of Corn Island. The results obtained include delimitation of 26 wetlands (150 ha), reforestation of 26.6 ha of wetlands with red mangrove species, implementation of an environmental education and awareness-raising plan, installation and functioning of meteorological and tide gauge stations, installation of the geodesic and mapping network for monitoring future rising sea level, a bathymetry study, the formulation and approval of the Corn Island environmental land use plan with a climate change focus, and construction of climate change mitigation measures in Wells #4 and #13 that improved drinking water quality through the creation of an manmade rainwater collection and recharge area. The component benefited 7,626 persons. Although project design had determined that the planning of measures to be taken would be established in the PRASNICA results, this did not occur. Subsequently, an alliance was formed with INETER to obtain the technical-scientific information required to prepare the environmental land use plan and guarantee the monitoring of climate conditions on the island.

Component 3: Institutional strengthening, project management and monitoring (US$1.564 million). This component aimed to strengthen institutional capacity and coordination mechanisms at the national and municipal levels to facilitate the integration of climate change adaptation into the country's water supply

and sanitation and water resource management sectors. Outputs obtained were: Water and Climate Change Information Web Module in the National Environmental Information System (SiAGUA), 700 (43 percent women) public sector technicians trained in water resource and climate change topics.

The tools developed and/or enhanced were (i) methodology to determine vulnerability of water sources and drinking water systems; (ii) guidelines to develop and systematize implementation of Municipal Plans for Environmental Protection in the face of Climate Change; (iii) technical-administrative procedural manual to protect water sources with climate change adaptation approach; (iv) improved Environmental Management System (SISGA), (v) methodology to delimit water recharge areas; (vi) land-use plan with a climate change focus for Corn Island; (vii) updated manual of implementation for water and sanitation projects (MEPAS); (viii) guide of good practices for wetlands protection with a focus on climate change; (ix) systematization of water harvesting experiences in rural areas; and (x) compendium of climate change adaptation measures in the rural water and sanitation sectors with their implementation costs. The implementation of a drinking water project with a climate change adaptation approach required the combination of different institutional technical competencies to obtain the necessary tools to integrate all the factors that can influence the performance of a successful initiative.

3. Factors that affected project implementation and outcome

During the first three years, project implementation was slow and disbursement was low. In July 2016, the Level 1 restructuring allowed for changes in the project development objective (PDO) and key indicators, reallocation of resources among disbursement categories, and revisions in component costs. The project closing date, however, remained 30 June 2018. At the beginning of the BM TF 13410 / P127088 operation, the PDO was to enhance climate resilience of investments made in Nicaragua's rural water supply sector to cope with: (i) increasing climate variability; and (ii) expected adverse impacts of climate change in selected areas. The mid-term evaluation conducted in July 2015 led to revisions to improve clarity of the nature and scale, and the monitoring and results measurement of the pilot project. Thus, the PDO was revised as: To pilot water resource protection and drinking water supply systems with an integrated and participatory approach in selected climate vulnerable communities in Nicaragua.

The project contributes to reducing vulnerability by making drinking water supply in rural areas more resistant to climate change and also helps Nicaragua come closer to reaching the Sustainable Development Goals (SDGs) for access to safe water and environmental sustainability. The adaptation project has also contributed to improving multi-sectoral collaboration in recognition that the mainstreaming of a climate change adaptation focus in environmental measures requires robust interinstitutional coordination and collaboration. The adaptation project's implementation process not only promoted this collaboration but also bolstered coordination between local and municipal bodies, such as the community-based Drinking Water and Sanitation Committees (CAPS), the Municipal Water and Sanitation Units (UMAS), and other local stakeholders. Regarding the adaptation project results framework, there were some barriers to demonstrating progress in the monitoring and evaluation of the original PDO and intermediate result (IR) indicators, as some of them presented constraints in the unit of measurement employed or in their wording. To remedy this, the WB approved a Level II restructuring that improved PDO indicators 1, 2 and 4 at the target level, and added a new indicator referring to the number of hectares conserved, reforested, and restored to increase the protection of the water sources of the selected vulnerable communities. In addition, IR indicator 1.1 was adjusted in terms of its wording and

unit of measurement, which facilitated the assessment of implementation progress for the drinking water and sanitation works. Furthermore, a new indicator was added: *Percentage of progress in the organization of vulnerable communities to manage and operate the new water system and to protect their water resources.* This indicator helps to make visible all the community organization work and training related to rural drinking water and sanitation projects. At project closing, the PDO indicator average compliance rate was 117 percent, and the IR indicator average compliance rate was 124 percent, thus exceeding the targets for both.

Other aspects affecting project development

At the start of the project, the contracting of the climate risk analysis study of vulnerable communities and water sources in the municipalities selected for the PACCAS project occurred six months later than scheduled. This delay caused a further delay in the prioritization and selection of the communities for direct intervention with investments in drinking water and the program for the protection of water sources. The specialized technical studies planned in the project thus required more time for contracting, a greater availability of funds, and more specialized personnel for their implementation.

Implementation

In the first three years the PACCAS project developed the technical studies related to the Climate Risk Analysis of the communities and water sources in the four intervention municipalities for Component 1 in order to prioritize and select the communities and water sources for direct impact. During this period, the project also worked on the planning of the municipal level adaptation measures, on the formulation of the Municipal Plans for Environmental Protection in the face of Climate Change, and on the study of water resource availability for the selected communities most vulnerable to the effects of climate change. For the municipality of Corn Island, hydrological and hydrogeological studies were developed. All these actions, mainly the technical studies, were prepared over a period that exceeded nine months.

The work processes that were developed in parallel during these years also focused on: (i) training, awareness raising, and environmental education regarding climate change and the protection of water resources with the population directly involved in the project; (ii) organization and implementation of the CES mechanism; (iii) installation of climate monitoring stations; and (iv) reforestation campaigns in Corn Island wetlands. In 2017, the PACCAS project advanced significantly with the formulation of the drinking water and sanitation investments and the Individual Social Facilitators (FSI) assistance to the communities under the modality of community-led projects (PGC). During the first semester of 2018, a beneficiary satisfaction survey was conducted. Its results indicate that the PACCAS project has had highly significant environmental, social, and economic effects through: (i) increased vegetation cover on farms, improved soil use and management, and protection of water sources in climate-vulnerable communities; (ii) improved technical skills of community and institutional technicians, potable water and sanitation projects in communities selected for their vulnerability to water access, and strengthened implementing institutions and municipal governments where the project intervened and improvement of the communities' organizational levels; and (iii) enhanced land productivity that, in turn, contributes to higher incomes for beneficiaries. Allof the above has resulted in the high satisfaction on the part of projects beneficiaries, as found in the survey performed by the project before and after.

3.3 Positive environmental and social impact

The positive environmental impacts of the project are related to the results and outputs achieved, which demonstrate that the investments have generated significant positive effects both on the environment and for the beneficiaries. The drinking water and sanitation subprojects have internalized the analysis of vulnerability to climate change in the design, execution, and post-construction phases to ensure greater sustainability in the operation and maintenance of the works. With the development of drinking water and sanitation works with adaptation measures to climate change, accompanied by technical assistance, training, and improvements of the organizational and participatory processes in the communities, the projects have contributed to improvement of the quality of life of the stakeholders through access to safe water and sanitation, non-contamination by open air defecation, adoption of good hygiene practices, the recognition and implementation of measures to adapt to climate change by the community in their daily activities, and protection of water catchment areas. The CES mechanism through the water source protection program had a positive impact on the optimization and management of natural resources on the beneficiaries' plots, on land use and management, and in the adoption of environmental conservation practices by the stakeholders in other areas on the farms and in neighboring communities within the project's area of intervention.

4. Bank and borrower performance assessment

The performance of the WB based on the project implementation and effectiveness refers to the technical assistance and recommendations of the supervisory and technical missions conducted by the WB, particularly the missions in February, June, and October 2017. During these missions, an action plan and key milestones were agreed upon and subsequently implemented satisfactorily. Project performance improved as measured by the status of compliance with the physical and financial goals of the project, and lessons were learned for future projects. The Government of Nicaragua, through MARENA and FISE, considers the performance of the WB as the Implementing Agency of the SCCF-GEF to be satisfactory within the framework of the execution of this project. Regarding the performance of the borrower, the Government of Nicaragua monitored the project and implemented technical and administrative measures that expedited fulfillment of its physical and financial goals. The assessment of borrower performance in terms of project implementation is satisfactory.

Assessment of Bank Financial Management

The implementation of a concurrent audit as a precondition for disbursements was a guarantee during the first three years of project execution. Between 2017 and 2018, the financial team composed of specialists from the WB, MARENA, and FISE conducted a review of the financial aspects of the PACCAS project and held biweekly meetings as a coordination mechanism between the fiduciary teams of MARENA and FISE to consolidate project execution and closure figures.

Procurement

Unexpectedly, the procurement processes threatened project implementation. The Standards of Procurement that were applied to the project were rigid, which resulted in several "Declarations of Ineffectiveness" in the bids for the design of the water and sanitation projects that FISE would execute. The solution applied was that the Government of Nicaragua appropriated financing for the designs of the works and applied its contracting procedures. Later, the project financed the execution of the works applying the WB standards.

Safeguards of Indigenous Peoples

This was mainly implemented in the social management on Corn Island since, as originally agreed, all of Component 2 of Corn Island was considered an indigenous project given that the majority of the native population of the islands is Afro-Caribbean Creole, with Miskitu, and Garifuna minorities. The requirement that no new settlements would be established on the wetlands in the islands was fulfilled. In addition, direct action was carried out in the neighborhoods of the islands through wetland clean-up campaigns, house-to-house visits, environmental dialogues and talks on topics including the importance of wetlands, good practices for restoring and protecting wetlands, and women's dialogues on topics related to the proper management of solid and liquid wastes. The Network of Environmental Promoters has been organized and trained, especially 12 female environmental promoters who are beginning to organize themselves as a cooperative to reuse and recycle bottles and plastic bags and generate their own income. They will do this with the support of the Municipality and MARENA-PACCAS. The Municipality has a compactor of plastic bottles which it will make available to these women, once they are organized.

5. Sustainability

a) Potential risks

The most relevant potential risks of the project fall within the following categories: (i) institutional risks; (ii) technical risks; and (iii) community capacity risks. The institutional risks are focused on the need for a continued robust interinstitutional coordination between MARENA, FISE, and ANA. The technical risks come from the experience in Nicaragua's water and sanitation sector with the implementation of planning and investment approaches resilient to change climate, especially in rural areas with a variety of climate, physical, and institutional constraints. Another risk that was identified is the loss of vegetation due to climate change. This risk, however, was addressed from the beginning of the project through strategies implemented using different methods of plant reproduction and environmental practices to expand vegetation cover.

b) Institutional capacity for sustaining outputs and results

A fundamental component for the execution of the water, sanitation and hygiene pilot projects of the PACCAS project was the alliance between the central government institutions and municipal governments, through the integration of the technical personnel of the Municipal Water and Sanitation Units (UMAS) during the entire the project cycle. This, combined with capacity building in water resource issues and adaptation to climate change, has provided them with the preparation and information required to assume the follow-up on the functioning of physical works and community organization in rural communities. An action plan has also been prepared for this purpose. As the competent authority for the drinking water sector in rural communities, FISE will integrate in its guidelines the replicability of the articulation of all the actors of the potable water system and the implementation of environmental practices for the protection of water recharge areas for the reduction of vulnerability to the effects of climate change. Likewise, MARENA has taken up in its portfolio of natural resource management projects the focus on the delimitation and protection of water recharge zones and will promote the system of monitoring, verification, and compensation for environmental services.

c) Community capacity for the sustainability of results

Community management for the sustainability of water supply, sanitation and hygiene systems has an impact on the entire project cycle, with the creation of spaces that allow beneficiary villagers to assume a leading role in the various stages of development (pre-investment, implementation, and post-construction). The PACCAS project promoted the linking of rural communities, including indigenous populations, through their participation in the implementation processes, such as the contribution of labor and the collection of fees. This has granted some autonomy to the communities represented by the members of the Water and Sanitation Committees (CAPS). The empowerment of the community during the different stages of the project has become the main community-based tool to achieve the sustainability of the water and sanitation project. The capacities created and strengthened, such as the CAPS, community promoters, and other leaders, guarantee the sustainability of the project. With FISE's investments in water system infrastructure and the pilot experiences of compensation for the protection of water sources with MARENA, the actions carried out by PACCAS made it possible to strengthen the Potable Water and Sanitation Committees (CAPS). The training and knowledge acquired of the mechanism for results-based incentives can give continuity to the program for the protection of water sources in their communities. Local entities, such as municipal governments, can be used to replicate the experience in other communities using the capacity that has been built in the Municipal Units of Water and Sanitation and the Municipal Environmental Units through their participation in the entire process for creating and operating the water source protection program.

6. Lessons learned

16. The accompaniment of social supervision and facilitation guarantees at each stage of the potable water and sanitation subproject cycle (pre-investment, execution of works, and post-construction) was important for the integration of environmental management measures and compliance with Environmental and Social Safeguard Policies as well as to guarantee empowerment for the sustainability of the works.
17. Use of the modality of community-led project implementation builds local capacity and community empowerment for the required decision making, administration, operation, and maintenance of the water systems.
18. The inter-institutional coordination between MARENA, FISE and ANA made it possible to provide a comprehensive response to community demands related to drinking water and sanitation with a focus on climate change adaptation.
19. The community promotion and organization through the Water and Sanitation Committees (CAPS) was fundamental for promoting the management and rational use of water, the strengthening of local capacities for adaptability and resilience to climate change, and sustainability of the rural drinking water and sanitation subprojects.
20. It is important to take into account the scientific methods for data collection and information analysis used by the expert authorities in this field, such as INETER.
21. Through the implementation of several practices and technologies of environmental restoration systems (agroforestry, silvopastoral, management of natural regeneration and forest conservation), improvements and increases in vegetation cover and emission reductions can be obtained by preventing deforestation.
22. In the implementation of agroforestry systems with basic grain crops under the agroclimatic conditions characteristic of the dry corridor of Nicaragua, species such as *Gliricidia sepium*

(*cacahuananche, madriago, madriado, mata raton, madre cacao, balo, madero negro, kakawate, cocoite earratón*) and *Leucaena leucocephala* (*leucaena*), can be encouraged as native plants that have adapted to the effects and variability of climate change.

23. In the dry corridor of Nicaragua, the implementation of silvopastoral systems and the promotion of cutting grasses and silage as an alternative to grazing livestock during the dry season should be considered, along with species adapted and resistant to the effects of climate change.

24. The management of natural regeneration for the protection of water sources in association with fodder trees and improved pasture grasses, accompanied by forest management activities such as selective trimming and spur pruning, offers significant advantages for the increasing vegetation coverage in the different environmental restoration systems.

25. The process of monitoring, follow-up, and verification was essential to implementing the results-based incentive mechanism for increased plant cover.

26. The implementation of training, environmental education, and awareness-raising plans linked with individual and group technical assistance, facilitated the implementation and replication of the farms plans that had been developed.

27. The joint implementation of several plant propagation methods to achieve increased vegetation cover is very important. The management of natural regeneration through the selection of native species and multiple use seedlings during the selective trimming are the best alternatives for a successful and significant increase of vegetation cover in the plots.

28. In order to reduce or avoid delays the trial and error effect, a pilot project of this nature must have the required technical studies in advance of the implementation of the planned investments.

Signed in the name of the project team

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ANNEX 6. SUPPORTING DOCUMENTS (IF ANY)

ANA. 2018. *Final Report on the Capacity Building and Strengthening Program to the Water Municipal Company Serving Corn Island.*

FISE. 2017. *Official Manual for the Implementation of Water Supply, Sanitation and Hygiene Investments Using the PGC (Communities Lead Project) Modality*. MEPAS.

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MARENA and FISE. 2015. *Water Vulnerability and Availability for Water Supply Needs of Selected Communities from the Municipalities of Murra, San Juan de Limay and San Ramon, Vulnerable to Climate Change.*

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ANNEX 7 – CHANGES TO THE RESULTS FRAMEWORK

1. This Annex describes in detail the changes and the rationale for them in the Project's Results Framework at the time of the first and second restructurings based on the respective Restructuring Papers.

2. **LEVEL I Restructuring (May – August 2016).**[46] The Results Framework was adjusted to improve its overall presentation and consistency, the logical results chain between the revised PDO formulation and the PDO and intermediate results indicators, and the measurability of the Project results, and to include the applicable World Bank core sector indicators. Further, the targets related with the WASH interventions under Subcomponent 1.1 were revised in accordance with updated and more adequate cost information.[47] The proposed changes are presented in detail in the following table:

Original PDO	Revision	Rationale
To enhance climate resilience of investments made in Nicaragua's rural water supply sector in order to cope with: (i) increasing climate variability; (ii) expected adverse impacts of climate change in selected areas.	**New**: "To pilot water resources protection and drinking water supply systems with an integrated and participatory approach in selected climate vulnerable communities in Nicaragua."	The PDO was revised to clarify the Project's pilot nature since its original design, innovative (integrated and participatory) approach, target scale (selected communities), and goal (protecting water resources and improving water supply in face of climate change). The drinking water supply systems to be constructed were not claimed to be climate resilient as related evidence cannot be collected and presented adequately by Project closure.
	1. New: "Integrated and participatory pilot investment projects completed in selected climate-vulnerable communities (Number)."	The indicator was added to measure the Project performance in terms of completing fully delivered "integrated and participatory pilot investments" on rural drinking water supply systems that combined sanitation and hygiene; and integrate climate considerations in their planning, design and construction. The unit of measure was the number of completed pilot works that combine the related technical tools completed by MARENA and FISE to facilitate replication and scale-up; tools measured by the then new intermediate results (IR) indicator 3.3.
Improve climate change adaptation capacity of rural water supply and sanitation infrastructure of the beneficiary communities in pilot areas (number)	**2.Revised:** "People in rural areas provided with access to improved water resources under the project (number)." The target number was revised from	The wording of the indicator was revised by a WB core sector indicator on water supply. The original indicator measured the number of individual beneficiaries with access to new or rehabilitated water supply and implied ability to evidence the improved climate change

[46] The World Bank's Restructuring Paper was dated May 27, 2016, but the associated letter to the Recipient communicating approval of the restructuring was dated August 1, 2016 and countersigned by the official representative of the Nicaraguan Government on August 12, 2016.

[47] The restructuring Appraisal Summary and the Economic and Financial Analysis included an explanation for these changes in costs.

	4,500 to 1.329 people., as reasoned under the appraisal summary of the restructuring paper.	adaptation capacity. With the revised indicator "improved climate change adaptation capacity" was to be measured through the number of people that gain access to improved water resources provided through the Project. This was to base infrastructure planning, design and construction, on technical studies that would consider and address projected climate impacts.
Adoption of land uses that improve resilience to climate change in areas that provide water supply to rural communities (percentage)	**3. Revised:** "Water Source Protection Index in water recharge areas of selected climate-vulnerable communities that benefit of a Compensation for Environmental Services (CES) program supported by the Project, disaggregated by municipalities." The result was to be expressed as an index rather than a number.	The wording of the indicator was revised to clarify the measured target: the score of the Water Source Protection Index that measured the applied land use benefit to downstream communities as a result of Subcomponent 1.2 activities on the CES program. The index was defined in detail in the Operational Manual.
Climate change adaptation mainstreamed in rural water supply sector's development frameworks, policies and investment tools in Nicaragua at the National level (percentage)	**Revised and moved to IRI level:** "Tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE (number)."	The wording of this indicator was revised to make it simpler and clearer. The tools include technical guides to incorporate climate change adaptation to integrated design in the water supply sector at both national and municipal level. The tools to be developed were identified in Annex 1 of the restructuring paper. The unit of measurement changed from percentage to number of tools developed to make it clearer.
	4. New: "Direct Project beneficiaries (number), of which female (%)."	This WB core indicator was being monitored as part of the Project's RF, though not officially. The restructuring officially adopted the core indicator at the PDO level.
Original intermediate results indicators – Component 1		
	New: "Improved community water points constructed or rehabilitated under the project (number)."	This core sector indicator had been monitored, while not officially part of the results framework
Communities directly benefitting from CES component of pilot projects within the project area.	**Revised**: "Drinking water sources with climate adaptation measures in their recharge areas (Number)."	The indicator has been revised to measure the number of water sources (36 wells and 20 rivers) that will be improved through the sustainable land uses promoted by Subcomponent 1.2, to allow aggregation of the Project results to an indicator of the National Human Development Plan 2013–2017.
Women's participation in the CES component of pilot	**Dropped**	Dropped as the core indicator on direct project beneficiaries at the PDO level captured the sex disaggregation

projects within the project area (percentage).		
Original intermediate results indicators – Component 2		
Improve protection of wetlands and water sources included in the program water sources management to reduce vulnerability to climate change and sea level rise (percentage).	**Revised.** "Index of wetland protection measures implemented by the project to improve adaptation capacity of water supply on Corn Island (percent)."	Indicator revised to measure progress of five key project activities to protect the wetlands of the two Corn Islands.
Establishment of a Climate (rainfall) Monitoring System in Corn Island and implementation of a climate change education program (Y/N).	**Revised.** "Environmental and climate monitoring stations established and functioning in Corn Islands."	Indicator revised to remove the latter part on education since these were two separate activities. Wording added to reflect the indicator would count the number of functional monitoring stations.
Original intermediate results indicators – Component 3		
Climate Change Information Module in operation within the National Water Resources Information System (Y/N).	**Revised**. "Climate Information Module for water and climate change developed and integrated in the National Water Resources Information System (SiAGUA) (Y/N)."	Minor wording revised, to adjust to project performance: SiAGUA had not been made available to the public and the slower than planned implementation of component 3.1 activities
Strengthen capacity to use the National Water Resources Information System (Number).	**Revised.** "Technicians of key public institutions trained in the area of water resources and climate change (Number)."	Wording revised to reflect outputs versus the original wording (outcome)
Education and training programs on climate change and adaptation are formulated and under implementation (number).	**Dropped**	Indicator dropped as it was captured in indicator 3.2. The Project was monitoring all participants in different events supported by the project, disaggregated by gender.

3. **LEVEL II Restructuring (February 28, 2018).** The Project restructuring revised the Results Framework to improve: (i) the linkage of the indicators to the PDO; and (ii) the logical results chain between the project activities and expected outcomes. The team explained that several indicators were using a unit of measurement that did not adequately show project implementation progress and likely achievement of the PDO. The PDO indictors 3 and 4 were not changed.
4. The most important change was on the Indicator 1 of the PDO, the project could not showed progress towards the development of the WASH system because the indicator measured the completion of the works. Because of this indicator, the last ISRs of the project the IP rating was maintained as MU. The change in this indicator to % allowed to report the progress in the overall WASH development in the communities that included many different stages and processes (terms of reference preparation, designs, consultations, technical studies, water quality assessment, social interventions to organize the

community, transportation of materials, etc). The changes are presented in detail in the following table:

PDO Indicators before Level II restructuring	Revised Indicator at Level II restructuring	Rationale
Integrated and participatory pilot investment projects completed in selected climate-vulnerable communities (Number).	**Revised:** Percent progress in the development of pilot drinking water supply systems following an integrated and participatory approach in selected climate vulnerable communities (percentage).	(i) The wording of this indicator was vague since it referred to 'investment projects' only and not specifically to 'drinking water supply systems' which was part of the PDO; (ii) the indicator only focused on the last stage of the development process- (completion) – ignoring other stages necessary to achieve the completion of the works like pre-feasibility and feasibility studies, consultations, budgeting, designs, construction, and operation) of the drinking water systems required to complete the works; (iii) indicator carried a 'unit of measurement' (number) which did not allow to show Project progress towards the development of the drinking water systems. The proposed unit change "percent progress" was defined as the total average progress of all seven works in the development of the pilot drinking water supply systems following an integrated and participatory approach; (iv) The revised indicator maintained the scope of **'integrated and participatory pilot investments'**[2] on rural drinking water supply systems that combined sanitation and hygiene and included climate change adaptation measures and the participation of the communities in the planning, design and construction of the water systems financed by the Project.
People in rural areas provided with access to Improved Water Sources under the project (number).	**Revised:** Number of people in selected communities provided with access to improved water sources with adaptation measures under the Project (number).	The wording of indicator was clarified.
	New: Number of hectares conserved, reforested and restored to increase protection water sources of selected vulnerable communities (Number).	This indicator measures the number of hectares protecting water sources, among these: (i) mitigation measures during construction of water systems; (ii) as part of the CES program; (iii) restoration efforts in Corn Islands; (iv) municipalities and project reforestation campaigns; (v) reforestation done by MARENA delegations.

2 **The word "integrated" refers both to packages of Water, Sanitation, and Hygiene (WSH) works,** as well as combining said works with climate change adaptation measures aimed to increase water resources conservation and protection. The latter refers to: reforestation of micro-watersheds and surroundings of water sources and wells, including environmental education and conscious raising on climate change impacts and related resilience measures. The whole aims at reliable provision of safe drinking water in terms of continuity, quantity and quality, considering the specific social and environmental conditions of each community. Further, **the word "participatory" refers to the participation of beneficiary communities** in leading the planning, construction and future operation of the drinking water systems, the CES program, the social work that FISE requests for the WSH projects, wetlands conservation measures on Corn Islands, training, environmental and restoration efforts.

Original intermediate results indicators – Component 1		
Improved community water points constructed or rehabilitated under the project (Number).	**Revised:** Percent progress in the construction of the drinking water supply systems (percentage).	This indicator was revised to measure the Project progress in the construction of the water supply systems. The proposed unit change "percent progress" is defined as the total average progress in the construction of all seven works.
	New: Percent progress in the organization of vulnerable communities to manage and operate the new water system and to protect their water sources.	This indicator measures the Project progress in reaching the following: **(**i) the coordination and organization of water community groups for the future management and operation of the drinking water systems; (ii) community organization for the protection of water sources, wetland restoration, application of adaptation measures, forest protection and erosion control.
Intermediate results indicators – Component 3		
Tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE (Number).	**Revised.** This is an indicator that aggregates the preparation of 10 tools (studies and reports). The description of the indicator is maintained. The restructuring proposed to replace two tools with ones that are more relevant to the Project; see more detail in Annex 1. **-Tool 9**, "Technical guide for water harvest in rural areas" to be replaced with: "Manual of water harvesting from the PACCAS project and other national experiences." **-Tool 10, "**Updated Project Management System (*Sistema de Control de Proyectos*, SICPRO)." Replaced with: "Compendium of climate change Adaptation measures in the rural water and sanitation sectors- costs and benefits."	Tools 9 and 10 are proposed to be replaced. **The original description of the Tool 9** is somehow general. The proposed tool captured best practices and lessons learned in water harvesting from this Project and from other projects implemented in the area. **The original Tool 10 referred to** the support to update SICPRO, but this had been already financed by other sources. The proposed tool elaborated a compendium on adaptation measures to climate change applied by the Project in the rural drinking and sanitation sectors, its cost and benefits. The tool was expected to become a guideline to FISE for incorporating future development of water and sanitation.

ANNEX 8. ADDITIONAL INFORMATION FOR THE ASSESSMENT OF PROJECT OUTCOMES (EFFICACY) BEFORE AND AFTER LEVEL I RESTRUCTURING

1. Because the Project Development Objective (PDO) was changed at the time of the first restructuring from the original statement contained in the Grant Agreement -- "to enhance climate resilience of investments made in Nicaragua rural water supply sector in order to cope with: (i) increasing climate variability; and (ii) expected adverse impacts of climate change in selected areas" -- to "to pilot water resources protection and drinking water supply systems with an integrated and participatory approach in selected vulnerable communities in Nicaragua"[48] and many of the associated PDO and Intermediate Results (IR) indicators were also changed, according to ICR Guidelines, a split-evaluation methodology needs to be applied in order to determine the project's overall outcome rating. This annex, therefore, presents the analysis of project achievements in relation to its PDOs before and after the two restructurings by applying the percentage of total disbursements at the time of each one to "weight" the respective extent of these accomplishments. At the time of the first (Level 1) restructuring, US$ 2.9 million of the US$ 6 million grant, or 48 percent had been disbursed. At the time of the second restructuring (February 28, 2018), US$ 4.66 million, or 78 percent, of the grant had been disbursed.

2. As a result of these restructurings and as detailed in Annex 7 above, in addition to the PDO itself, the PDO indicators were revised twice and most of the IR indicators were changed at least once, with two of the eight original IR indicators – "women's participation in the Compensation for Environmental Services (CES) component of the pilot projects within the project area" (for Component 2) and "education and training programs on climate change and adaptation are formulated and under implemented" (for Component 3) – being dropped at the time of the first restructuring. The first of these indicators was dropped because a new Bank core indicator on direct number of beneficiaries was added and would be disaggregated by gender. The second one was dropped because the revised second IR indicator for Component 3 would capture the project results in terms of education and training.[49] Thus, the reduction from eight to six IR indicators at the time of the first restructuring was justified. In addition, one of the original and one of the revised PDO indicators were converted to IR indicators at the time of the first and second restructurings, respectively, as will be further described below.

Project Performance with Respect to the PDO Indicators

3. Of the three *original PDO indicators*, two had not yet been achieved and the third – "climate change adaptation mainstreamed in rural water supply sector's development frameworks, policies, and

[48] As noted in the main text of this ICR, revision of the wording of the PDR at the time of the first (Level 1) restructuring was primarily for the purpose of providing a more precise and accurate statement of what the project was actually seeking to accomplish as the original version contained in both the Grant Agreement and the PAD could readily be interpreted as being too broad for what in practice was a small pilot project. Accordingly, it could be argued that the fundamental project objective did not really change because of the restructuring and this a split evaluation methodology would not be required. However, because the outcome indicators were also revised and the scale of one of the project's main subcomponents in terms of the number of communities involved, this ICR applies this methodology.

[49] The Restructuring Paper (pg. 12) also observed that "in every case, the project will continue monitoring the total number of people participating in several types of events organized by the project, disaggregated by gender. The actual results of this indicator is (sic) high as the respective monitoring has covered all the participants in a variety of diverse awareness raising and educational events."

investment tools in Nicaragua at the national level" -- had reportedly been only partially (that is, 38% percent) achieved at the time of the first restructuring. However, during the first restructuring, this indicator was reformulated as "tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE (Number)" and moved (correctly) to the IR indicator level under Component 1, since it referred to outputs rather than outcomes. Thus, achievements in this regard will be discussed in the section on project performance in relation to its IRs below.

4. This PDO indicator 1 was also replaced at the time of the first restructuring with one stating "integrated and participatory pilot investments projects completed in selected climate-vulnerable communities (number)." According to the Restructuring Report, the rationale for this change was as follows:

> "The PDO will be revised to clarify the project's pilot nature since its original design, innovative (integrated and participatory) approach, target scale (selected communities), and goal (protecting water resources and improving water supply in face of climate change). The drinking water supply systems to be constructed are not claimed to be climate resilient as related evidence cannot be collected and presented adequately by project closure."

A target of 12 systems was established but none had been completed by the time of the first and second restructuring. As a result, the wording of this indicator was again revised at that time to read "Percent progress in development of pilot drinking water systems" because, according to the Restructuring Paper, the former indicator would only be achieved when the water system works **were completed**." At the same time, it was also (again correctly) converted to an IR (that is, output) indicator, whose results will also be discussed in the next section.

5. As concerns the other two original PDO indicators, the target for the first, which essentially applied to Subcomponent 1.1 – "improved climate change adaptation capacity of rural water supply and sanitation infrastructure of the beneficiary communities in pilot areas" – was reduced from 4,500 to 1,329 people, and this indicator was replaced by one stating "People in rural areas provided with access to improved water services under the project." According to the restructuring paper, "the wording of the indicator has been revised by a World Bank core sector indicator on water supply. The original indicator measured the number of individual beneficiaries with access to new or rehabilitated water supply and implied ability to evidence the improved climate change adaptation capacity. With the new indicator, "improved climate change adaptation capacity" will be measured through the number of people that gain access to "improved water resources" provided through the project that bases infrastructure planning, design and construction on technical studies that consider and address projected climate impacts." At the time of the second restructuring, the wording of this PDO was again revised to read "Number of people in selected communities provided with access to improved water adaptation measures under the project." This did not fundamentally change the nature of the indicator and the revision was only intended to further clarify its wording. The EOP target set for this indicator (1,329 people) at the time of the first restructuring was surpassed by 34.4 percent (1,786) at the time the project closed, and thus was fully achieved.

6. The third original PDO indicator, which basically applied to Subcomponent 1.2 – "adoption of land uses that improve resilience to climate change in areas that provide water supply to rural communities," in turn, was revised during the first restructuring to read "Water Source Protection Index in water recharge areas of selected climate-vulnerable communities that benefit from a Compensation for Environmental

Services (CES) program supported by the project, disaggregated by municipality," which also effective occurred. According to the first Restructuring Paper, this index "measures the applied land use benefit to downstream communities because of the CES program." However, this version was also replaced at the time of the second restructuring by: "Number of hectares conserved, reforested, and restored to increase protection of water sources of selected vulnerable communities." This change was justified in the second Restructuring Paper in the following terms: "this indicator measures the number of hectares protecting water sources, among these: (i) mitigation measures during construction of water systems; (ii) as part of the CES program; (iii) restoration efforts in Corn Islands; (iv) municipalities and project reforestation campaigns; (v) reforestation done by MARENA delegations." At the time of the first restructuring, the EOP target for the Water Source Protection Index was established at 73,241 and by the time of the second restructuring was reported to exceed that target by 16.1 percent (that is, 85,045). The new indicator target (3,000 ha), in turn, was reported 95 percent (2,850 ha) achieved at the time of the last ISR (May 2018). Thus, both indicators can be considered to have been essentially met.

7. The only significant shortfall in relation to the project's initial targets was with respect to the reduction of project-supported communities from 15 to 7 at the time of the first restructuring. As indicated in the first Restructuring Paper (pg. 18), at the time of appraisal "based on the original cost estimations, the available funds were expected to cover climate resilient water supply infrastructure for 15 communities with an estimated 4,500 direct beneficiaries, half of them women." However, it also observed that

> "…a revised cost analysis conducted by FISE in March 2014 for the needed investment for the pilot works revealed that the cost estimations made during project preparation were too low. Prices for standard sector infrastructure had risen, and the number of communities that the project budget could cover was reduced from 15 to 12, yet no formal restructuring of the Project's results framework took place at that time."

8. According to the same source, the Mid-Term Review (MTR), in turn, concluded that "the additional costs associated with incorporating aspects of enhanced climate resilience would bring the total investment cost to US$175,000 per community" and that "due to the new and substantially higher cost estimates and the integrated approach to the pilot infrastructure, it became clear a reduction in the number of targeted communities was unavoidable." Finally, as a result it stated that

> "…the number of the target communities sized down to seven communities, prioritized based on the population size in order to prioritize the biggest communities. Another criteria [sic] for the prioritization of the communities was the project being the only identified funding source for WSH investments. The revised target on direct beneficiaries is 1,329 people."

In summary, the downsizing was a direct result of the limited resources available for the project in combination with the increased unit costs (compared with the appraisal estimates) of properly implementing climate-resilient drinking water systems in the selected pilot communities and, thus, appears to have been fully justified. By the time of project closing, moreover, this revised target had been exceeded by 34.4 percent (1,786 people).

9. Finally, two new PDO indicators – "direct project beneficiaries" and "female beneficiaries" – were added at the time of the time of the first restructuring with EOP targets of 23,801 and 50 percent, respectively.

At the time of the second restructuring, the first of these two targets achieved stood at 72 percent (17,126), and by the time of project closing it had risen to 108.9 percent (25,929), thereby having been fully achieved. Similarly, at the time of project closing, 50 percent of direct project beneficiaries were also reported as being female, meeting this target as well.

10. In summary, the project's achievements in relation to the three original PDO indicators as revised over the course of project implementation, as well as the new ones introduced at the time of the first restructuring are thus rated substantial, even though accomplishments in this regard had been Modest at the time of the first restructuring in July 2016. Applying the percentages identified above to weight achievement prior and following the restructurings, overall this leads conservatively to an **efficacy rating of Substantial**. It can, therefore, be concluded that while project efficacy in relation to the original PDO may have been less impressive that that compared with the revised version, this was due largely to the way in which this objective was initially formulated exacerbated by implementation delays which were one of the reasons for the Level 1 restructuring shortly following the MTR. This conclusion is further supported by the review of project achievements in relation to the Intermediate indicators (Annex 1).

Project Performance with Respect to the Intermediate Results (IR) Indicators

11. The *original intermediate results indicators*, at the time of the first restructuring, the experience was also mixed, but more positive than with respect to the original PDO indicators. One of the original eight IR indicators – "education and training programs under implementation," which had an end-of-project (EOP) target of 500 had already been greatly surpassed (1,553) and another – "communities directly benefitting from Compensation for Environmental Services (CES) component of the pilot projects within the project area" had reportedly been met (that is, 100 percent of the target number of beneficiary communities, although the number of such communities was not indicated in the Results Framework contained in the PAD). A third such indicator – "establishment of a climate (rainfall) monitoring system in Corn Island and implementation of a climate change education program" – had likewise reportedly been achieved by the time of the first restructuring. Thus, three of these eight original IR indicators, or 37.5 percent, had already been met by the time of the first restructuring, and another one – "women's participation in the CES component" -- was largely (77.1 percent) met, which would bring the total to 50 percent even at the time of the first restructuring.

12. Progress with respect to the other four original intermediate results indicators, however, was less impressive according to the last ISR archived prior to the first restructuring (Sequence No. 8, June 21, 2016). The first of these (for Component 1) — "communities directly benefitting from the infrastructure investment component of the pilot projects in the selected areas, reducing human vulnerability to climate change," which originally had an EOP target of 15 — was dropped at the time of the first restructuring and replaced by a new one stating "improved community water points constructed or rehabilitated under the project." This new indicator had an EOP target of 7, reflecting the reduction in the scale of the restructured project in relation to the original design discussed above. At the time of the second restructuring, this target had not yet been met and the indicator itself was again revised to read "Percent progress in development of pilot drinking water schemes." According to the second Restructuring Paper (p. 6), it was revised the second time in order to "measure the project progress in the construction of the water supply systems" and "the proposed unit change 'percent progress' is defined as the total average progress in the construction of all seven works." Thus, the number of

systems involved remained the same, and at the time of project closing, this indicator had been 100 percent achieved.

13. No progress was reported either at the time of the first restructuring either for the indicator (for Component 2) "improve protection of wetlands and water sources included in the program or water sources management to reduce vulnerability to climate change and sea-level rise," which had an initial EOP target of 50 percent. During the first restructuring this IR indicator was revised to read "index of wetland protection measures implemented by the project to improve adaptation of water supply on Corn Islands (Percent)." This new indicator was given an EOP target of 70 percent, which had been surpassed at the time of the second restructuring (73 percent) and fully achieved (100 percent) by the time the project closed.

14. Another of the original intermediate results indicators (for Component 3) – "Climate Change Information Module in operation with National Water Resources Information System" – similarly had not been met by the time of the first restructuring, at which time its wording was slightly revised for purposes of greater clarity to read "Climate Information Module for water and climate change developed and integrated in the National Water Resources Information System." While not yet achieved at the time of the second restructuring, it had been achieved by the time the project closed. The target (2 stations) for the revised (at the first restructuring[50]) IR indicator "environmental and climatic monitoring stations established and functioning on Corn Island," in turn, had been met by the time of the second restructuring and surpassed by 50 percent (3) at the time the project closed.

15. Finally, for the PDO indicators that were converted to IR indicators during the first and second restructurings, the target for the new IR indicator "tools to incorporate climate change adaptation in water and sanitation investments developed by MARENA and FISE (Number)" was changed at the time of the first restructuring from 90 percent (of which 38 percent had reportedly been achieved prior to the restructuring) to the absolute number 10, reflecting the number of outputs expected to be generated. By the time of the second restructuring, 4 of the 10 products (40%) had been delivered and this number had increased to 7 (70%) by the time of the second restructuring, while the three remaining outputs were reportedly under preparation and expected to be completed by the time of project closing. This revised IR indicator was, in fact, achieved by the time of project closing as all ten expected products were delivered. Similarly, at the time of the last ISR—and thus also at that of project closing—however, the target for the indicator "Percent progress in development of pilot drinking water systems" was 100 percent achieved.

[50] According to the first Restructuring Paper (p. 11), the original statement of this indicator – "establishment of a Climate (Rainfall) Monitoring System in Corn Islands and implementation of a climate change education program" – was revised "firstly to remove the latter part 'implementation of a climate change education program' since these are two separate activities." It also observed that "the project will continue monitoring the total number of people participating in different types of awareness raising and educational events organized by the project, disaggregated by gender, at the level of the Operational Manual (OM)" and that "further, wording has been added to specify that the indicator will count the number of functional monitoring stations."

ANNEX 9. LIST OF TOOLS (MANUALS, GUIDELINES, AND PLANS) DEVELOPED WITH PACCAS SUPPORT

Tool	Responsible Agency	Description
1. Technical manual to protect water sources with climate change adaptation approach	MARENA	A manual that establishes technical criteria and administrative procedures to be applied in the Water Source Protection Program (*Programa de Protección de Fuentes de Agua - PPFA*) to compensate beneficiaries who implement sustainable practices in their farming activities and generate positive effects in land use and management to protect water resources adapting the ecosystems of the watersheds to climate change in the municipalities of San Ramón, San Juan de Limay, Murra, and Juigalpa.
2. Guideline to develop and systematize implementation of Municipal Plans for Environmental Protection in the face of Climate Change (*Planes Municipales de Protección Ambiental de las Familias ante el Cambio Climático,* PMPAFCC)	MARENA 2015	A guideline that explains methodological steps to develop PMPAFCCs, which explain methodological process to develop actions for conservation, management and protection of natural resources to adapt to climate change impacts under the principles of the common good of the Mother Earth and human values, ensuring a process of capacity building and empowerment of the actors in environmental issues related to climate change. The related capacity building was part of the adaptive process that contributes to the identification of appropriate adaptation measures for local conditions.
3. Methodology to determine vulnerability of water sources and drinking water systems	MARENA 2016	A step-by-step description of how to estimate the vulnerability of water resources with a Safe Water Index that addresses coverage, quantity, quality, continuity and water consumption habits (*cultura hídrica*), including how to determine potential water recharge zones at the community and water source scale. The methodology was developed through an inter-institutional effort led by MARENA with contributions from FISE and ANA.
4. Methodology to delimit water recharge areas in the drinking water supply sector	MARENA 2016	A step-by-step description of how to delimit water recharge areas; a methodology that facilitates climate-smart water resources management to supply safe drinking water.
5. Guide of good practices for wetlands protection with a focus on climate change	MARENA 2017	A guide that provides and develops good practices to protect wetlands as water source. These practices correspond to the adaptation measures implemented on Corn Islands with project support, resulting from INETER land use planning strategy and characterization of each wetland.

6. Land-use plan on the Corn Islands	MARENA 2017	A process of inter-institutional territorial planning on the Corn Islands with technical lead by INETER and participation by INETER, MARENA, FISE, ANA and the Municipality of Corn Island included a particular focus on environmental and climate change aspects to facilitate the islands' sustainable development.
7. Improved Environmental Management System (*Sistema de Gestión Ambiental*, SISGA) to incorporate key considerations and methodologies for environmental management in water and sanitation works to help enhance climate resilience	FISE 2016	SISGA updated to evaluate, validate and focus on environmental instruments applied at various stages of the FISE project cycle in rural water and sanitation focusing on climate change adaptation and watershed management, as well as to articulate SISGA in FISE's other operating manuals and tools, and design environmental performance indicators for rural water and sanitation projects.
8. Improved manual of implementation for water and sanitation projects (*Manual de Ejecución de Proyectos de Agua y Saneamiento, MEPAS*) to integrate key considerations and methodologies for enhanced climate resilience of the developed projects	FISE 2017	Adjustments made to the MEPAS in accordance with the new tools for environmental assessment and water and sanitation works' design and implementation, including adaptation measures to climate change with integrated and sustainable watersheds approach developed through the project in inter-institutional cooperation.
9. Manual of water harvesting from PACCAS and other National Experiences	FISE, MARENA, ANA 2017	The existing data and experience gained on water harvesting in Nicaragua was revised to prepare a technical guide for water harvest in rural areas as an additional methodology to provide for rural drinking water and sanitation systems, especially considering the lessons learned and results of the PACCAS project and other national/international experiences. This guide was developed through inter-institutional collaboration led by FISE with contributions from MARENA and ANA.
10. Compendium of climate change Adaptation measures in the rural water and sanitation sectors - costs and benefits.	FISE, MARENA, ANA 2017	This document is a compendium of the different actions and measures that can be taken in Nicaragua to increase resilience of communities with vulnerable water resources. The report was prepared including all best practices implemented by the PACCAS project and includes estimates of their costs.

ANNEX 10. PACCAS BENEFICIARIES

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While the project originally envisaged benefiting around 4,500 people in the PAD, the final number of direct project beneficiaries greatly surpassed the initial figure to reach the following groups:

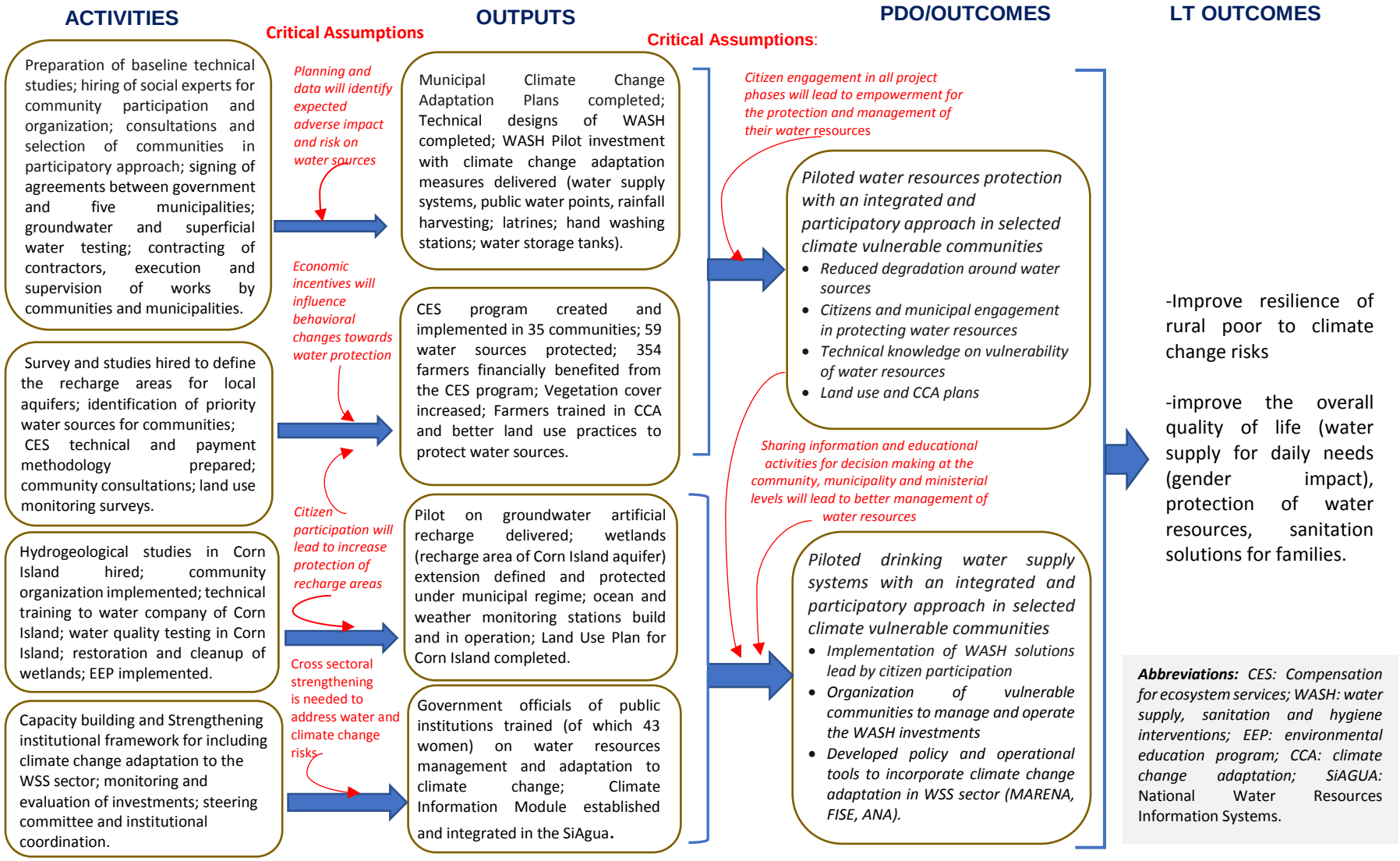
- The population of Corn Island (8,000 people);
- A total of 354 farmers (land owners) who directly participated in the CES;
- A total of 1,782 people benefited by the seven pilot projects (new or rehabilitated projects water, sanitation, and hygiene)
- A total of 15,093 people – the inhabitants of the 35 communities downstream from the 59 sources of water benefited by the PPFA and
- A total of 700 technical staff working in public institutions, trained on adaptation to climate change, management of water sheds.
- Almost 26,000 people (25,929 versus a goal of 23,801) in total.

ANNEX 11. WATER SUPPLY, SANITATION, AND HYGIENE (WASH) INVESTMENT PROJECTS: TIME AND DISTANCE TO DRINKING-WATER SOURCES

Water supply subproject name (ID)	Community	Municipality	Distance (range) traveled to bring drinking water prior to pilot project	Travel time	Water location	Family members responsible to carry the water home
Project 20020 A y S San Juan de Murra	San Juan	Murra	150 meters to 5 km	30 minutes to 3 hours	Ravine, creek; hand-excavated well	Men, women, and children
Project 20023 A y S El Olingo	El Olingo	Murra	150 to 500 meters	30 minutes to 1 hour	Ravine, creek; small hand-excavated well	Women
Project 20026 A y S Las Animas	Las Animas	Murra	300 to 600 meters	45 minutes to 1 hour	Ravine, creek; hand-excavated well	Women and children
Project 18791 A y S Piedras Grandes 2	Piedras Grandes 2	Juigalpa	300 meters to 7 km	45 minutes to 4 hours	Ravine, well	Women and children
Project 20019 A y S EL Terrero 2	El Terrero 2	San Juan de Limay	1km to 3 km	40 minutes to 2 hours	Ravine	Women and children
Project 20022 A y S La Danta	La Danta	San Juan de Limay	1km to 3 km	40 minutes to 2 hours	Ravine	Women and children
Project 20028 A y S Sabana Grande	Sabana Grande	San Ramón	150 meters to 5 km	30 minutes to 3 hours	Excavated well	Men, women, and children

ANNEX 12. THEORY OF CHANGE DIAGRAM FOR PACCAS PROJECT

***Original Project Development Objective**: To enhance climate resilience of investments made in Nicaragua's rural water supply sector in order to cope with: (i) increasing climate variability; (ii) expected adverse impacts of climate change in selected areas.*



Abbreviations: *CES: Compensation for ecosystem services; WASH: water supply, sanitation and hygiene interventions; EEP: environmental education program; CCA: climate change adaptation; SiAGUA:* National Water Resources Information Systems.

ANNEX 13. MAP OF THE PROJECT AREA