



Regional Framework for Sustainable Use of the Rio Bravo

Project summary

TABLE OF CONTENTS

SECTION 1: PROJECT IDENTIFICATION.....	Error! Bookmark not defined.	
ACRONYMS AND ABBREVIATIONS.....	Error! Bookmark not defined.	
SECTION 2: BACKGROUND AND SITUATION ANALYSIS (BASELINE COURSE OF ACTION).....	12	
2.1. Background and context.....	12	
2.2. Global significance.....	13	
2.3. Threats, root causes and barrier analysis.....	13	
2.4. Institutional, sectoral and policy context.....	16	
2.5. Stakeholder mapping and analysis.....	19	
2.6. Baseline analysis and gaps.....	20	
2.7. Linkages with other GEF and non-GEF interventions.....	23	
SECTION 3: INTERVENTION STRATEGY (ALTERNATIVE).....	24	
3.1. Project rationale, policy conformity and expected global environmental benefits.....	24	
3.2. Project goal and objective.....	25	
3.3. Project components and expected results.....	26	
3.4. Consistency with national priorities or plans.....	47	
3.5. Sustainability.....	48	
3.6. Replication.....	48	
3.7. Public awareness, communications and mainstreaming strategy.....	49	
3.8. Environmental and social safeguards.....	50	
SECTION 4: INSTITUTIONAL FRAMEWORK AND IMPLEMENTATION ARRANGEMENTS.....	50	
SECTION 5: STAKEHOLDER PARTICIPATION.....	52	
SECTION 6: MONITORING AND EVALUATION PLAN.....	52	

Project Rationale, Objectives, Outcomes and Outputs

Background

At 3,000-km in length, The Rio Bravo is the 5th largest river in North America, and 24th largest in the world, and is a major boundary between Mexico and the U.S. (where it is known as the Rio Grande). As an asymmetric border between a developing and developed country, any successfully implemented transboundary management mechanism can be a useful example to be emulated in other transboundary basins in the world.

The river is central to the cultural heritage and history of the border region of both countries, with its 467,000 km² drainage basin stretching across five Mexican States (Chihuahua; Coahuila; Nuevo Leon; Tamaulipas; and Durango) and three U.S. States (Colorado, New Mexico, and Texas) with a combined population of more than 13 million inhabitants. This international basin is the most rapidly-growing area

in both countries, with 90% of the border population residing in 14 paired sister cities, most exhibiting growth rates exceeding 3%.

There is significant agricultural activity on both sides of the border, particularly in the lower Rio Bravo Valley and the Rio Conchos basin. The Mexican side of the border has experienced a proliferation of maquiladoras (product assembly plants) as a result of the North American Free Trade Agreement, stimulating migration from the Mexican interior to the border region, accompanied by a significantly increased number of informal settlements (colonias) in the U.S., lacking basic water supply and sanitation facilities.

Water diversions, dams, high evaporation rates, recurring droughts, invasive species, sensitive biodiversity, agricultural and urban land use changes, and social dislocations seriously hinder the river's sustainable use for meeting human and ecosystem water needs. Due to such factors, the Rio Bravo is a river in serious disarray, with a compromised ability to support a formidable range of human physical, social, and economic needs, while also maintaining important ecosystems. Because of its importance to both countries, and because it has been identified in recent years among the world's ten most endangered rivers by both the Worldwide Fund for Nature (previously World Wildlife Fund) and American Rivers, the primary objective of this project is to develop and facilitate implementation of integrated, ecosystem-based, bi-nationally-agreed management activities to address the serious human and environmental problems confronting this sensitive bi-national river system, while maximizing its transboundary benefits to the inhabitants of both riparian countries.

The need to share and utilize the water resources of the Rio Bravo Basin in a sustainable manner is at the core of this project. It is directed to developing a comprehensive, participatory framework for coordinated bi-national management activities, with a focus on facilitating more efficient water use throughout the basin for both human and ecological uses. The socio-economic factors influencing the livelihoods of basin inhabitants, particularly the poor and underrepresented population, are integral to such goals, particularly for maximizing transboundary benefits. The natural heritage of the Rio Bravo Basin also must be considered, being unmatched by any comparable desert riverine system in the world.

The current project, outlined below, seeks to develop an integrated approach to the management of the Rio Bravo Basin through the adoption of integrated water resources management (IWRM) principles consistent with ecosystem management.

The project will follow the proven approach of developing an agreed and scientifically robust Transboundary Diagnostic Analysis (TDA) that identifies the key issues of transboundary concerns (Appendix 20 and sub-project II.3). In parallel to this, and with broad stakeholder involvement, a vision for the future use and management of the Rio Bravo Basin will be developed (Appendix 16 and sub-project I.1). These activities will lead to the preparation of a Strategic Action Programme (sub-project III.4) incorporating lessons and results from targeted research projects that are designed to supplement the available knowledge in the TDA (Appendices 18, 20, 25). The SAP will benefit from the results of a series of pilot projects where a range of potential solutions to the key concerns of transboundary importance will be tested. The project will address both the demands of the environment and those of the local population to ensure sustainable livelihoods for the people of the Rio Bravo Basin (Appendices 21, 22 and sub-projects III.1 and III.2). The finalized SAP with prioritised issues of transboundary concerns, including a financing strategy, will have broad stakeholder support and ministerial approval from both the Mexican and U.S. governments (Appendix 24).

The project will consider potential impacts of climate variability, and through a planned pilot demonstration activity will assess the potential impacts in a sub-basin of the Rio Bravo to provide local stakeholders with an improved understanding on changing water resources (Appendix 22 and sub-project III.2).

The project also attaches great importance to gender equality as a fundamental component of this transboundary management effort directed to sustainable use of the Rio Bravo. The IWRM-based approach envisioned within the development of a basin-wide TDA, with subsequent development and implementation of a Rio Bravo SAP incorporating a gender-sensitive approach for achieving the overall project goals, as well as ensuring project outcomes of better quality, validity and utility. Although such factors as gender are usually readily identified as being important when considering health-focused activities, it is less evident that gender concerns are considered an important factor in regard to such issues as water resources management. Whether or not they are readily evident, gender differences often exist where human beings are directly or indirectly involved as stakeholders, research subjects, and users or in training or dissemination activities relevant to achieving water resources management goals. The reality is that considering gender issues within the context of transboundary water system management efforts, such as those to be undertaken in the Rio Bravo Basin, elevates gender involvement as a type of socio-economic indicator for assessing progress in achieving (or not) the goals of project activities and outcomes relevant to sustainable use of the Rio Bravo. Accordingly, gender-related issues will be considered and addressed under the supervision of the project coordination unit (PCU) and Project Steering Committee, as an integral part of the project and to ensure the highest level of quality in the project's outcomes

Rationale

Virtually the only readily-available freshwater source in this arid region of North America, the Rio Bravo is a vitally-important transboundary water system source for both Mexico and the U.S. Central to the cultural heritage and history of the border region of both countries, its 467,000 km² drainage basin stretches across 5 Mexican states (Chihuahua; Coahuila; Nuevo Leon; Tamaulipas; Durango) and 3 U.S. states (Colorado, New Mexico, Texas), with a combined basin population of more than 13 million inhabitants. This international basin is the most rapidly-growing area in both countries, with 90% of the border population residing in 14 paired sister cities, most exhibiting growth rates exceeding 3%. There is economically-significant agricultural activity on both sides of the border, particularly in the lower Rio Bravo Valley and the Rio Conchos Basin. Further, the Mexican side of the border has experienced a proliferation of product assembly plants (maquiladoras) as a result of the North American Free Trade Agreement, which has stimulated migration from Mexico's interior to its border region, accompanied by a significantly-increased number of informal settlements (colonias) in the U.S., lacking basic water supply and sanitation facilities.

The threats to sustainable use of the water resources of the Rio Basin include recurrent droughts, excessive water abstractions, pollution, sensitive biodiversity and invasive species, agricultural and urban land use changes, inadequate water infrastructure, and social dislocations. The water abstractions in some stretches of the river, for example, are so large that little or no water is available. In fact, the Rio Bravo can be hydrologically characterized as two conjoined river systems. The upper river begins in southeast Colorado and essentially stops flowing at or immediately below Ciudad Juarez, Chihuahua/El Paso, Texas, where the river is entirely diverted from its channel for human uses. The river stretch below these two cities is typically dry throughout the year, with no significant flows until its confluence with the Rio Conchos 400 km downstream, earning this stretch of the river the title of the "Forgotten River." The absence of flood flows has drastically changed the environment of this stretch of the river, and its ability to transport water and sediments, causing the river channel to narrow, and native riverine habitats to disappear, while facilitating the growth of exotic plants like salt cedar (tamarisk).

Because it is the primary source of irrigation water for economically-important agricultural activities on both sides of the border, the water scarcity situation in the lower Rio Bravo Valley is particularly critical, with intermittent droughts being a continuous threat in this stretch of the river. The precarious state of the estuary at the Rio Bravo river mouth became dramatically evident in February 2001, when the mouth was blocked by a sandbar caused by low-flow conditions resulting from a severe drought since 1995. The average annual flow rate at the Rio Bravo mouth was nearly 3 million m³ in 1962, compared to an average flow of zero during 1990-1995. The river mouth remained closed until dredged open by the International Boundary and Water Commission (IBWC) in September 2001. Subsequent tidal water changes again closed the mouth until September 2002, when higher tides and increased rainfall runoff partially opened it.

The Rio Bravo Basin also is one of the most biologically-diverse regions in North America, possessing a range of important aquatic and terrestrial ecosystems (mudflats; salt marshes; freshwater cienegas; riparian forests). It traverses three major ecoregions (Southern Rocky Mountains; Chihuahua Desert; Tamaulipan Thorn Scrub) exhibiting a mosaic of mountain, desert and coastal habitats, unmatched by any desert river system in the world. The lower Rio Bravo Valley provides habitat for millions of migratory birds to feed and rest during migration, consequently it has become a major bird watching site in North America. Thus, developing and implementing a basin-wide management plan for sustainable use of the Rio Bravo will have global environmental benefits related to conservation of unique biodiversity within its basin.

Both countries have treaty obligations to deliver specified quantities of water to each other at different locations in the basin, without appropriate consideration of such adverse factors as drought and impending climate change, which seriously hinders the holistic management of the river's water resources on a basin scale. Further, use of the water resources of the Rio Bravo is governed by a plethora of uncoordinated binational treaties, interstate compacts, reclamation projects, water right and contracts, which are implemented by a range of international, national, state and local levels, thereby ensuring fragmentation of water management authority. These institutions, as well as relevant private organizations (e.g., irrigation districts), comprise a major grouping of different basin stakeholders which must be involved in transforming the current fragmented management system into a more integrated decision-making process. Inadequate communication between water-user communities and other stakeholder groups also constrains sustainable use of the river. Taken together, failure to address these factors ensures a continuing piecemeal, and non-sustainable, approach to managing this important transboundary water system.

This surfeit of international treaties, interstate compacts, reclamation projects, water rights and contracts being implemented by a broad range of governmental agencies and private organizations obviously complicates achievement of binational integrated water management goals. Part of the solution to this problem lies in better coordination of activities between organizations, activities and programs on both sides of the border. Undertaking the formulation of a transboundary SAP and TDA for the Rio Bravo Basin will facilitate the identification and consideration of ways to better cooperate and coordinate the activities of these disparate management entities, both within and between the two riparian countries, thereby working to transform the current fragmented system into a more integrated and sustainable decision-making process directed to the basin as a whole. To this end, and in addition to national institutions in the riparian countries, the following international institutions and programs also are of key interest to this project:

- **Commission on Environmental Cooperation (CEC):** Complementing the environmental provisions of the North American Free Trade Agreement (NAFTA), the CEC is an international organization created by Canada, Mexico and the United States under the North American Agreement on Environmental Cooperation (NAAEC).
- **International Boundary and Water Commission (IBWC; the Mexican section of IBWC is called La Comisión Internacional de Límites y Aguas (CILA)):** The IBWC is an

international body responsible for applying the boundary and water treaties between Mexico and the USA, and settling any differences that may arise in their application.

- **Border Environment Cooperation Commission (BECC):** The BECC is an international organization created by the Mexican and US Governments under side agreements to the North American Free Trade Agreement (NAFTA).
- **Border 2012 Program:** The 1983 Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area (La Paz Agreement) is the legal basis for this bi national collaborative program.

It is noted that, in spite of these international activities and programs, there still is a continuing lack of coordination and integrated institutional actions by the two riparian countries, thereby ensuring that within constraints to the sustainable use of the Rio Bravo remain major problems. Currently no holistic, basin-wide management strategies are in practice, and until the rapid assessment conducted during the PPG was performed, very little perspective had been given to basin-wide issues on the necessary scale. As highlighted in the first basin-wide rapid assessment, the Rio Bravo Basin problems and the constraints to the sustainable use of its water resources, which are interrelated to varying degrees, can be summarised as follows:

- **Water Quantity:** The Rio Bravo Basin suffers from continuing drought events, sometimes lasting for many years. The Rio Bravo also is subjected to significant water abstractions in many places along its main stem for agricultural irrigation and domestic water supply, particularly in the lower Rio Bravo valley.
- **Water Quality:** The water quality in the Rio Bravo Basin was assessed during 1993 – 1995 in two studies. One focused on the portion of the river from its headwaters through Ciudad Juarez, Chihuahua/EL Paso, Texas, and a subsequent assessment of the lower portion of the Rio Bravo. The general water quality concerns focused on pollutants from urban centers (waste water; microorganisms, organic chemicals), agriculture (fertilizers, pesticides); mining (trace elements).
- **Biological Resources:** Although the natural heritage of the Rio Bravo basin is believed to be unmatched by any desert riverine system in the world, continuing habitat degradation resulting from invasive species, land use changes, climate change, and other human influences are having a severe impact on its vulnerable flora and fauna.
- **Agricultural Activities and Water Use:** With agricultural irrigation comprising more than three quarters of all water abstractions in the Rio Bravo Basin, particularly in the lower Rio Bravo Valley, irrigation methods have significantly affected the river's health and sustainability in supplying water for both human and ecosystem needs. Furthermore, more than half of aquifers in the basin are experiencing non-sustainable rates of pumping, thereby placing present and future water supplies and spring ecosystems at risk.
- **Tourism Potential in Lower Rio Bravo Valley:** The Lower Rio Grande (Bravo) Valley National Wildlife Refuge system in the U.S. is the area's major attraction for wildlife watchers of all types. Birdwatchers account for the large majority of the total, with the lower Rio Bravo Valley being rated as second best bird watching region in the entire U.S., boasting a unique array of species numbering in the hundreds. Continuing water abstractions for agricultural irrigation can significantly impact this important and economically-important ecosystem amenity.
- **Increasing Rio Bravo Basin Population:** The Rio Bravo Basin has one of the fastest growing regions in both riparian countries. Accordingly, water availability in the Rio Bravo Basin will be affected by domestic water supply demands, as well as agricultural irrigation, in the basin.

- **Increasing Industrialization:** A major factor contributing to the rapidly-growing urban population in the Rio Bravo Basin is the increasing economic development and industrialization associated with the North American Free Trade Agreement (NAFTA), including the 1,400 product assembly plants (maquiladoras) and related economic activities associated with the Agreement.
- **Border Security Wall:** A topic of some political sensitivity on both sides of the Rio Bravo is the construction of a so-called “security wall” as a physical barrier to illegal immigration from Mexico to the U.S. The geopolitical ramifications notwithstanding, there are legitimate environmental concerns associated with the construction of the wall, including the disruption of both aquatic and terrestrial ecosystems and corridors.

Objectives

Against this background of continuing degradation and over-exploitation of the water resources in the Rio Bravo Basin, the myriad of national and international agreements, compacts and treaties influencing its allocation and use, and the current uncoordinated, piecemeal approach to its management, a holistic, integrated approach is needed to manage this transboundary river system for sustainable use. The ecosystem-based approach encompassed within the development of a basin-wide TDA (sub-project II.3), and subsequent implementation of an agreed SAP (sub-project III.4) to address the prioritized constraints to its sustainable use, provide such an approach.

Development Objective: Based on a common and integrated vision, to facilitate the protection and sustainable use of the water resources of the transboundary Rio Bravo Basin, within the context of an integrated ecosystem approach to water resources management and improved ecosystem structure and function.

Project Objective: In order to meet the above development objective, and enhance the environmental functioning of the Basin as a whole, the objective of this project is to equip the two riparian countries in the Basin with the required planning tools, including formulation and implementation of a comprehensive, bi-national, ecosystem-based action programme (SAP), based on the principles of integrated water resources management (IWRM), for the management and sustainable use of the Rio Bravo throughout its basin, and for creating the necessary enabling social-economic and policy mechanisms for implementing the agreed action programme and engendering the necessary reforms.

Outputs/Outcomes

The main outcomes of the project will be:

- **Outcome 1:** Enhanced understanding of the stakeholders’ Vision for the Rio Bravo Basin, leading to revision and acceptance of the SAP by the two riparian countries. Enhanced understanding of the national and regional, legal and institutional frameworks and options for a joint basin-wide cooperation mechanism (Appendices 16, 17, 25)
- **Outcome 2:** Improved understanding of the natural resource base, and threats to the ecosystem, in the Rio Bravo Basin
- **Outcome 3:** Basin-wide ecosystem-based management approaches strengthened through knowledge gained through the successful completion of Pilot Projects (Appendices 21, 22)
- **Outcome 4:** Agreement and commitment from both riparian countries for coordinated management of the water resources of the Rio Bravo Basin, leading to: (i) policy, legal and institutional reforms to address the priority trans-boundary issues at the regional / national / local levels; and (ii) the required profile of structural and non-structural measures to achieve the sustainable Rio Bravo Basin Vision.

These outcomes will be realised with the significant contribution of the successful outcome of:

- **Outcome 5:** Effective project co-ordination, management and oversight (Appendices 26, 27 and Component IV)

These outcomes will be delivered from the following Components and main outputs of the Rio Bravo project will be:

Component I: Understanding the Rio Bravo Society and Related Water Needs

- Stakeholder identification
- Strategies for stakeholder participation and information sharing
- Development of an agreed vision for the Rio Bravo (Appendix 16)
- Analysis of legal and institutional frameworks and options for a basin-wide co-operation mechanism (Appendix 17)
- Establishment of a working group of experts on legal framework harmonization
- Agreement and documented procedures on legal and institutional frameworks that would strengthen the bi-national cooperation mechanisms including options for establishing a Basin-wide cooperation mechanism.

Component II: Understanding the Natural Resource Base

- Targeted research to address knowledge and information gaps on (Appendix 18):
 - Improved knowledge on water quality
 - Identifying linkages between environment and human health
 - Improved knowledge on agricultural impacts on water quantity
 - Impacts of non-sustainable groundwater pumping in the transboundary and Rio Conchos Regions
- Design and development of a common Integrated Information System as a basis for data sharing in the basin (Appendix 19)
- Completion of a Transboundary Diagnostic Analysis (TDA) incorporating pre-existing information and material derived from the targeted research (Appendix 20)
- Analysis and agreement of the priority transboundary concerns of the Rio Bravo Basin

Component III: Response Strategies

- Implementation of pilot projects and replication strategies (Appendix 21) to inform the SAP preparation on:
 - U.S., with co-financing
 - Outreach and education programme for the Rio Bravo Basin
 - Development of a web-based bilingual, bi-cultural professional development approach to teaching about the Rio Bravo Basin
 - Los Caminos del Rio River Appreciation Project facilitating river-based recreation and cultural heritage activities to highlight the relationships among the communities

- Identification of transboundary corridors and biodiversity hotspots in the Rio Bravo Basin, using a ‘umbrella’ species approach
- Re-vegetation of bare soil areas adjacent to riparian corridors
- Restoration of riparian woodland park in the lower Rio Bravo Basin
- Mexico, with GEF Funding (Appendix 22) :
 - Water use efficiency in the Rio Conchos Basin
 - Inter-sectoral water transfer between the Delicias irrigation district and the city of Chihuahua
 - Climate variability and climate change scenarios in the Rio Conchos Basin
- Development of a knowledge base for targeted basin stakeholders strengthening future stakeholder engagement in the SAP formulation and approval process
- Implementation of a communications strategy and stakeholder participation programme (Appendix 23)
- An agreed and endorsed SAP
 - An agreed financial strategy with appropriate financial instruments for implementing the SAP (Appendix 24)

Component IV: Project Management

- Functional Project Co-ordination Unit and Supervision functions (Appendix 26)

Component V: Monitoring and Evaluation

- Operational and utilised M&E procedures with SMART indicators (Appendix 27)
- Mid-Term and Terminal Evaluations

ACRONYMS AND ABBREVIATIONS

APAZU	Drinking Water, Sewage and Sanitation in Urban Zones / Agua Potable, Alcantarillado y Saneamiento en Zonas Urbanas
ArcHydro	Name of geographic information system
BECC / COCEF	Border Environment Cooperation Commission / Comision Cooperacion Ecologica Fronteriza
BEHI	Border Environmental Health Initiative
CAFO	Concentrated Animal Feeding Operations
CEC	Commision on Environmental Cooperation
CONAGUA	Mexico’s National Water Commission / Comisión Nacional del Agua
DO	Dissolved oxygen
EA	Executing Agency
EOU	Evaluation and Oversight Unit
GEF	Global Environment Facility

GIS	Geographic Information System
GOM LME	Gulf of Mexico Large Marine Ecosystem project
GS/OAS	General Secretariat of the Organization of American States
HHS	United States Department of Health and Human Services
IA	Implementing Agency
IBWC / CILA	International Boundary Waters Commission / Comisión Internacional de Límites y Aguas
IIS	Integrated Information System
IMTA	Mexican Institute of Water Technology
INEGI	Instituto Nacional de Estadística y Geografía
IW	International Waters
IW: LEARN	International Waters Learning Exchange and Resource Network
IWCAM	Integrated Watershed and Coastal Area Management
IWRM	Integrated Water Resources Management
IWRN	Inter-American Water Resource Network
LRGV	Lower Rio Grande Valley
km	kilometer(s)
m ³	Cubic meters
mi	mile(s)
Mm ³ /km	Million cubic meters per kilometer
Mm ³ /yr	Million cubic meters per year
MDGs	Millennium Development Goals
MTE	Mid Term Evaluation
NADBank	North American Development Bank
NAAEC	North American Agreement on Environmental Cooperation
NAFTA	North American Free Trade Agreement
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NPEU	National Project Execution Units
O & E	Outreach and Education
PAHO	Pan-American Health Organization
PCU	Project Coordinating Unit
PDF-A	Project Development Fund - A
PDF-B	Project Development Fund – B

PIF	Project Identification Form
PIR	Project Implementation Review
PPG	Project Preparation Grant
QA/QC	Quality assurance and quality control
RFP	Request For Proposal
Rio Bravo Basin	Rio Bravo/Grande Basin
RGWFCC	Rio Grande Watershed Federal Coordinating Committee
SAGARPA	Secretary of Agriculture, Cattle Raising, Rural Development, Fishing and Nourishment / Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
SAP	Strategic Action Program
SEMARNAT	Secretary of Environment and Natural Resources / Secretaría de Medio Ambiente y Recursos Naturales
SC	Steering Committee
SIDS	Small Island Development States
SO	Strategic Objective
SS	Mexican Secretariat of Health
SWQB	Surface Water Quality Bureau
TCEQ	Texas Commission on Environmental Quality
TDA	Transboundary Diagnostic Analysis
TDS	Total dissolved solids
TOC	Total organic carbon
TOR	Terms Of Reference
TxHwy	Texas Highway
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNEP	United Nations Environment Programme
UNEP GEF	United Nations Environment Programme Division of Global Environment Facility Coordination
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States of America
US \$	US dollars
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USHHS	Department of Health and Human Services

USMX-GIS	United States-Mexico Border Geographic Information System
WRAP / PADUA	Water Rights Adjustment Program / Programa de Adecuación de Derechos de Uso del Agua
WSSD	World Summit on Sustainable Development
WWF	Worldwide Fund for Nature (previously World Wildlife Fund)

SECTION 2: BACKGROUND AND SITUATION ANALYSIS (BASELINE COURSE OF ACTION)

2.1. Background and context

The 3,000-km long Rio Bravo, the 5th largest river in North America, and 24th largest in the world, is a major boundary between Mexico and the U.S. (where it is known as the Rio Grande). It also is an **asymmetric border between a developing and developed country**, so that any successful transboundary management mechanism can be a useful example to be emulated in other transboundary basins in the world.

The river is central to the cultural heritage and history of the border region of both countries, with its 467,000 km² drainage basin stretching across five Mexican states (Chihuahua; Coahuila; Nuevo Leon; Tamaulipas; Durango) and three U.S. states (Colorado, New Mexico, Texas) with a combined population of more than 13 million inhabitants. This international basin is the **most rapidly-growing area in both countries**, with 90% of the border population residing in 14 paired sister cities, most exhibiting growth rates exceeding 3%.

There is **significant agricultural activity** on both sides of the border, particularly in the lower Rio Bravo Valley and the Rio Conchos Basin. The Mexican side of the border has experienced a proliferation of maquiladoras (product assembly plants) as a result of the North American Free Trade Agreement, stimulating migration from the Mexican interior to the border region, accompanied by a significantly increased number of informal settlements (colonias) in the U.S., lacking basic water supply and sanitation facilities.

Water diversions, dams, high evaporation rates, recurring droughts, invasive species, sensitive biodiversity, agricultural and urban land use changes, and social dislocations seriously hinder its sustainable use for meeting human and ecosystem water needs. Because of such factors, the Rio Bravo is a river in serious disarray, with its ability to support a formidable range of human physical, social, and economic needs, while also maintaining important ecosystems, is being overwhelmed. Because of its importance to both countries, and because it has been identified among the world's ten most endangered rivers by both the World Wildlife Fund and American Rivers, the primary objective of this project is to develop and facilitate implementation of integrated, ecosystem-based, bi-nationally-agreed management activities to address the serious human and environmental problems confronting this sensitive bi-national river system, and to maximize its transboundary benefits to the inhabitants of both riparian countries.

Whilst there has been considerable research undertaken in the basin and there are a **number of regional co-operation mechanisms**, there has been **little coordinated management** of the water resources within this important transboundary river basin.

The need to share and utilize the water resources of the Rio Bravo Basin in a sustainable manner is at the core of this project. It is directed to developing a comprehensive, participatory framework for coordinated bi-national management activities, with a focus on facilitating more efficient water use throughout the basin for both human and ecological uses. The socio-economic factors influencing the livelihoods of basin inhabitants, particularly the poor and underrepresented population, are integral to such goals, particularly for maximizing transboundary benefits. The natural heritage of the Rio Bravo Basin also must be considered, being unmatched by any comparable desert riverine system in the world.

Rio Bravo Basin contains many threatened and endangered species among its extensive biodiversity. More than 95% of the lower basin's native brushland has been converted to agricultural or urban use since the 1920s, with few undisturbed, natural communities remaining. Water development projects have seriously disrupted natural flow regimes, affected wetlands and aquatic fauna, and degraded native riparian plant communities. A further significant constraint to sustainable use of the Rio Bravo lies in the fact that both countries have treaty obligations to deliver specific quantities of water to each other at different locations in its basin, seriously complicating the holistic, integrated use of the river. A legal and institutional fragmentation of authority for water management also exists because the waters of the Rio

Bravo are governed by a plethora of binational treaties, interstate compacts, reclamation projects, water rights, and contracts that are, in turn, implemented by a range of governmental agencies at international, national, State, and local levels. These institutions, and a large number of private organizations (e.g., irrigation districts), comprise a major grouping of different stakeholders that must be involved in transforming the current fragmented system into a more integrated decision-making process. Although part of the solution lies in better coordination of organizational activities on both sides of the border, this goal remains difficult and elusive. Lack of effective communication between water-user communities and other stakeholder groups also constrains sustainable use of the river. Taken together, these factors ensure a continuing piece-meal, and non-sustainable, approach to managing this important transboundary water system.

The current project, outlined below, seeks to develop an **integrated approach to the management of the Rio Bravo Basin through the adoption of IWRM principles** consistent with ecosystem management. The project will follow the proven approach of developing an agreed and scientifically robust Transboundary Diagnostic Analysis (TDA) that identifies the key issues of transboundary concerns. In parallel to this, and with broad stakeholder involvement, a vision for the future use and management of the Rio Bravo Basin will be developed. The project will assess the legal and institutional structures and make recommendations (including options for establishing a Rio Bravo Basin-wide cooperation mechanism) for strengthening basin co-operation and will strengthen communications and information sharing between stakeholders (Appendices 16, 17, 20, 23).

These activities will lead to the preparation of a Strategic Action Programme incorporating lessons and results from targeted research projects that are designed to supplement the available knowledge in the TDA. The SAP will benefit from the results of a series of pilot projects where a range of potential solutions to the key concerns of transboundary importance will be tested. The project will address both the **demands of the environment and those of the local population** to ensure sustainable livelihoods for the people of the Rio Bravo Basin. The finalised SAP with prioritised issues of transboundary concerns, including a financing strategy (Appendix 24), will have broad stakeholder support and ministerial approval from both the Mexican and U.S. governments.

2.2. Global significance

The preparation of a basin vision and an agreed Strategic Action Plan for the Rio Bravo Basin supports the activities of the national executing agencies (SEMARNAT and USEPA) and the various regional and national co-operational programmes in the basin (Appendices 16, 25). The lessons learned through this process will be of value to other highly stressed basins developing integrated plans to address the key issues of water resources and ecosystem management.

The basin contains many threatened and endangered species among its extensive biodiversity. The basin supports 121 fish species, for example, 69 of which being found nowhere else on our planet. The basin also has 3 areas that support endemic bird species, as well as a high level of mollusc diversity. Unfortunately, however, few undisturbed, natural communities remain. The outcome of this intervention, therefore, will overall lead to an overall improvement of the management of the limited water resources and the biological resources within the basin, with reduced pollution also contributing to the concerns of the Gulf of Mexico. The integrated approach to water quantity and water quality management with consequential benefits to biodiversity to be a valuable case study to GEF IW and the approach will also benefit the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) in the region.

2.3. Threats, root causes and barrier analysis

Biophysical Factors

Excessive water abstractions, inadequate water infrastructure, salinization, and invasive species rank among the threats to sustainable use of the water resources of the Rio Bravo Basin. Virtually the **only**

readily-available freshwater source in this arid region of North America, the Rio Bravo is a vitally-important transboundary water system source for both Mexico and the USA. The water abstractions in some stretches of the river, however, are so large that little or no water is available. In fact, the Rio Bravo can be hydrologically characterized as two conjoined river systems. The upper river begins in southeast Colorado and essentially stops flowing at or immediately below Ciudad Juarez, Chihuahua/El Paso, Texas, where the river is entirely diverted from its channel for human uses. The river stretch below these two cities is typically dry throughout the year, not resuming significant flows until its confluence with the Rio Conchos 400 km downstream, earning this stretch of the river the title of the “Forgotten River.”

The **absence of flood flows** has drastically changed the environment of this stretch of the river, and its ability to transport water and sediments, causing the river channel to narrow, and native riverine habitats to disappear, while facilitating the growth of exotic salt cedar (tamarisk). Exotic water plants (water hyacinth; hydrilla) draw water up into their roots and transpire it into the atmosphere, as well as clogging the free flow of the river. The result is seriously-disrupted natural flow regimes, affected wetlands and aquatic fauna, and degraded native riparian plant communities. Salinity, nutrients, faecal coliform bacteria and some toxic substances remain concerns throughout the Rio Bravo Basin.

The **water scarcity** situation in the lower Rio Bravo valley is particularly critical, being the primary source of irrigation water for economically-important agricultural activities on both sides of the border. Intermittent droughts remain a constant threat in this stretch of the river. The precarious state of the estuary at the Rio Bravo river mouth became dramatically evident in February 2001, when the mouth was blocked by a sandbar caused by low-flow conditions resulting from a severe drought since 1995. The average annual flow rate at the Rio Bravo mouth was nearly 3 million m³ in 1962, compared to an average flow of zero during 1990-1995. The river mouth remained closed until dredged open by the International Boundary and Water Commission (IBWC) in September 2001. Subsequent tidal water changes again closed the mouth until September 2002, when higher tides and increased rainfall runoff partially opened it.

These events highlighted the importance of Rio Bravo freshwater inflows in providing reduced salinity habitat for post-larval and juvenile marine species, and a means of ingress and egress to the estuarine habitat for some sensitive aquatic species. The Rio Bravo estuary itself is renowned for some characteristic estuarine species, including indigenous hypersaline-tolerant oysters (*Crassostrea equestris*). Some fish species with tropical affinities reach their regular northern occurrence in the western Gulf of Mexico, including snook (*Centropomus undecimalis*) and tarpon (*Tarpon atlanticus*). The relative abundance of other species, including blue crab (*Callinectes sapidus*) and white shrimp (*Penaeus setiferus*), compare favourably at times with other western Gulf of Mexico estuaries. Thus, the ecological health and integrity of this fragile estuary is extremely dependent on minimum and period flood flows from the Rio Bravo Basin to maintain estuarine habitats and periodically flush the system and facilitate over banking to the riparian wetlands.

The Rio Bravo Basin also is one of the **most biologically-diverse regions in North America**, possessing a range of important aquatic and terrestrial ecosystems (mudflats; salt marshes; freshwater cienegas; riparian forests). It traverses three major ecoregions (Southern Rocky Mountains; Chihuahua Desert; Tamaulipan Thorn Scrub) exhibiting a mosaic of mountain, desert and coastal habitats, being unmatched by any desert river system in the world. The lower Rio Bravo Valley provides habitat for millions of migratory birds to feed and rest during migration, thereby being a major bird watching site in North America. Thus, developing and implementing a basin-wide management plan for sustainable use of the Rio Bravo will have global environmental benefits related to conservation of unique biodiversity within its basin.

Socio-economic Factors

The **economic development** of this region, and considering of the uncertain natural factors affecting it (e.g., lack of precipitation), have affected the region's water availability. Additionally, the effect of climate change on water availability is a growing concern requiring further research and adaptive management strategies. In the absence of any efforts to address the sustainability of these resources, the situation can only worsen into the future. Regional **population growth** (including migration into the region) and economic development are major factors. Urban centers and industrialization will inevitably increase with the increasing regional development. Thus, reducing the environmental impacts of these factors will require technologies that simultaneously consider them and the relevant environmental issues (e.g., river flows) and approaches to address them (e.g., water recycle and reuse).

It is noted that many scientific and other studies have already been undertaken on both sides of the border. Although the results of many of these efforts have been documented in various technical and scientific journals, professional documents and reports, proceedings of professional meetings, etc., they have largely focused on hydrological and biodiversity issues. Unfortunately, **little effort has been made to date to integrate such information** into a detailed understanding of the Rio Bravo Basin as a whole. The proposed SAP will attempt to address this decision, utilizing the prioritized issues identified in the TDA (Sub-Project II.3), and other project activities, thereby facilitating a better understanding of the Rio Bravo Basin, and provide guidance to achieving its sustainable use (Appendices 20, 25).

Because of such unique, often conflicting features, the Rio Bravo has been identified among the world's **ten most endangered rivers** by both the World Wildlife Fund and American Rivers. Developing and implementing an ecosystem-based management program for the Rio Bravo Basin will facilitate the equitable, sustainable use of the river and its resources throughout its basin. Restoring and maintaining a sustainable transboundary river system will translate into **benefits to both the basin inhabitants and its natural environment**. Despite the rapidly-growing economy in the region, for example, the Rio Bravo Basin is one of the **poorest regions in the US**. By enhancing economic benefits to the basin inhabitants, developing and implementing a SAP for the Rio Bravo Basin also will work to alleviate the poverty characterizing much of the population on both sides of the border in this important transboundary basin, thereby also enhancing opportunities to also protect and conserve the very resource, the Rio Bravo, and providing many of these benefits. Further, the freshwater - coastal connection at the river mouth and coastal estuary downstream mouth of the river has relevance to the GEF's ongoing Gulf of Mexico Large Marine Ecosystem (GOM LME) project.

Significant **legal and institutional fragmentation** of authority for water management in the basin is a significant constraint to equitable, sustainable use of the Rio Bravo.

Both countries have **treaty obligations** to deliver specified quantities of water to each other at different locations in the basin. Inadequate consideration of such adverse factors as drought and impending climate change seriously hinders the holistic management of the river's water resources on a basin scale. Further, use of the water resources of the Rio Bravo is governed by a plethora of uncoordinated bi-national treaties, interstate compacts, reclamation projects, water right and contracts, which are implemented by a range of international, national, state and local levels, thereby ensuring fragmentation of water management authority. These institutions, as well as relevant private organizations (e.g., irrigation districts), comprise a major grouping of different basin stakeholders must be involved in transforming the current fragmented management system into a more integrated decision-making process. Inadequate communication between water-user communities and other stakeholder groups also constrains sustainable use of the river. Taken together, **failure to address these factors ensures a continuing piece-meal, and non-sustainable, approach to managing this important transboundary water system**.

Global-scale Factors

Global **climate change** is an overriding concern that could seriously hinder the integrated management of the water resources of the Rio Bravo Basin. It is widely believed that many of the major impacts of global climate change will be manifested in changes in the hydrologic cycle, with potential consequences to water

availability and water users in many regions. In the case of the Rio Bravo Basin, the absence or presence of flows in the basin determines its character. The Rio Bravo Basin currently receives about two-thirds of its annual precipitation of 8 inches (approximately 130 mm) in the late summer and early fall. In regard to future conditions, although extensive climate change studies focusing on the Rio Bravo Basin have not yet been conducted, most scientific projections of climate change for the Rio Bravo Basin suggest it will experience higher temperatures, and less precipitation, with sporadic years of extreme rainfall, perhaps also impacting snowpack in the headwaters areas in the San Juan Mountains of Colorado. Some studies have down-scaled global climate change impacts to focus on the Rio Bravo Basin, with predictions of reduced precipitation and surface runoff in the basin. As previously noted, the Rio Bravo is virtually the only readily-available water source in this arid region of Mexico and the US, with water abstractions already so great in some stretches of the river to meet agricultural irrigation and domestic water supply needs that little or no additional water is available during an average hydrologic year. Thus, the Rio Bravo Basin will be very vulnerable to future climate change impacts because of its hydro-climatic conditions, and the excessive demands already being placed on its limited water resources, necessitating adaptive management and conservation strategies for sustainable use.

2.4. Institutional, sectoral and policy context

Many regional and national priorities and plans that focus on the Rio Bravo Basin are encompassed within ongoing activities of national organizations in the two riparian countries, and also are consistent with goals of this proposed integrated, ecosystem-based management program. These organizations and their activities include the following:

Relevant National Institutions

Mexico

- **Secretary of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales, SEMARNAT):** A department of the federal government's Executive branch, SEMARNAT is responsible for environmental protection policy to reverse ecological deterioration, and establishing the basis for sustainable development in Mexico.
- **National Water Commission (Comisión Nacional del Agua, CNA):** The 1992 National Water Law, as revised in 2004, gives the federal government, through CNA, a department of SEMARNAT, responsibility for key water sector functions, with the chief mission of managing and preserving national water resources, with participation of society, to achieve sustainable use of these resources.
- **National Institute of Water Technology (Instituto Mexicano de Tecnología del Agua, IMTA):** Created by presidential decree, IMTA has the mandate of developing technology, and training the necessary qualified human resources needed to ensure rational utilization and integrated management of water resources.

United States

- **U.S. Environmental Protection Agency (EPA):** The EPA was established in 1972 as a federal response to growing public demands for cleaner water, air and land. The concerns of EPA's Region 6 encompass the US portion of the Rio Bravo Basin, including facilitation of construction of wastewater and drinking water facilities for people living in unincorporated areas (colonias) along the US side of the border. The EPA also works with other Federal, State, and local agencies to help identify and solve border environmental problems.
- **Rio Grande Watershed Federal Coordinating Committee (RGWFCC):** The RGWFCC is a consortium of 11 US federal agencies, including IBWC, National Park Service, EPA, Army Corps of Engineers, Bureau of Reclamation, Department of Agriculture, Bureau of Indian Affairs, Bureau of Land Management, and National Weather Service. Its purpose is to facilitate

familiarity of these agencies with each other's mission and ongoing projects related to watershed planning activities relevant to the Mexico-US border, and facilitate opportunities for interagency collaboration.

Relevant Water-related Legal Instruments and Policies

It is noted that the mandate of many of these organizations is to facilitate a number of international, national and state laws, programs and agreements. In presenting the examples below, it is noted that water management in Mexico is handled by the federal government through federal law. In contrast, the US federal government grants water management and regulatory authority to the states. Although not an extensive list, a brief overview of some major international and federal water-related legal instruments include the following:

- **1906 Convention above Fort Quitman:** This convention requires Mexico to deliver 60,000 acre-feet/0.074 km³ of Rio Bravo water per year, except in event of extraordinary drought or facility accident, in which case Mexico and the US will prorate available water resources. With this convention, Mexico also waived claims to Rio Bravo water downstream of Fort Quitman, Texas.
- **1944 Water Treaty between US and Mexico:** This treaty created the International Boundary and Water Commission (IWBC/CILA) (also see following section on international institutions). This body was created to keep record of water deliveries, establish priority use and resolve disputes of water allocation between each nation and within each nation. A major responsibility is allocation of water entering the Rio Bravo below Fort Quitman, Texas, on the mainstream and tributaries allocated to Texas and Mexico by the IBWC/CILA. Under this treaty, Mexico provides an annual minimum water volume of 350,000 AF/0.432 km³ (averaged over a 5-year period) from named tributaries in Mexico. In event of extraordinary drought, the deficit is to be made up in following 5-year cycles. The IWBC/CILA also jointly constructs and operates international storage reservoirs on the Rio Bravo. Rio Bravo Basin both in Mexico and US. Mexico provides an annual minimum amount of 350,000 AF/0.432 km³ averaged over 5-year periods from named tributaries. In event of extraordinary drought, the deficit is to be made up in following 5-year cycles.
- **Interstate Water Compacts (US):**
 - Pecos River Compact – This compact allocates waters of the Pecos River between Texas and New Mexico, based on an agreed intra-state formula.
 - Rio Grande Compact – This compact allocates flow from the headwaters of the Rio Bravo in Colorado throughout New Mexico to Elephant Butte Reservoir to Texas, New Mexico and Colorado on an agreed intra-state formula.
- **General Law on Ecological Equilibrium and Environmental Protection (Mexico):** This law details what the Mexican government does to better preserve and restore the environment. It is intended to protect all natural environments, rivers, promote biodiversity and for Mexico to achieve a sustainable environment, and work towards controlling contaminants.
- **National Water Law (1934 Ley de Aguas Nacionales; Mexico):** This law is the legal framework for all water usage and all revised water policy in Mexico. It establishes the fundamental law for the use of national waters. It is applicable to all national waters, whether surface water or groundwater, in addition to the Mexican marine zones. Modifications establish that the coordination, realization, and administration of water resource management actions by basin or hydrologic region be done through Basin Councils, with participation and commitment of the three levels of government, water users, private individuals, and community organizations.

- **Clean Water Act (US):** An outgrowth of the Federal Water Pollution Control Amendments of 1972, the Act is the primary US federal law governing water pollution (it does not deal directly with groundwater or water quantity issues). It employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff, as a means of addressing its broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. It established the goals of eliminating releases to water of high amounts of toxic substances, eliminating additional water pollution, and ensuring surface waters would meet standards necessary for human sports and recreation.
- **National Environmental Policy Act (NEPA):** Passed in 1969, NEPA represents the US national policy for the environment. Recognizing the profound impacts of human activities (population growth, high density, urbanization, industrialization, resource exploitation, etc., as well as the critical importance of restoring and maintaining environmental quality to the overall welfare and development of US citizens), the purpose of NEPA was to: (i) declare a national policy encouraging productive and enjoyable harmony between humans and the environment; (2) promote efforts to prevent or eliminate damage to the environment and biosphere and simulate the health and welfare of humans; (3) enrich understanding of ecological system and natural resources important to the nation; and (4) establish a Council of Environmental Quality.

Relevant International Institutions and Programs

In addition to the national-level organizations and activities focusing on the Rio Grande Basin, there also are several major international organizations and programs relevant to development and implementation of an integrated management approach for the Rio Bravo, as encompassed within the proposed SAP (Appendix 25). These organizations and programs provide institutional linkages on an international basis, and enhance the ability of the two riparian countries to manage the Rio Bravo for sustainable use, including the following:

- **Commission on Environmental Cooperation (CEC):** Complementing the environmental provisions of the North American Free Trade Agreement (NAFTA), the CEC is an international organization created by Canada, Mexico and the United States under the North American Agreement on Environmental Cooperation (NAAEC). It was established to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law. Among other features, the CEC was the first intergovernmental agency for environmental protection established to accompany a commercial pact.
- **International Boundary and Water Commission (IBWC; the Mexican section of IBWC is called La Comisión Internacional de Límites y Aguas (CILA)):** The IBWC is an international body responsible for applying the boundary and water treaties between Mexico and the USA, and settling any differences that may arise in their application. Its mission is to apply the rights and obligations assumed by Mexico and the United States under numerous boundary and water treaties and related agreements in a way that benefits the social and economic welfare of the peoples on both sides of the boundary and improves relations between the two countries, including such issues as boundary demarcation, national ownership of waters, sanitation, water quality, and flood control in the border region.
- **Border Environment Cooperation Commission (BECC):** The BECC is an international organization created by the Mexican and US Governments under side agreements to the North American Free Trade Agreement (NAFTA). BECC's mission is to help conserve, protect and enhance the environment in the Mexico-US border region, through developing and certifying environmental infrastructure projects incorporating innovative sustainability and public participation concepts. BECC's mandate addresses water pollution, wastewater treatment, and

municipal solid waste management projects, including issues such as hazardous waste, water conservation, water and sewer system hookups, and waste reduction and recycling. Air quality, transportation, clean and efficient energy, and municipal planning and development projects (including water management) have subsequently been added to BECC's mandate.

- **Border 2012 Program:** The 1983 Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area (La Paz Agreement) is the legal basis for this bi national collaborative programme. With active participation of 10 Mexican and US border states, and US tribal governments, the US Environmental Protection Agency (EPA) and Mexico's Secretariat of Environment and Natural Resources (SEMARNAT), in partnership with the US Department of Health and Human Services (HHS), the Mexican Secretariat of Health (SS) and other federal agencies, the goal of the Border 2012 Program is to improve the environment, and protect the health of people living along the common border, consistent with principles of sustainable development. The program focuses on providing safe drinking water, cleaning the air, reducing risks of exposure to hazardous waste, and ensuring emergency preparedness along the border region.

2.5. Stakeholder mapping and analysis

Development of this project document was preceded by a rapid assessment of the environmental and socio-economic characteristics of the Rio Bravo, which provided an initial knowledge base for development of the Rio Bravo PPG. Other ongoing border region activities and stakeholders have provided information and other inputs for development of this project, including the Mexico-US Border 2012 Program, and the activities of the Boundary Environment Cooperation Commission (BECC) and the International Boundary and Water Commission (IBWC). A full stakeholder listing and analysis also is a key element of the Rio Bravo Basin Project within the TDA/SAP process. In fact, the Rio Bravo Project was designed with a goal of involving a broad range of stakeholders at different stages of the project, beginning from the identification of the basin vision, through data and information gathering and analysis within the TDA and causal chain analysis, to the final agreement and implementation of the SAP. The project also will bring together scientists, municipal, state and national government officials and administrators, agricultural specialists, river basin inhabitants, NGOs, and other stakeholders in a collaborative effort to improve the possibilities for sustainable use of the Rio Bravo throughout its basin, including addressing the needs of the poor and facilitating environmental sustainability.

The project also attaches great importance to gender equality as a critical component of a transboundary management effort directed to sustainable use of the Rio Bravo. The IWRM-based approach envisioned within the development of a basin-wide TDA, and subsequent development and implementation of a Rio Bravo SAP, will ensure a gender-sensitive approach for achieving the overall project goals, as well as ensuring project outcomes of better quality, validity and utility. Whether or not they are readily evident, gender differences often exist when human beings are directly or indirectly involved as stakeholders. Thus, this issue will be considered and addressed under the supervision of the PCU and Project Steering Committee as an integral part of the project to ensure the highest level of quality in the project's outcomes. In fact, consideration of gender issues within the context of sustainable transboundary water system management efforts, such as those to be undertaken in the Rio Bravo Basin, elevates gender involvement to the status of a type of socio-economic indicator for assessing achievement (or not) of project activities and outcomes relevant to sustainable use of the Rio Bravo. Accordingly, gender-related issues will be integrated in all components and sub-projects to assist with gender mainstreaming throughout the project. Specific expertise will be retained to guide the stakeholder analysis and understanding the different needs of both women and men in the Rio Bravo Basin in regard to its water resources.

Further, in addition to the key ministerial stakeholders (SEMARNAT; US EPA), the Rio Bravo Project will engage representatives from local government, educational institutions, non-governmental

organizations, civil society and industry. A Sub-Project (Communications, Outreach and Information Exchange, Appendix 23) will focus on identification of basin stakeholders, developing a stakeholder database, and a communication strategy for multi-stakeholder participation, to be involved at all key stages of the TDA/SAP process. This approach will also be of value to the post-project mechanisms (e.g. Basin-wide cooperation) for co-ordinating activities and management with the basin.

2.6. Baseline analysis and gaps

There are multiple problems related to water resources and ecosystem health in the Rio Bravo Basin. A significant number of programs have been implemented to address elements of these problems. However, many of these issues have been addressed within each country, and on a limited scale. The resulting lack of co-ordinated and integrated action has resulted in few basin-wide improvements or mitigations.

The problems have been highlighted in recent Rio Bravo Rapid Assessments conducted under the PPG stage. This highlighted the problems of water quantity, water quality, ecosystem status, legal and institutional arrangements, and presented gaps in current knowledge, although the lack of accessibility to data and large scale (lack of fine detail) of the data in Mexico is still to be considered as a significant gap in the available information. However this Rapid Assessment provides sufficient information to provide an initial baseline analysis of the situation in the Rio Bravo Basin and to highlight some key gaps in information to be addressed through this current project. The baseline will be further refined during the inception phase of the project and through the activities of the TDA when the present situation and status will become clearer as a result of data collected from the targeted research and the finer detail that will be obtained from the pilot demonstration sites.

Key issues identified in the Rio Bravo Rapid Assessments include the following:

- **Water Quantity:** The Rio Bravo Basin suffers from continuing drought events, sometimes lasting for many years. The Rio Bravo also is subjected to significant water abstractions in many places along its main stem for agricultural irrigation and domestic water supply, particularly in the lower Rio Bravo Valley. The available data indicate that 96% of the average annual flow has already been allocated to various water uses along the course of the river. On a basin scale, it is estimated that about 88% of the allocated water is devoted to agricultural activities, while about 11% of the water is allocated for municipal use. Further, a number of artificial structures have been built to assist the IBWC/CILA carry out its water allocation responsibilities. It also is noted that altered river flows and historically-normal flooding conditions, has contributed to the replacement of mesic riparian wooded areas with xeric plants (e.g., mesquite tree). Further, the lack of periodic flooding has required native vegetation to adapt or be replaced with non-indigenous vegetation. Thus, the quantity of water within the Rio Bravo has been significantly affected by both climate and physical features, as well as by non-structural legal instruments and related international, national and state agreements and allocations.
- **Water Quality:** The water quality in the Rio Bravo Basin was assessed during 1993 – 1995 in two studies, one concentrating on the portion of the river from its headwaters through Ciudad Juarez, Chihuahua/EL Paso, Texas. The general water quality concerns focused on pollutants from urban centers (waste water; organic chemicals), agriculture (fertilizers and pesticides); mining (trace elements). Although not part of the above study, the basin also receives nitrate and phosphorus in atmospheric deposition. Microbial impairment, believed to be linked to municipal, agricultural and livestock operations along the river, was measured in river water in New Mexico, with particularly high bacterial levels in the Rio Bravo in southern New Mexico above Las Cruces, and in Texas upstream of El Paso. The impacts of discharges or emissions from the abundance of maquiladoras (product assembly plants) along the border are unknown, although accurate assessment of these discharges is vital to successful management of the basin waters.

- **Biological Resources:** The natural heritage of the Rio Bravo basin is believed to be unmatched by any desert riverine system in the world. Nevertheless, habitat degradation resulting from invasive species, land use changes, climate change, and other human influences are having a severe impact on the vulnerable flora and fauna in the Rio Bravo basin. Fish biodiversity, for example depends on water flow rates, temperature, and hydrologic modifications to their habitat. Non-aquatic animals require healthy riparian vegetation for access to water and food along the river and, in turn, are a food source for larger organisms. The lower river basin valley, from the cities of Ciudad Acuña/Del Rio to the Gulf, is considered one of the most biologically diverse regions in the world. The 1100 species of plants in the lower valley make it possible for the wildlife to flourish. Millions of migratory birds stop to feed and rest along this portion of the river as it is on the main pathway for seasonal migration, being considered one of the best bird-watching locations in the world, with 485 documented species. Reptiles and amphibians thrive in the wetlands throughout the basin, including many sea turtles, freshwater turtles, lizards, snakes, frogs, and salamanders. There are thousands of species of invertebrates throughout the basin, and with 199 species of butterfly in the Big Bend region alone.

Degradation of river water quality and riparian vegetation in the Rio Bravo Basin, however, has changed significantly over time. Approximately 7% of the birds and mammals and 20% of the fish are listed as threatened or endangered species, including the bald eagle (*Haliaeetus leucocephalus*), Gulf Coast jaguarundi (*Herpailurus (=Felis) yagouaroundi cacomitli*), star cactus (*Astrophytum asterias*), Mexican long-nosed bat (*Leptonycteris nivalis*), Rio Grande silvery minnow (*Hybognathus amarus*), Walker's manioc (*Manihot walkerae*), and black-footed ferret (*Mustela nigripes*). Causative factors include construction of dams and channels, overgrazing throughout the basin, variable water flow rates, urbanization, ecosystem fragmentation, and introduction of non-native species. Hydrologic modifications and exotic species have even proven fatal to certain populations, to the point of causing species extinction. Altered flooding regimes, overgrazing, infrastructure projects, and increased irrigation-related salt levels, have altered the sensitive riparian vegetation dynamics and communities overall. Few undisturbed, natural communities remain in the lower portion of the Rio Bravo Basin. The final 48 km of the Rio Bravo is a tidal river system, with the offshore portion of the Gulf of Mexico directly influenced by the river's freshwater discharge plume comprising the Rio Bravo estuary system.

- **Agricultural Activities and Water Use:** With agricultural irrigation comprising more than three-fourths of all water abstractions in the Rio Bravo Basin, it is no surprise that irrigation methods have affected the river's health and sustainability in supplying water to regions within both riparian countries. The Rio Bravo originates as snowmelt from the San Juan Mountains in Colorado. It supplies water to two nations: three states in the United States and five in Mexico. It is crucial that the irrigation methods in Colorado and New Mexico, the states using the river for irrigation first, begin to focus more on conservation. Since 1922, these regions have used flood or furrow techniques for irrigating crops. This type of irrigation floods the fields of crops and leads to evapotranspiration as well as run-off from fertilizers that are leached into the water table. Many farmers do not know how much water their crops actually need, and through flood irrigation many cubic feet of water are lost. More water meters as well as other techniques such as drip irrigation could curb this problem. Drip irrigation requires more equipment but allows for a controlled drip of water directly to each individual plant. Water loss is low and the plant is able to more efficiently use the water. Cost is the main reason that many farmers in New Mexico and Colorado cannot practice more conservative water measures.
- **Tourism Potential in Lower Rio Bravo Valley:** In contrast to the consumptive use of water for agricultural irrigation, the lower Rio Bravo Valley National Wildlife Refuge system is the area's major attraction for wildlife watchers of all types, with birdwatchers accounting for the

large majority of the total. In fact, the Lower Rio Bravo Valley has been rated as second best bird watching region in the entire US, boasting a unique array of species that number in the hundreds. Accordingly, such “ecotourism” accounts for well over half of Texas’ entire tourism industry, contributing an estimated US\$ 25.4 billion of the total funds realized from such activities. An estimated 200,000 annual ecotourists visit the Lower Rio Bravo Basin, as well as at least 150,000 part-time residents (so-called “Winter Texans”), resulting in about 19,000 people in the region being employed in tourism-related jobs. Accordingly, businesses and municipalities in the Lower River Bravo Valley have embraced the influx of tourists and money by developing and expanding recreational opportunities, particularly for the bird-watching community. A downside of any ecotourism activity is the reality that, although such activities are meant to be “environmentally-friendly,” when increasing numbers of individuals want to visit, view or otherwise congregate in specific environmentally-sensitive regions, there always is a serious potential for environmental impacts resulting from increasing resource demands to satisfy tourist needs (e.g., housing, food, water, waste disposal space). Thus, maintenance of environmental quality, and the need to ensure that the ecosystems that support such “nature-based” activities, is a major concern related to the sustainability of ecotourism activities.

- Increasing Rio Bravo Basin Population:** The availability of water in the Rio Bravo Basin will obviously be a factor of domestic water supply demands as well as agricultural irrigation. To this end, the Rio Bravo Basin has one of the fastest growing populations in both riparian countries. The states on the Mexican side of the border (Coahuila, Chihuahua, Nuevo Leon, Durango and Tamaulipas) contain more than 14.5 million (although this figure includes the entire state populations, rather than that portion lying only within the Rio Bravo Basin), while there are an estimated 4.3 million people living in the US portion of the basin. There are 7 major Mexico-US city pairs along the international border, with the largest urban concentration being in the Ciudad Juarez, Chihuahua/El Paso, Texas region, which totalled 2.2 million residents in 2006. Based on Mexican census data, the population on the Mexican side of the river increased 22%, to almost 9.5 million between 1990 and 2000. The US side of the border exhibited a 29% population increase during the same period. The annual growth rate exceeds 3% in most of the basin’s largest cities, with the lower Rio Bravo Basin facing a predicted population increase of 175% between 2000 and 2050. It is noted the state of Texas has more than 2.5 million people living in close proximity to the Rio Bravo Basin, with the majority living in the Lower Rio Bravo Valley. The water resources of the Valley residents, which exhibits the lowest per capita income for the entire state of Texas, exceeds the quantity of water that can be allocated from the river annually on a sustainable basis. The situation is similar on the Mexican side of the Lower Rio Bravo Basin. Increasing industrialization of the border region is contributing substantially to the population boom in the Rio Bravo Basin. Further, such topics as water rights and laws are outdated; being inadequate to protect the environmental health of the Rio Bravo, particularly in view of the related sanitation and human health issues associated with the high population numbers in the Rio Bravo Basin.
- Increasing Industrialization:** A major factor contributing to the rapidly-growing urban population in the Rio Bravo Basin is the increasing economic development and industrialization associated with the North American Free Trade Agreement (NAFTA), including the 1,400 product assembly plants (maquiladoras) and related economic activities associated with the Agreement. To this end, the Texas-Mexico border is one of the most rapidly-growing regions in both countries. Most people live in or near the numerous twin cities along the border that share social, environmental and economic interests. The maquiladora industries that have been the impetus for migration from the interior of Mexico to the border region, however, are not adequately monitored, and the extent of their compliance with environmental regulations is unclear. Based on data from the Mexican National Commission on Water (CNA), for example, industry in the states of Chihuahua, Coahuila, Durango, Nuevo Leon, and Tamaulipas annually

discharge an estimated 1,540,000 tons of waste. The number of municipal sewage treatment plants in the region also is inadequate. In addition to the pollution aspects associated with increasing industrialization, industrial consumption of water also is increasing. The environmental impacts associated with increasing industrialization require considerable additional study on both sides of the border.

- **Border Security Wall:** A topic of some political sensitivity on both sides of the Rio Bravo is the construction of a so-called “security wall” as a physical barrier to illegal immigration from Mexico to the US. The geopolitical ramifications notwithstanding, there are legitimate environmental concerns associated with the construction of the wall. The proposed location of the Mexico-Texas portion of the wall is in Starr, Hidalgo and Cameron counties in the lower Rio Bravo Valley. This region contains the ‘South Texas Brush Country,’ lying in a semi-arid, sub-tropical region of the Rio Bravo Basin. Although this region previously supported extensive communities of Texas Palmetto (*Sabal mexicana*), Montezuma bald-cypress (*Taxodium mucronatum*), and Ebony-Anaqua (*Pithecellobium ebano-Ehretia anacua*) woodlands, the region now mainly supports crops and thorny shrub species as a result of anthropogenically-related land use and management changes.

The required infrastructure for the Lower Rio Bravo Valley portion of the wall would consist of 21 sections of fence, patrol roads and access roads, with individual sections of fence ranging from 1 to 13 miles (1.61 to 20.92 km) in length, and located primarily in the vicinity of the Texas cities of Roma, Rio Grande City, McAllen, Progreso, Mercedes, Harlingen, and Brownsville. The footprint of the fence will permanently impact hundreds of acres of land. Vegetation clearing/removal and wall construction activities could result in the direct take of a number of terrestrial and aquatic species including rare and protected species. Perhaps less obvious and more difficult to measure, but nevertheless potentially more harmful than the fence’s footprint, would be the increased fragmentation of wildlife habitat associated with the construction of the 15- to 18-foot (4.6 to 5.5 m) tall fence. Adverse impacts to wildlife could result from prevention of movement or migration between food, cover, and breeding locations on both sides of the border.

Against the background of such transboundary environmental and human issues, the degradation trends being experienced in the Rio Bravo Basin under the baseline scenario cannot be addressed in the absence of an integrated, sustainable approach. Without such an integrated, holistic and Basin-wide management approach, environmental stresses on the basin ecosystems will continue to intensify. The increasing stresses on the ecosystem from above-noted population growth, increases in agriculture pressures and industry will continue to threaten the delicate ecosystem through further demands on the already limited water resources and pollution. In addition, potential climate change impacts are likely to further exacerbate the current stressed system.

This project, offering a detailed assessment of the basin, leading to an agreed Strategic Action Programme for the Rio Bravo Basin, is urgently required. It will identify the steps necessary for an integrated management approach and vision for the basin shared by both the governments of Mexico and the U.S.

2.7. Linkages with other GEF and non-GEF interventions

The 2002 World Summit on Sustainable Development (WSSD) emphasized water as a limiting resource for sustainable development, affecting not only the human populations and their economic activities but also the natural resource base underlying these economic activities and sustaining human life. For this reason, the Summit specifically called upon participants, in paragraph 26 of the Plan of Implementation, to develop integrated water resource management plans at the national and regional levels. To facilitate the preparation of such strategies, plans and programs, the Summit called upon governments and international agencies to support the development of integrated water resources management plans as a matter of

urgency. Consequently, the GEF identified issues of water scarcity and competing use of water resources, especially those resulting from climatic fluctuations, as the strategic priority for International Waters.

In facilitating development of an integrated ecosystem based management for the transboundary Rio Bravo Basin, this project is consistent with the GEF IW Strategic Objective 1. The proposed project compiled under GEF IW Strategic Programme 3 (Balancing Overuse and Conflicting Use of Water Resources in Transboundary Surface and Groundwater Basins) aims to assist the Rio Bravo Basin to: (i) identify transboundary water resource and ecosystem management problems, (ii) formulate possible solutions, (iii) agree measures to reduce the stress in the basin, and (iv) identify measures of a preventative nature within the context of climate change and variability. These measures (policies, programs and actions) are necessary to reach the 2015 Millennium Development Goals (MDGs) as agreed at the WSSD.

The existence of several basin organizations that focus on specific Rio Bravo border issues (e.g., above-noted IBWC, BECC, Border 2012 Programs) will facilitate achievement of project goals. The proposed IWRM approach also will facilitate inter-linkages between sustainable water resources and biological diversity, two related issues within the context of addressing equitable, sustainable use of the scarce water resources of this transboundary river basin. The project also may aid in achieving an integrated coastal area-river management plan, potentially coupling it with the work embodied in the ongoing UNIDO-GEF Gulf of Mexico Large Marine Ecosystem project (GOM LME). In addition to consideration of freshwater-coastal area hydrological issues at the river mouth relevant to the GOM LME, the Rio Bravo estuary is biologically productive in its own right, being home to an indigenous species of hypersaline-tolerant oysters (*Crassostrea equestris*). Fish species with tropical affinities reach their regular northern occurrence in the western Gulf of Mexico, including snook (*Centropomus undecimalis*) and tarpon (*Tarpon atlanticus*). The ecological health and integrity of this fragile estuary is extremely dependent on quantifiable target freshwater inflows from the Rio Bravo. Such interfaces could facilitate mutually-beneficial institutional mechanisms between the Rio Bravo project and the GOM LME, including formation of joint steering committees/working groups and complementary joint activities between the two projects.

SECTION 3: INTERVENTION STRATEGY (ALTERNATIVE)

3.1. Project rationale, policy conformity and expected global environmental benefits

The Rio Bravo Basin Project will contribute to addressing the above described serious environmental concerns in the region caused by excessive and insufficiently regulated use of water resources and the impacts of pollution from agriculture, industry and inadequate municipal waste water. These issues have impacts on both the ecosystem and potentially human health.

The project will follow the proven approach of developing an agreed Transboundary Diagnostic Analysis that identifies the key issues of transboundary concerns. In parallel to this, and with broad stakeholder involvement, a vision for the future use and management of the Rio Bravo Basin will be developed (Appendices 16, 20). These activities will lead to the preparation of a Strategic Action Programme incorporating lessons and results from a targeted research projects that are designed to supplement the available knowledge in the TDA (Appendices 18, 25). The SAP will benefit from the results of a series of pilot projects where a range of potential solutions to the key concerns of transboundary importance will be tested (Appendices 21, 22).

The overall outcome of the project will be the improved integrated management of the Rio Bravo Basin that will benefit both the ecosystem and the people of the region. The experiences and lessons learned from this project also will be of benefit to transboundary water systems being used in an unsustainable manner in arid and semi-arid regions in other locations in the world.

The proposed project is closely aligned to and conforms to GEF International Waters Strategic Objective 1 (SO-1) and SP-3. Developing and implementing an ecosystem-based management program for the Rio Bravo, a transboundary river of major economic and ecological importance to both Mexico and the US, will facilitate the equitable, sustainable use of the river's limited water resources for meeting both

human and nature's water needs. In addition to being a region of rapid population growth, and of both agricultural activities and industrial development, the Rio Bravo Basin is believed by some to be unmatched by any desert river system in the world, possessing a mosaic of important terrestrial and aquatic habitats along its length, including riparian forests, mudflats, salt marshes and small freshwater lakes. Some of the species in these habitats are found nowhere else in the world. Thus, developing and implementing a basin-scale, ecosystem-based management plan for the sustainable use of this transboundary basin will have global environmental benefits related to conservation of unique biological diversity. The freshwater-coastal connections at the mouth of the Rio Bravo also will be relevant to the ongoing GEF-UNIDO Gulf of Mexico Large Marine Ecosystem (GOF LME) project. More efficient agricultural, municipal and industrial water use throughout the basin also will facilitate transboundary benefits for the basin inhabitants. Increasing the availability of the limited freshwater resources to the continually-increasing basin population in this arid region of both riparian countries, by developing and implementing an integrated, basin-wide management program, also will facilitate the maintenance of the terrestrial and aquatic ecosystems dependent upon the river's waters, thereby enhancing the transboundary economic benefits to be derived from maintaining and restoring these ecosystems, as well as helping to alleviate the poverty that characterizes much of the population in this important bi-national basin.

The analysis undertaken by a TDA and then incorporated in the SAP with subsequent implementation is important in this water stressed region. In addition the measures adopted to reduce pollution loads (including nutrient pollutants) will have a positive impact on the Gulf of Mexico – a region that has been heavily impacted by nutrients in the past.

3.2. Project goal and objective

Overall Project Objective: The overall objective of this project is to formulate a comprehensive, bi-national, ecosystem-based action programme, based on the principles of integrated water resources management (IWRM), for the management and sustainable use of the Rio Bravo throughout its basin, and to create the necessary enabling social-economic and policy mechanisms for implementing the agreed action programme and engendering the necessary reforms. This will be achieved with the development and implementation of a Strategic Action Programme (SAP) for the Rio Bravo Basin, based on analyses and synthesis of the results of all sub-projects and available hydrological, climate, bio-geophysical, institutional, legal, economic, social, cultural and political data and information. A related objective is to consider the possibility of a permanent cooperation mechanism of some type to further the long-term objective of sustainable use of the Rio Bravo.

The successful achievement of this objective will deliver four substantive outcomes:

- **Outcome 1:** Enhanced understanding of the stakeholders Vision for the Rio Bravo Basin leading to revision and acceptance of the SAP. Enhanced understanding of the national and regional, legal and institutional frameworks and options for a joint basin-wide cooperation mechanism (Appendix 16)
- **Outcome 2:** Improved understanding of the natural resource base and threats to the ecosystem in the Rio Bravo Basin
- **Outcome 3:** Basin-wide ecosystem based management approaches strengthened through the successful completion of Pilot Projects (Appendices 21, 22)
- **Outcome 4:** Basin counties agreement and commitment leading to, (i) policy, legal and institutional reforms to address the priority trans-boundary issues at the regional / national / local levels, and (ii) the required profile of structural measures to achieve the Rio Bravo Basin Vision

These outcomes will be realised with the significant contribution of the successful outcome of:

- **Outcome 5:** Effective project co-ordination, management and oversight (Appendix 26)

Although the project is focused on a TDA/SAP preparation (a ‘process’) the planned pilot projects will deliver clear stress reduction benefits and an improvement to the environmental status of the region (Appendices 21, 22). The project will encourage the replication of the successful pilot projects, **within the lifetime of the Rio Bravo Basin Project**, to further demonstrate and highlight the benefits of the approaches. These successes will be captured for wider dissemination as Experience Notes of lessons learned through GEF-IW:LEARN. The proposed M&E plan will monitor and report the success of the project against agreed Process, Stress Reduction and Environmental Status Indicators (Appendix 27). Additional outcomes of the pilot projects will include strategies for pilot and basin wide project implementation, including identification of critical areas that would potentially benefit from further research (Appendices 21, 22).

The SAP is intended to inform comprehensive and coordinated actions by governments, non-governmental organizations, and stakeholders to implement common integrated water management measures in the transboundary Rio Bravo Basin. It addresses the key issue identified in the Transboundary Diagnostic Analysis (TDA), including the results of the Rio Bravo vision formulation (Sub-Project I.1); the analysis of the legal and institutional mechanisms (Sub-Project I.2); the results of the targeted research activities (Sub-Project II.1) and the communications, outreach and information exchange strategy (Sub-Project III.3) (Appendices 16-18, 20, 23).

The finalised SAP will be endorsed at Ministerial level for subsequent implementation. The implementation is expected to provide significant further stress reduction resulting in environmental status improvement across the whole basin and will also benefit the wider environment and livelihoods of the population in the region.

3.3. Project components and expected results

The Rio Bravo Basin Project will be implemented through five components each with a number of Sub-Projects. Detailed information regarding the Sub-Projects is presented in Appendices 16-20. The proposed workplan and timetable of the Rio Bravo Project is given in Appendix 5. A summary of the main activities and outputs for each sub-project is presented below for the Components of the Rio Bravo Basin project.

The Rio Bravo Basin Project foresees five closely linked Components which are carefully designed to meet the overall project objective (below):

- **Component I: Understanding the Rio Bravo Society.** This component will deliver a common vision for the future and sustainable use of the Rio Bravo throughout its basin, and assess the options for harmonising legislation and institutions in the basin, including the possibility of considering the development of a Basin-wide Cooperation Mechanism. These activities will be central to ensuring agreement regarding the final Strategic Action Programme and development of a communication strategy for the basin.
- **Component II: Understanding the Natural Resource Base.** This component will prepare a Transboundary Diagnostic Analysis, on the basis of existing data, as well as the results of pilot projects and targeted research studies to address gaps identified in the Rio Bravo Rapid Assessments, all to be consolidated into an Information System.
- **Component III: Response Strategies.** A Strategic Action Programme for the Rio Bravo Basin is the overall objective and output of this GEF project. This component will validate the recommendations in the SAP through a series of pilot projects and communication strategies for basin-wide stakeholder involvement.

- **Component IV: Project Management.** The component provides overall project management through a Project Co-ordination Unit (PCU) and supports the oversight of the activities through Steering Committee supervision, reports, etc. Further, the PCU will oversee development of an ‘exit strategy,’ with the support of the National Project Execution Units (NPEUs), to further improve the sustainability of the actions implemented and principles agreed through the Project.
- **Component V: Monitoring and Evaluation (M&E).** The UNEP best practices for M&E will be followed involving independent mid-term and terminal evaluation, and will enable the routine internal monitoring of progress against the SMART indicators in Appendix 7.

Component I: Understanding Rio Bravo Society.

This component will deliver a common vision for the future of Rio Bravo Basin and will assess the options for harmonising legislation and institutions in the basin, including the option of forming a Basin-wide cooperation mechanism. These activities will be central to the agreement of the final Strategic Action Programme and the development of a communication strategy for the basin.

Two Sub-Projects are foreseen under this component:

- **Developing** a shared Vision for the Rio Bravo Basin;
- **Strengthening** the legal and institution system in the basin.

A summary of these Sub-Projects is presented below. Full details of the Sub-Projects, their activities and outputs are presented in Appendices 16-20.

Sub-Project I.1: A Vision for the Rio Bravo Basin (Appendix 16)

There are numerous challenges confronting the sustainable utilization of the Rio Bravo Basin’s land and water resources as the region experiences exponential socio-economic growth and internal migratory flows and immigration. The complexity of the issues, coupled with a rapid rate of change in the environment requires the implementation of a process that will help minimize risks associated with change, and conflicts regarding the use of water and natural resources, while creating a strong foundation upon which to build a Strategic Action Program that will address transboundary water resource management concerns shared by Basin countries. Developing a solid, shared “Vision for the Future of the Rio Bravo Basin” will assist governments, the private sector, and society in general to reach a degree of consensus with respect to IWRM concerns and challenges within the overall development process of the Rio Bravo Basin, facilitating national and regional strategy formulation and policy planning.

The systematic assessment of the concerns and challenges for IWRM in the Basin calls for the application of a methodology appealing and efficient at the local, national, regional, and global levels.

This Sub-Project will serve as a basis for Sub-Project II.3.1: Transboundary Diagnostic Analysis (TDA), Sub-Project III.5.1: Strategic Action Program (SAP) and will provide inputs to Sub-Project III.4: Communication, Outreach, and multi-stakeholder participation.

This Sub-Project contains three activities:

Activity I.1.1: Preparation and Exploration

Activity I.1.1 includes three elements related to stakeholder identification and socio-economic analysis of the Rio Bravo basin:

- **Stakeholder identification.** This will begin by using the existing, effective network of Border 2012 stakeholders on the U.S.-Mexico border, the research on and findings of Rio Grande stakeholders conducted during the PDF-A's Project Rio, the U.S. government's Rio Bravo Federal Coordinating Committee's comprehensive list of U.S. agencies involved in the Rio Bravo, census data on U.S. special districts dealing with water in the Rio Bravo region, and corresponding data from Mexican experts on stakeholders for the Rio Bravo. This information will be refined and expanded upon using the existing baseline data to complete a comprehensive list of Rio Bravo stakeholders.
- **Analysis of the socioeconomic situation** in the entire Rio Bravo basin, which will be built upon the socioeconomic rapid assessment that has already been completed, with the goal of gaining knowledge of the culture and socioeconomic situation of the Rio Bravo. The analysis will include an assessment of each country's national agenda to gain an understanding of the work that is already being planned for the Rio Bravo basin. The analysis will also include an assessment of gender roles within the basin, which will be reflected in the strategy for stakeholder participation within the Rio Bravo Basin.
- **Strategy for stakeholder participation**, which will consist of at least six workshops, with at least two workshops in each of the three following regions: Colorado and New Mexico, Texas and Mexico, Rio Conchos basin. The design strategy will allow for the stakeholders to both give and receive information about the basin, and should focus on information sharing as well as encouraging active involvement.

Activity I.1.2: Stakeholder Information Sharing

Information sharing between stakeholders is integral in order to successfully have a shared vision. Overall outcomes of workshops will enhance the knowledge and understanding of the Basin. This section will also include why stakeholder involvement is important, including the importance of ensuring an assessment of gender specific issues, and why having stakeholder involvement is key in having effective solutions and an objective analysis. This stage of the project is very important to the overall success of the project activities and attention will be paid to ensure a fully participatory approach from stakeholders representing different aspect of the ecosystem and its impacts (the project will involve those who 'stress' or 'drive' the pressures on the environment such as farmers and industrial operators) as well as those who are responsible for managing the environment from government and non-governmental organizations). This will assist with the generation of a common agreed vision to the issues and demands on the basin enabling an appropriate formulation of the SAP to address these concerns and needs.

Activity I.1.2 comprises two elements:

- **Workshops:** At least six workshops, with two to be held in each of the following three regions: Colorado and New Mexico, Texas and the Mexico side of the U.S.-Mexico border, and the Rio Conchos basin. The workshops will gather information, share information on interest, needs and desires for the Rio Bravo Basin; workshops will help facilitate an agreement on a vision for the Basin; the environmental perception of stakeholders will determine the priority issues for the basin-wide workshops.

- **Analysis and Report:** Analysis of workshops and other methods decided upon in section I.3 in the context of existing policies, laws and programs in Mexico and the U.S. This will help formulate the needs of the Rio Bravo.

Activity I.1.3: Vision Formulation Phase

The purpose of this Activity is to formulate a shared vision that will guide the development of the SAP. The Vision will be discussed and agreed with stakeholders in a final workshop.

The shared vision will inform the strategies to be developed during SAP formulation for the sustainability of the Rio Bravo Basin. The SAP will consist of a multi-disciplinary approach to securing a sustainable future for the Rio Bravo Basin.

The main **outputs** of Sub-Project I.1 will be the identification of stakeholders in the basin and the agreement of a basin-wide Vision for the future of the Rio Bravo Basin.

Sub-Project I.2: Strengthening the Legal and Institutional System of the Rio Bravo / Basin-wide cooperation mechanism (Appendix 17)

Based on the recommendations of the PDF-A Project Rio workshop that took place in October 2006 as well as the legal and the institutional rapid assessments conducted in preparation of the PPG, this Sub-Project will review the institutional and legal framework of the Rio Bravo Basin countries, with a view to strengthen national institutions and legal frameworks in support of the integrated water resources management of the Basin.

In addition, this Sub-Project will explore basin-wide cooperation mechanisms by:

- **Promoting at the national level**, inter-institutional and inter-sectoral collaboration through further assessment, which is needed to fully understand the fragmented systems that manage water resources in both of the Rio Bravo countries, and through a process, which would include institutions strategizing for Inter-Departmental cooperative communications in support of basin wide water management.
- **Proposing a set of recommendations** to strengthen national institutions in support of Integrated Water Resource Management (IWRM) as well as recommendations for research to explore a basin-wide cooperation mechanism, coordinating an inter-institutional network of organizations and agencies dealing with water management issues in the basin.
- **Recommending actions** for the harmonization of existing legislative and regulatory frameworks, seeking a common framework for IWRM actions at the bi-national and basin-wide levels, and strengthening the ability of the two countries to implement basin wide programs and projects.

This Sub-Project will provide input for the formulation of the Strategic Action Program (SAP).

This Sub-Project contains two activities:

- Institutional integration;
- Harmonization of the legal framework

Activity I.2.1: Institutional Integration

National water resources management institutions of the Rio Bravo Basin countries have very different institutional histories and degrees of development. The establishment of an efficient institutional

framework for water management in the Rio Bravo Basin is paramount to support the implementation of a shared basin-wide IWRM Strategic Action Program.

Therefore, the objectives of this activity are:

- To **analyse** the national water resource institutions concerning their organizational capacities, infrastructure and human resources, and to propose strategic actions that may adapt and strengthen these institutions in support of IWRM for the basin, and
- To **explore** the creation of a basin wide cooperation mechanism.

Activity I.2.2: Harmonization of the Legal Framework

This activity, to be developed in parallel to Activity I.2.1, seeks to identify the existing gaps and inconsistencies in the legal frameworks currently in force in Mexico and the U.S. in relation to the management of water resources in the Rio Bravo Basin, and to identify a common framework for IWRM actions at the national and basin-wide levels, strengthening the ability of countries to implement basin-wide programs and projects.

The activity is comprised of three major elements:

- **To establish** a working group of water, environmental, and comparative law experts, and acquisition of statutory and constitutional data with respect to national and international regulations and laws relevant to IWRM in the Basin;
- **To conduct** targeted workshops at the national level to identify gaps and inconsistencies in the existing legal frameworks, proposing necessary refinements to implement the principles of IWRM within the two Basin countries;
- **To establish** an international task force made up of legal experts and authorities to analyze the feasibility of the a proposed set of refinements in the legal norms and regulations and their acceptability to both countries' inputs to the TDA and SAP, designed to promote harmonization of the various legal frameworks extent within the Basin.

The main **outputs** of Sub-Project I.2 will be analysis of existing legal and institutional structures leading to the formation of an international task force and recommendations for a revised structure for IWRM in the basin as an input to the SAP.

Component II: Understanding the Natural Resource Base

This component will prepare a Transboundary Diagnostic Analysis on the basis of existing data and the Targeted Research designed to address gaps identified in the Rio Bravo Bio-geographical Rapid Assessment. This data and information will be consolidated into an Information System for the Rio Bravo Basin.

Three Sub-Projects are foreseen under this Component:

- Four Targeted Research Projects, addressing water quality, human health impacts, agriculture impacts on water quantity and quality and groundwater resources
- Development of an Integrated Information System for the Rio Bravo Basin
- Formulation of an agreed Transboundary Diagnostic Analysis (TDA) for the Rio Bravo Basin.

Sub-Project II.1: Targeted Research (Appendix 18)

The hydrologic reality in this water-stressed region is that the waters of the Rio Bravo are not being used by Mexico and the United States in an equitable and sustainable manner. One reason is the occurrence

of periodic droughts and floods, associated with extremes of climatic variability. Further, extensive agricultural activities have been undertaken by both countries in the lower Rio Bravo Valley. In addition, the basin contains a continually-increasing population along both sides of the Mexico – U.S. border, including that in the informal colonias, along the border that depend on the Rio Bravo for drinking water. Aquatic ecosystems along this transboundary river system are being stressed in many places from its headwaters to its mouth at the Gulf of Mexico. In fact, the river has ceased flowing to the Gulf of Mexico several times in recent years because of diminished flows, resulting in the formation of a sand bar across its mouth. A fuller understanding of the actual quantity of readily-available water, both surface and underground, is essential to developing a long-term, mutually-satisfactory resolution to the current and possible future water shortages in the Rio Bravo drainage basin, and to sustaining the coastal zone and riverine ecosystems adversely affected by variable river flows.

Four specific issues of concern were identified during the project preparation phase. These four issues of concern are:

- Water quality;
- Linkages between environmental and human health;
- Agriculture’s impact on water quantity; and,
- Non-sustainable groundwater pumping in the transboundary and Rio Conchos regions.

The four research activities have been identified for targeted research in this area and will provide the necessary scientific knowledge to be used in the formulation of the Transboundary Diagnostic Analysis (TDA).

There are four activities planned under this Sub-Project on targeted research.

Activity II.1.1: Improved Knowledge on Water Quality

From two assessments of Water Quality in the Rio Bravo in 1993 to 1995, general contributors to water quality deterioration in the Rio Bravo were found to be: urban centers polluting through waste water, organic chemicals, and water temperature change; agricultural operations contributing fertilizers and pesticides to the water body; and, mining polluting by contributing trace elements. The Rio Bravo in southern New Mexico below Las Cruces and in Texas upstream of El Paso is impaired for contact recreation. The sources of high bacteria levels are unknown, although they are believed to be linked to municipal, agricultural and livestock operations along the river, as well as possible groundwater sources. Water quality directly affects health of humans, and health of aquatic life in the Rio Bravo basin. Indeed, a significant amount of research on water quality has been produced on many parts of the Rio Bravo but there is a lack of synthesis of this knowledge that is necessary to conduct a TDA that will provide a more accurate basin-wide base of knowledge.

This activity comprises four major elements:

- **Undertake desktop research and data mining** concerning industry’s water consumption and as contributor of pollutants;
- **Assess the impacts** of increased non-point pollution by urbanized/unincorporated towns or colonias;
- **Assess the impacts** of point source discharges; and,
- **Improve knowledge** of the Rio Concho’s water quality and quantity.

The results of this activity will provide necessary input for TDA formulation, to Sub-Project III.3 Integrated Information System and the SAP (Appendices 19, 20, 25).

The output of this research project will be an improved knowledge and data analysis of the Rio Bravo's water quality in the transboundary region and the Rio Conchos Basin.

Activity II.1.2: Identify linkages between environmental health and human health

Health of a population is usually indicative of the environmental health of the region. Over the last century, the Rio Bravo basin has experienced rapid population growth and economic growth which has drastically altered the surrounding ecosystem. In rural and underdeveloped settings, education regarding safe practices (including hygiene, proper waste disposal and minimizing exposure to illness) is limited or non-existent. The resulting challenge is to increase the public's knowledge about water borne illness and contamination of drinking water supplies that will improve not only public health, but water quality. Assessing risks and implementing sustainable growth policies to protect the environment and quality of life greatly increase in complexity along international borders, where social services, environmental regulations, lifestyles, and cultural beliefs are unique for each country.

This activity comprises two elements:

- The **design of strategic collaboration** between existing Border Health Initiative and bi-national state agencies; and
- **Research and identification** of areas of concern.

The results of this activity will provide necessary input for TDA formulation and the SAP (Appendices 20, 25).

The output of this research project will be an expanded GIS dataset and a report that will each support environmental/human health studies by expanding the Border Environmental Health Initiative to include the border area of the basin between Nuevo Laredo/Laredo and Ciudad Juarez/El Paso.

Activity II.1.3: Improved knowledge of agriculture-irrigation/conservation practices

The vulnerabilities of Rio Bravo Basin were recently on display for the last several years, as a deep and persistent drought in northern Mexico- combined with an inadequate bi-national water management framework- led to a serious bi-national dispute over Mexico's water delivery obligations under the 1944 Treaty. Because agriculture accounts for so much water use it has been at center of this dispute. Rio Bravo Basin governments must make significant investments and provide more technical assistance to help agricultural producers reduce water use and become more competitive and efficient. These challenges are present on both sides of the border, but they are particularly acute in Mexico, where public funds available for assistance to the agricultural sector have been severely reduced over the last decades. Without government investment to help producers address water management issues, trans-boundary water crises and disputes are sure to reoccur. It is crucial that water savings from irrigation efficiency improvements are not merely used to open new irrigated acreage.

Existing data and information on the types of irrigation methods used in the Rio Bravo Basin will be utilized to improve the knowledge on the impact of different irrigation methods on water quantity in the Rio Bravo.

This activity comprises three major research areas:

- research on the types of irrigation methods used in the Rio Bravo Basin at municipio and county level;

- research on the types of crops grown and on the usage of pesticides, herbicides, and fertilizers;
- Inter-regional research on the interactions between drought and agriculture.

The results of this activity will provide necessary input for TDA formulation and the SAP (Appendices 20, 25).

The output of this research project will be a dataset on the irrigation methods employed in Rio Bravo and a report that analyzes the irrigation methods used for types of crops and the usage of chemicals for increased productivity. An additional report will be produced on the interactions between drought and agriculture.

Activity II.1.4: Groundwater-current pumping rates versus what is allowed, an information gap

Groundwater is another significant component of water resources throughout the Basin. Subsurface systems include a regional, interconnected groundwater system from southern Colorado to the border area of Mexico, New Mexico, and Texas; shallow alluvial aquifers that interact with surface waters of the main stem river; deep aquifers with more than one productive zone; and closed, saline-type basins. Eight major aquifers are considered transboundary, located across in the northern states of Mexico into the southern portions of New Mexico and Texas. Productive aquifers are increasingly pumped for irrigation, municipal, and industry uses; however, pumping is taking place typically in the absence of substantive monitoring. From evaluation of available data on both sides of the border, a major groundwater concern is overexploitation, or non-sustainable use, of these key water resources.

This activity focuses on groundwater pumping in critical groundwater-use areas of the transboundary region and the Rio Conchos Basin. Results of the rapid assessment have indicated both a lack of comprehensive data and knowledge about aquifers in these regions, and over-extraction (annual pumping volume exceeds annual recharge of the aquifer) of aquifers that are important sources of water.

The activity comprises three elements

- **Data collection** and identification of over-exploited aquifers,
- **Design** a network of observation points,
- **Evaluation** of possible solutions.

The output of this research project will include documented results of identified aquifers at critical stages of extraction through improved knowledge and data analysis of aquifers in the transboundary region and the Rio Conchos Basin; a design for implementing a network of observation points using existing wells and equipment to the extent possible; and a report of possible solutions that target sustainable groundwater pumping and a template of the process, to be utilized for other aquifer evaluations in the Rio Bravo Basin as a whole.

The overall **output** of Sub-Project II.1 will be research results focussing on key information gaps to assist with the formulation of the TDA addressing water quality, human health, irrigation, and aquifer resources.

Sub-Project II.2: Integrated Information System (Appendix 19)

This sub-project is designed to improve the water data exchange between Mexico and the United States in the Rio Bravo/Grande basin, by updating and completing the Water Management Information System

in which most of the water quantity, quality, and groundwater data for this binational basin are included in a geographically referenced bilingual relational database (i.e. a geodatabase).

In this sub-project, agencies from Mexico and the USA will cooperate to build on the results of the previous research in the basin, achieved by other Mexican and American agencies under different binational programs such as the Border 2012 program or U.S. – Mexico Border Environmental Health Initiative to accomplish three tasks:

- Update the existing relational database – geodatabase - for the Rio Bravo basin, including both water quantity and quality data;
- Create a geodatabase of groundwater information for aquifers in the Río Grande/Bravo basin;
- Create a platform to share the temporal and spatial information through Internet. This platform could be a multiuser server to allow access for multiple users simultaneously

This project will assist Mexico to develop advanced capability to manage critical water resources in the Rio Bravo/Grande basin shared with the US and in developing bi-national cooperation between Mexico and the United States, providing accurate and reliable data necessary for analysis and resolution of water resources issues.

Activity II.2.1 Design and Implementation of the Integrated Information System

The objective is to update and complete the binational geodatabase for the Rio Bravo/Grande basin, including both water quantity and quality data as well a geodatabase of groundwater information for aquifers in the Rio Grande/Bravo basin

Activities will include:

- i) In updating and completing the geodatabase for the Rio Grande/Bravo basin, data distributed on a national or state level have to be clipped to remove information outside the study area; while data distributed at a county or Hydrologic Cataloguing Unit level, had to be merged into a single and larger data set.
- ii) Entering and processing the available information into the ArcHydro Rio Grande/Bravo geodatabase. Several feature datasets (essentially, sets of data with specific characteristics in the geodatabase) would be created that include feature classes (layers of data within the feature datasets) related to each type of information.

Activity II.2.2 Create a platform to share the temporal and spatial information through an Internet portal

The objective is the creation of a WEB platform linking databases, metadata catalogues, models and user interfaces spread throughout the Rio Bravo/Grande basin within a Geographic Information System (GIS).

Activities will include:

- i) Undertaking national surveys to identify, analyze and select local databases and information sources which will be linked to the platform,
- ii) Establishing national nodes to centralize the databases and information at the basin level.
- iii) Developing the WEB platform to link the different types of databases, through national nodes, and the interface with the GIS, and using a multi-users environment.

The overall **output** of Sub-project II.2 will be a bilingual relational database (GIS) for the Rio Bravo Basin with a web access and including surface and groundwater data on quantity and quality.

Sub-Project II.3: Transboundary Diagnostic Analysis (Appendix 20)

This Sub-Project is designed to formulate the Transboundary Diagnostic Analysis (TDA) for the Rio Bravo Basin. The TDA provides the scientific basis for the actions to be identified under Component III (Response Strategies), and will serve as a vehicle for integrating the results of the bio-geophysical (including water resources, sources of pollution, ecosystem status and resources), institutional, legal, economic, cultural and political knowledge and data generated as a result of Component I, and the results of the targeted research activities (Component II), all of which are to be integrated into and synthesized with the knowledge base that currently exists within the bi-national Rio Bravo Basin.

The TDA will build on a rapid assessment conducted on the state of the basin's ecosystem and the impact from human activities in the region, including best available information on climate change scenarios that are likely to impact available water resources and water demand.

This Sub-Project will strengthen the ability of country-level institutions to implement common basin-wide programs and projects by creating a shared knowledge base upon which a common management framework for the Rio Bravo Basin can be formulated. As a particularly important outcome of this activity, it will provide the basis for subsequent management interventions to be determined through the formulation of a Strategic Action Program (SAP) for the Basin.

The approach will reflect GEF's guidance on the TDA/SAP process (www.IWLEARN.net) for IW projects.

Sub-Project II.3 comprises of three major activities, with wide stakeholder involvement through workshops at key stages, including the following:

- **Synthesis and integration** of the information and data derived from existing sources including, the Rio Bravo Basin vision formulation process (Sub-Project I.1), the results of the targeted research activities (Sub-Project II.1), the findings of the analysis of the legal and institutional mechanisms Sub-Project I.2); and other relevant inputs;
- **Analysing** the assembled data and information [1 workshop] including a causal chain analysis to identify the root and immediate **causes of** the transboundary concerns and issues [1 workshop]; and
- **Prioritising** the transboundary issues to be addressed in the SAP formulation (Sub-Project III.4) [validation workshop]

Activity II.3.1: Identification and synthesis of data and information

This activity will assemble information from previous studies, reports and ecosystem assessments (including the Rapid Assessment report). This will contribute to a knowledge database for the Rio Bravo Basin and assist with the identification of knowledge gaps. This will contribute to the integrated information system (Sub-Project II.2) as well as informing the diagnostic analysis necessary under the TDA.

Activity II.3.2: Synthesis and integration of the outputs derived from the target research and related enabling activities

In addition to the information collected in Activity II.3.1, new information from the target research activities (Sub-Project II.1) will assist with a clear understanding of the stresses and impacts on the

ecosystem further enabling the definition of a prioritised list of issues of transboundary concern. The targeted research (providing information on water quality, environment and health, agricultural impacts and groundwater abstraction) is expected to significantly advance the scientific understanding of key concerns in the basin through a Causal Chain Analysis involving stakeholders. This knowledge will again be an important contribution to the Integrated Information System (Sub-Project II.2).

Activity II.3.3: Analysis and determination of priority transboundary concerns

This activity will integrate the outputs of Activity II.3.1 and Activity II.3.2 to present the evidence and understanding of the issues of priority transboundary concern. This priority list will be discussed and agreed at a stakeholder workshop.

The overall **output** of Sub-Project II.3 will be a transboundary diagnostic analysis containing technical and socio-economic information in support of the prioritised key issues of transboundary concerns.

Component III Response Strategies

Sub-Project III.1: Pilot Projects with USA co-financing (Appendix 21)

The focus of this sub-project is the conduct of six pilot demonstration projects related to development of appropriate response strategies to address unsustainable management practices related to natural resources usage in the Rio Bravo Basin, utilizing an integrated, ecosystem-based management approach, as espoused in the development of a TDA and SAP for the Rio Bravo Basin.

The six activities under this Sub-Project are:

- Rio Bravo Basin outreach and education feasibility study;
- Web-based, bilingual, bicultural professional development approach to teaching about the Rio Bravo Basin;
- Conduct of river recreational/cultural festivals in twin urban areas along the river;
- Identification of transboundary corridors and biodiversity hotspots;
- Re-vegetation of bare soil areas adjacent to riparian corridors in the Rio Bravo Basin; and
- Integrated water resources management of refuge lands in the Lower Rio Bravo Basin.

These pilot demonstration activities address various concerns and issues identified during the project preparation process (including PDF-A Project Rio workshop), for which specific information and about specific scientific and socio-economic aspects related to the feasibility of potential interventions in the Rio Bravo Basin is required. Based upon the outcomes of these activities, specific actions and interventions elsewhere within the Rio Bravo Basin will be recommended within the SAP.

This sub-project seeks both to increase public awareness of issues and concerns related to sustainable use of the water resources of the Rio Bravo Basin, as well as to acquire additional information that can be used to address specific water-related technical issues within the Rio Bravo Basin.

Activity III.1.1: Outreach and Education Program for Rio Bravo Basin

The essential goal of this activity is to review existing outreach and education (O & E) programs in the Rio Bravo Basin, with the ultimate goal of developing, evaluating and implementing a suitable O&E program focusing on sustainable use of the water resources of the Rio Bravo throughout its basin.

Activity III.1.1 will comprise several elements, including: (1) reviewing the experiences with current O&E programs in the Rio Bravo Basin, with the goal of identifying those components most suited to the

basin's diverse socio-economic and geophysical sectors; (ii) utilizing the findings of the above-noted review as the basis for developing and implementing an O&E program suited to the whole basin, as well as portions thereof, and (iii) evaluating the feasibility of the O&E program to inform and educate the basin population, including field testing it in specified locations in the basin, with the goal of refining it as necessary.

The output will be a documented, field-tested O&E methodology to informing and increasing the awareness and knowledge of basin inhabitants, and water resources decision-makers, regarding the water-related issues in the Rio Bravo Basin, their impacts and root causes and, ideally, providing an impetus for basin inhabitants to participate in developing solutions to these issues. It is the intention that the results of this activity also be considered for elaboration within the SAP. This is expected to lead to a basin population, and water resources decision-makers that are more knowledgeable in the problems and hindrances to sustainable use of the water resources of the Rio Bravo Basin, and a greater sensitivity to the need for actions and programs to address these water-related issues.

Activity III.1.2: Web-based, Bilingual, Bicultural Professional Development Approach to Teaching about Rio Bravo Basin

Because the transboundary Rio Bravo Basin is shared by the US and Mexico, any concerns related to the condition or use of the river and its resources necessarily has a bi-national focus. Notwithstanding the cultural, social and economic differences on both sides of the border, managing the river and its resources for sustainable use requires consideration of similar issues on both sides of the border. An effective O&E program, for example, generally requires consideration of the same water-related issues, whether in the US or Mexico. Accordingly, there is a need for sensible cooperation between the countries and states that share this transboundary river system. Because of the importance of facilitating knowledge in both countries about the critical nature of this watershed and its importance to the joint cultural and economic development of this international borderland, this activity involved the development and application of a bilingual, bicultural approach, directed specifically to teachers, with the goal of enhancing their knowledge of the unique nature of watershed resources in a bi-nationally-shared river basin such as the Rio Bravo Basin.

This goal will be addressed with the production of an English and Spanish video, featuring best practice teaching techniques for high school geography, social studies, and environmental science teachers, with an area and content focus on the Rio Grande river basin. Top quality lessons, focusing on such issues as water quality and quantity, existing agreements about joint Rio Bravo water use, the environmental considerations related to runoff and wastewater, and the importance of water for municipal, industrial, agricultural, and recreation uses, will be filmed and supported with content, graphic, and pedagogic enhancements. These programs will then be offered to schools in Mexico and the US via a Web-based dissemination system.

The output will be two 30-minute professional development programs focused on critical watershed management issues in the Rio Bravo Basin, in Spanish and English. This project is under the funding and guidance of a three-party partnership, including the Grosvenor Center at Texas State University-San Marcos, National Geographic Society Education Foundation, and Agency for Instructional Technology in Bloomington, Indiana. The outcome of this activity will be well-trained teachers capable of transmitting accurate, critical information and knowledge about important water-related issues central to an understanding of the Rio Bravo Basin. It is anticipated this project also can be replicated in other locations containing transboundary river systems (e.g., Zambezi, Danube, Ganges, Congo, and Tigris-Euphrates).

Activity III.1.3: Los Caminos del Rio River Appreciation Project

Los Caminos del Rio, a non-profit organization based in McAllen, Texas, is facilitating a series of ‘river festivals,’ comprising canoe and kayak races and other river-based recreation and cultural heritage festivities to highlight the relationships between and among communities on both sides of the Rio Bravo, and also increase awareness of river shore community citizens of lifestyle changes that ultimately protect the Rio Bravo. These activities are meant to address the reality that the lower Rio Bravo basin is being degraded and overused, due at least in part to the reality that the approximately 5 million people who live on its shores are essentially alienated from the river.

This project designed to enhance understanding and appreciation of the water- and recreational-opportunities inherent in the lower Rio Bravo Basin, serving to catalyze locals ‘re-acquaintance’ and tourists acquaintance with the special amenities and features of the Rio Bravo. The effort is meant to be an image ‘make-over’ of the Rio Bravo, similar to that experienced by the Hudson River over the past 30 years through heritage-themed efforts of the Clearwater Organization.

The outputs of this project include a range of activities, including bi-national river festivals involving the twin US-Mexico city pairs of Laredo/Nuevo Laredo; Roma/Miguel Aleman; McAllen/Reynosa; and Brownsville/Matamoros, bi-national canoe and kayak races and clubs, water quality testing training programs, demonstration and training programs to promote healthy outdoor living and sustainable environmental practices, native plant nurseries, and potentially a 1:1,000,000 scale replica of the Rio Bravo Basin, to be built in a currently-abandoned water park at the geographic center of the Los Caminos del Rio Corridor. The project will result in a lower Rio Bravo shoreline population that is better acquainted and ‘in-tune’ with the features and amenities of the transboundary Rio Bravo, as well as changed perception among and between the river shoreline communities along the Lower Rio Bravo.

Activity III.1.4: Identification of Transboundary Corridors and Biodiversity Hotspots in the Rio Bravo Basin: An Umbrella Species Approach

Biodiversity conservation requires an international perspective, with the movement of organisms not recognizing national borders. Thus, biodiversity conservation requires a landscape approach irrespective of political boundaries. The Big Bend region of the Rio Bravo Basin ranks high as a biodiversity hot spot, based on its combination of species rarity and richness. In fact, Mexico is the 14th largest nation, but ranks 5th in biodiversity.

One approach to biodiversity conservation is an umbrella species approach. It is based on protecting the selected umbrella species, thereby also indirectly protecting the many other species making up the ecological community of its habitat. Much research has documented the significance and importance of large carnivores as umbrella species, noting their role in ecosystems can affect species at all trophic levels. To this end, mountain lions and black bears are the only two remaining large carnivores in the Big Bend National Park region of the Rio Bravo Basin, being a valued attraction for scientists, residents and tourists. Transboundary corridors are essential for the continued persistence of these two species in the Rio Bravo Basin.

Although the umbrella species approach to wildlife conservation is not new, few studies have evaluated its success in conservation planning. This pilot demonstration project focuses on evaluating the effectiveness of black bear and mountain lion as umbrella species, using advanced mapping techniques (geographic information systems and remote sensing) to evaluate their transboundary movement. Biodiversity hotspots also will be used to determine if biodiversity increases along corridors used by large carnivores, the latter by determining whether or not other taxa (migratory birds, desert bighorn sheep, threatened and endangered species, etc.) also use the proposed corridors.

The output of this project will be identification of transboundary corridors and associated biodiversity ‘hotspots’ associated with the movement of two umbrella species in the Big Bend National Park region of the Rio Bravo Basin. This will lead to a greater understanding of the movement of selected large carnivores in transboundary corridors increases and/or otherwise influences the characteristics of the biodiversity along the corridors

Activity III.1.5: Re-vegetation of Bare Soil Areas Adjacent to Riparian Corridors

Past research has demonstrated that vegetative cover can have major impacts on the distribution of water resources to groundwater, surface water, soil moisture, and atmospheric loss. Further, landscape-level conversion of grasslands and savannas, to woodlands or shrub lands, and increased occurrences of exotic invasive species, can both decrease groundwater recharge and sustainable surface flow. Water allocations to high-pulse surface flows and atmospheric losses also can increase with this shift in vegetation type.

To this end, this pilot demonstration project focuses on analyzing methods of re-vegetation and their impacts on vegetative cover and freshwater supplies. The geographic area of interest is the Trans-Pecos area of the Rio Bravo Basin. The project would focus on specific upland areas in important Rio Bravo sub-watersheds in Brewster and Presidio counties in Texas. Historic overuse has resulting in the proposed study areas being converted to shrub land and bare soil.

The output of this project will include a protocol for vegetation restoration for buffer area water protection in the Chihuahuan Desert portion of the Rio Grande Basin, including determination of costs and feasibility of each techniques; and reliable data on changes in available water resources resulting from vegetation management. This will lead to a greater understanding of the efficacy of re-vegetation as a restoration method for bare soils, and an agreed protocol on restoration of arid and semi-arid systems adjacent to the Rio Bravo and elsewhere.

Activity III.1.6: Restoration of Riparian Woodland Park Refuge Lands in the Lower Rio Bravo Basin

The Lower Rio Grande Valley (LRGV) National Wildlife Refuge in South Texas contains the highest diversity of birds in the US. Located in a region that is a confluence of sub-tropical climate, gulf coast, plains and Chihuahuan desert, its forest provides habitat to nearly 400 different types of birds and a myriad of other species (indigo snake; malachite butterfly; endangered ocelot; etc.). Thousands of birds fly through the area on their way to and from Central and South America, and more than 18 endemic and/or state-threatened species rely solely on this habitat for their survival. This small patch of riparian woodland is also habitat for nearly half of all butterfly species found in the US.

The flood forest requires frequent, managed flooding to protect and maintain historically mature flood forest habitat that supports “legend” trees and hundreds of species of resident wildlife. Because the Rio Bravo is incised in this portion of Texas, however, and is disconnected by levees from its historic floodplain, river floods no longer reach these crucial habitat areas. Without frequent inundation, the forest will continue to diminish in size by an estimated 5% annually. The LRGV flood forest is now limited to an area of less than 2,000 acres on the U.S side of the Rio Bravo, representing the last remaining 5% of this habitat in an area now dominated by nearly 2 million acres of agricultural lands.

Although the LRGV has sufficient water rights to protect these habitats, there are insufficient funds to develop the needed infrastructure and bear the costs of delivering water to 8 priority sites, including one site impacted by the construction of the US Border fence. Accordingly, the LRGV System of the US Fish and Wildlife Service has submitted a US\$ 1.2 million funding proposal to construct and operate facilities to accomplish the necessary flooding of these lands.

The output of this project will be a report on the measured impacts and efficacy of artificial interventions to inundate 8 flood forest areas in the LRGV, as a means of restoring their habitats and habitat functions and will include information on the effects the border fence on biodiversity, flooding and restoration.

Sub-Project III.2: Pilot Projects in Mexico with GEF Grant (Appendix 22)

This sub-project is designed to increase awareness on how to diminish current and future water pressure in the Rio Conchos basin, which is one of the most representative hydrological areas in the Rio Bravo/Grande basin and that would be the case study area for implementing actions considered in the pilot projects. Proposed is to elaborate a blueprint program to prioritize actions towards reducing current water use through the modernization of irrigation techniques in the Delicias Irrigation District based on experiences and investments achieved by the Mexican National Water Commission (CONAGUA), the North American Development Bank (NADBANK), State Government of Chihuahua, among others, and the reduction of leaks in urban water distribution network of Chihuahua City. In order to discourage new water rights' requests it is envisaged to work on a draft agreement for inter-sectoral water transfers so that new needs of urban waters are met via fresh waters originally granted in concession to irrigation in exchange for urban treated wastewaters; this transfers, altogether with water use efficiency actions, will meet current and future water demands without increasing the water pressure in the Rio Conchos basin and, eventually, even decreasing it.

Another key objective of this sub-project is to assess different climatic variability and climatic change scenarios for the Rio Conchos basin in order to identify the water rights that need to be restricted during drought periods and the ones that require to be decreased in the future due to climate change impacts; in these cases, it would be also required to link the economical or social activities affected with mitigation measures to cope with droughts and adaptation measures related to climate change to compensate their associated water use rights, such as the water use efficiency support addressed in the first activity of this sub-project. The climatic change scenarios will also be useful to identify the water rights that should be subject to greater physical efficiency so that the same products and services are still attained with a smaller water volume.

It is important to mention that Mexican Government, through CONAGUA, Secretary of Environment and Natural Resources of Mexico (SEMARNAT), and the Secretary of Agriculture, Cattle Raising, Rural Development, Fishing and Nourishment (SAGARPA) recognize the importance and impact of the actions considered in the pilot projects, and hence they would replicate the actions in the pilot projects for the whole basin.

Three non-structural Pilot Projects are planned:

- Water use efficiency in the Rio Conchos Basin
- Inter-sectoral water transfers between the Delicias Irrigation District and the Chihuahua City
- Climate variability and climate change scenarios of 50 x 50 km for the Rio Conchos basin

The outcomes for the Rio Conchos basin, which is one of the most representative hydrological areas in the Rio Bravo/Grande basin, will be:

- i) Increased awareness on how to decrease the current water pressure in the Rio Conchos basin due to over concession and assignment during drought periods
- ii) Enhanced awareness on how to reduce current and future urban water demand due to population growth and increased economical activities, and

- iii) Preparedness to face future water pressure due to recurrent drought periods and foreseeable impacts of climate change in the Rio Conchos basin.

Activity III.2.1 Water use efficiency in the Rio Conchos basin

The objective of this pilot is to maintain the same agricultural production using less water, and to keep delivering the public service of drinking water with less water quantity.

The planned activities include:

- i) Identification of irrigation areas that could be subject to the SAGARPA's PADUA program in order to decrease the water volume granted in concession in the Rio Conchos basin,
- ii) Identification of irrigation areas that could be benefited with the CONAGUA's program Sustainable Water Use in the Bravo River Basin,
- iii) To prepare a catalogue of modernization actions to reduce infiltration in the conveyance, distribution and application of irrigation water, as well as in water leaks in urban distribution network in the Chihuahua city,
- iv) To prepare a blueprint to aid replication and to prioritise modernizations of water distribution for irrigation and the reduction of leaks in urban water systems through demonstration in Chihuahua City.

Activity III.2.2 Inter-sectoral water transfers between the Delicias Irrigation District and the Chihuahua City

The objective of this pilot is to reduce the request for new water concessions and allocation through the City of Chihuahua and farmers collaboration agreements.

This pilot activity will evaluate the Delicias irrigation district and the City of Chihuahua to encourage collaboration leading to improved water exchange between the agricultural and urban users. This is expected to lead to a draft agreement on the exchange of fresh waters originally granted in concessions to irrigation for urban treated wastewaters.

Activity III.2.3 Climate variability and climate change scenarios in the Rio Conchos basin

The objective of this pilot is to identify mitigation measures due to natural climate variability expressed in recurrent drought periods, and adaptation measures in order to reduce the impact of possible climate change effects on the occurrence of water resources in the Rio Conchos basin, which is one of the most representative hydrological areas in the Rio Bravo/Grande basin

The planned activity is to assemble research findings to select the best mitigation and adaptation measures before climate variability during drought periods and in face of climate change effects on the Rio Conchos basin. This is expected to lead to a drought Preparedness Methodology to identify the water use rights that require restriction during drought periods and an assessment document of water use rights that may require to be either reduced in the future or subject to greater physical efficiency because of climate change impacts. This methodology will include the downscaling process to generate climate change scenarios of 50 x 50 Km for the Rio Conchos basin that would represent results with much better resolution than the climate scenarios published by the IPCC (250 km x 250km)

Sub-Project III.3: Communications, Outreach and Information Exchange (Appendix 23)

Effective, widespread communication and outreach is essential for the development and implementation of any strategic sustainable management of the Rio Bravo Basin's water resources. An informed basin population will better understand and appreciate the problems associated with mismanaged (over-allocation; pollution) human water uses in the Rio Bravo Basin, the consequences of these mismanaged water resources in regard to human socio-economic needs and maintenance of life-supporting ecosystem goods and services, as well as the potential for effectively alleviating such problems. In addition, improved communications between countries and their water management agencies will ensure a more streamlined, targeted approach to present and future water concerns throughout the Basin.

A number of Sub-Projects (Sub-Projects I.1, 1.2, II.1, II.2 and II.3) that relate to the available knowledge and information base for the Rio Bravo Basin will contribute directly to this Sub-Project. Those Sub-Projects that focus on analyzing and responding to constraints to sustainable use of the waters of the Rio Bravo (Sub-Projects II.3 and III.4) also will inform decision-makers regarding appropriate actions and programs to be undertaken to address such issues. Conversely, the expressed needs and aspirations of basin stakeholders will provide necessary input and data to enable development of strategies for stakeholder participation and public outreach programs. Thus, Sub-Project III.3 (Communication, Outreach and Information Exchange) is composed of activities to address these issues, as well as seeking to create a receptive, sustainable environment for implementation of the Rio Bravo SAP.

Sub-Project III.3 consists of three activities:

- **Identification** of relevant basin stakeholders;
- **Development** of knowledge base for targeted basin stakeholders;
- **Development** of a communication strategy and multi-stakeholder participation process.

Activity III.3.1: Identification of Relevant Basin Stakeholders

An initial activity under this Sub-Project will be to identify the stakeholder groups, organizations and agencies to receive the communication materials to be prepared under the Rio Bravo Basin communications strategy. This identification and assessment will include the different roles and needs of women and men, to ensure communication material is best targeted to address gender issues in the basin. Since there will be a comprehensive stakeholder process during the preparation and exploration phase of the Vision (Sub-Project I.1), this activity will use the comprehensive group of stakeholders developed during that Sub-Project and modify it for this communication strategy. The communications materials will include specific basin information on such topics as geography, economy, demography, water and land use, water resources governance and management, sustainability and related issues, the materials must be adapted to specific stakeholder groups within the basin.

Activity III.3.2: Development of Knowledge Base for Targeted Basin Stakeholders

This will comprise the information base for the identified stakeholders and stakeholder groups. Although the exact mode(s) of the communication strategy must be developed in consultation with the PCU and other relevant Rio Bravo Basin stakeholders, the anticipated information materials may comprise written (reports, leaflets, newsletters), audio (radio announcements/broadcasts) and visual (television programs) components. Such materials will be targeted to specific subjects being addressed and the specific audience to receive such information (e.g. decision-makers; basin stakeholders; scientists; managers; media). These materials also will be readily-available, understandable in both content and language to the audience being addressed, and useful within a management context.

Activity III.3.3: Communications Strategy and Multi-stakeholder Participation

This activity focuses on development and implementation of a communications strategy for raising awareness about the Rio Bravo Basin project, including the potential role(s) of governments, civil society, NGOs, academia, the media, and other relevant basin stakeholders in meeting the challenges to be addressed to ensure the sustainable use of the water resources of the Rio Bravo Basin. It is anticipated the strategy would comprise a general communication system, using all traditional mass media outlets (e.g., printed materials, radio, TV, Internet/websites) for conveying information and data.

The communication strategy also will facilitate a multi-stakeholder participation plan for the purpose of supporting and sustaining the interests and active engagement of major basin stakeholders. This activity will provide a vehicle through which key stakeholders can participate, contribute and potentially guide the elaboration of relevant activities and programs, particularly those identified in the Rio Bravo SAP, insofar as these activities and programs address issues under the influence or control of specific basin stakeholders. The participation plan also will stimulate and orient the activities of various communities and social groups in the Rio Bravo Basin, enhancing environmental awareness throughout the basin in regard to the sustainable use of its water resources and the conservation of its ecosystems.

The communications strategy developed under this Sub-Project also will be linked to the integrated information system (Sub-Project II.2), the Vision (Sub-Project I.1) and adapted to the overall framework of the SAP (Sub-Project III.4), and will address both the content and conveyance of the information required for the integrated and sustainable management of the water resources of the Rio Bravo Basin.

The main **output** of Sub-Project III.3 is the development of a Communications and Outreach Strategy as a means of achieving proper dissemination of information and data. It also will facilitate the exchange of information and data between stakeholders, and stimulate, orient and engage civil society, thereby increasing their receptiveness to the need for an integrated, ecosystem-based management approach for the Rio Bravo Basin.

Sub-Project III.4 Strategic Action Programme Development (Appendix 25)

This Sub-Project is designed to formulate a Strategic Action Program (SAP) and funding plan for its implementation. The SAP will provide a holistic and integrated management of the transboundary water and related resources in the Rio Bravo Basin, considering existing and anticipated water uses and users, potential climate change impacts, and the basin's bio-geophysical, institutional, legal, economic, social, cultural and political characteristics. It also will serve as a vehicle for establishing a permanent multi-disciplinary scientific group to provide continuing review and recommendations to support the decision-making process relevant to the bi-national Rio Bravo Basin.

The SAP provides the scientific, socio-economic and political basis for the conduct of key interventions necessary to support the sustainable utilization of the land and water resources of the Basin in a manner consistent with the principles of integrated water resources management (IWRM), and the potential impacts and consequences of changing water availability, uses and users, including both human and ecosystem water needs. It also provides a basis for country-level institutions, local governments, non-governmental entities, and all relevant stakeholders having an interest in a sustainable Rio Bravo Basin can focus their actions and activities, identify and prioritize needed management interventions, and implement common and agreed basin-wide programs and projects. This Sub-Project generates the principle output of the GEF Rio Bravo project

The formulation of a SAP for the Rio Bravo Basin builds upon the outputs and priorities identified within the context of the Rio Bravo TDA, including the basin vision (Sub-Project I.1); institutional and

legal framework analyses (Sub-Project I.2); target research projects (Sub-Projects II.1 and II.2); pilot projects (Sub-Projects III.1 and III.2), TDA formulation (Sub-Project II.3), and other relevant inputs; analysis of the information and data to be derived from 3 information workshops and 1 ministerial approval workshop. These elements are critical components of the strategy (Sub-Projects III.4.1 and III.4.2). With this background, this activity comprises the formulation, documentation and agreement of a Strategic Action Program for the Rio Bravo Basin, including establishment of a permanent scientific group to facilitate SAP continuation.

The preparation of the SAP will be undertaken through two activities:

- **Development** of an agreed Financial Strategy for SAP Implementation
- **Formulation and approval** of the SAP

Activity III.4.1: Financial Strategy for SAP Implementation (Appendix 24)

The objective of this activity is to develop a Financial Strategy for a sustainable funding source(s) for implementation the SAP for the Rio Bravo Basin.

There are a number of potential funding sources for such activities, including:

- Governments -- Collection of taxes; charging of fees for water abstractions and/or pollution penalties; provision of loans or letting of bonds; subsidies for undertaking (or not) specific activities that can affect water quantity and/or quality; and undertaking of activities and programs directed to monitoring, assessment or implementation by government agencies;
- Donors -- Grants and/or subsidies for undertaking (or not) specific activities; donations from civil society; activities and programs undertaken by non-governmental organizations);
- Private sector (including public-private partnerships) -- Provision of taxes; provision of technology and expertise to address specific basin problems; payment of penalties for environmental degradation; and
- Payment for ecosystem services (PES) -- Fees or charges for utilizing ecosystem services (e.g., nutrient cycling, water purification, food source, flood control), or alternatively trading of such services between water users and providers.

While the former two sources are more traditional in nature, the latter two represent innovative funding sources gaining greater recognition in recent years.

Because development of a viable, long-term Financial Strategy can involve many potential funding sources, it also is important to clearly identify the various governmental, non-governmental, private and donor organizations and agencies in both countries that can potentially invest in, or support implementation of, the priority activities and programs identified in the Rio Bravo SAP. Thus, the SAP Financial Strategy must consider the ongoing international, national and state-based programs currently being carried out by both countries in the Rio Bravo Basin. Each program has its own mandate and goals, but there are doubtless synergies that can be utilized to maximize the benefits of all relevant programs. The Financial Strategy also will provide a means of integrating various financial resources and economic instruments that can be used to sustain the Rio Bravo SAP, comprising short-, medium- and long-term tasks. The initial task will be to identify and research the various activities and programs to be undertaken, as identified in the Rio Bravo SAP including the current economic instruments in use. The next task would be to identify various activities and programs in the basin that could contribute to SAP implementation. The longer-term step would be to develop a realistic Financial Strategy, perhaps

using relevant, agreed scenarios involving the various financial sources, that would best ‘pair’ the activities and programs with the most likely and relevant funding sources.

The requested GEF funds will provide catalytic funding to enable the development and implementation of actions and programs directed to facilitating the sustainable use of the water resources of the Rio Bravo throughout its basin. Over the long term, however, it is possible that all the above-noted potential funding sources could be mobilized to fund Rio Bravo Basin SAP activities, particularly within the perspective of long-term investments directed to facilitating the sustainable use of its water resources. Such concepts as eco-efficiency and cleaner production, designed to minimize the environmental impacts of production activities in the basin, also can be considered. Whatever financing combination proves feasible over the long term, the Financial Strategy will provide a coordination framework for obtaining the necessary funding to implement the Rio Bravo SAP.

The output of this action will be an agreed, binational Financial Strategy to fund implementation of the Rio Bravo SAP (Sub-project III.4.1) throughout the basin. It will focus on identifying, accessing and obtaining the necessary financial resources for this purpose. It also will serve as the basis for long-term investments directed to sustainable use of the water resources of the Rio Bravo in both riparian countries.

Activity III.4.2: SAP Formulation and Approval

Three main tasks will be undertaken leading to the preparation of the SAP:

- Conducting stakeholder information workshops in the Rio Bravo Basin;
- Formulating the SAP for the Rio Bravo Basin;
- Seeking Ministerial approval for the SAP

Conducting stakeholder workshops in the Rio Bravo Basin

This activity will include wide dissemination of the agreed TDA (Sub-Project II.2.1) and other relevant documents throughout the Rio Bravo Basin prior to the workshops, for the purpose of providing accurate, understandable background information and data for discussion at the workshops. The workshop will provide opportunities for stakeholders to comment and provide feedback on the documents and presentations to assist with the SAP development. Activities also will include developing meeting venue, format and considering other associated details, in consultation and cooperation with the PCU staff.

Formulation of SAP for Rio Bravo Basin.

The SAP formulation will build upon the outputs and priorities identified within the context of the Rio Bravo TDA, including the basin vision (Sub-Project I.1); institutional and legal framework analyses (Sub-Project I.2); target research projects (Sub-Projects II.1 and II.2); pilot projects (Sub-Projects III.1 and III.2), TDA formulation (Sub-Project II.3), and other relevant inputs; analysis of the information and data to be derived from 3 information workshops and 1 ministerial approval workshop. These elements are critical components of the strategy (Sub-Projects III.4.1 and III.4.2), as well as the above-noted stakeholder information workshops. Development of the SAP will begin at the conclusion of relevant TDA activities, and continue throughout the conduct of the stakeholder information workshops, being organized and facilitated by the PCU and basin stakeholders.

Ministerial-level approval of SAP.

Upon formulation of the Rio Bravo Basin SAP, government approval and buy-in by the riparian countries is necessary. To this end, this activity comprises convening of a ministerial-level conference to review and approve the Rio Bravo SAP, as the basis for the riparian governments to undertake the recommended management interventions in the SAP. In consultation and cooperation with PCU staff,

additional tasks will include obtaining agreement on suitable workshop venue, date, agenda, etc., and ensuring personnel and other requirements for the workshop are appropriately handled.

The overall output will be a SAP approved by the ministers of the basin and supported by a wide stakeholder base. The SAP will focus on integrated management of the transboundary water resources of the Rio Bravo Basin to meet both socio-economic and ecosystem water needs, based on the above-noted results. The results will serve as the baseline for identifying needed management actions throughout the basin, as well as provide a future reference for assessing progress made after implementation of the SAP. The SAP will provide a financial strategy for implementing and maintaining these transboundary actions and programs, and, through subsequent implementation of the SAP, improved environmental status and socio-economic conditions that minimise environmental impacts.

Component IV: Project Management and Oversight (Appendix 26)

This Component will comprise of two main activities.

- Day-to-day Project Management through the PCU
- Co-ordination by the EA.

Activity IV.1: Day-to-day Project Management through the PCU

This project is designed to assist the regional and national stakeholders with responsibility for the management of water resources and the ecosystem of the Rio Bravo Basin with the development of an agreed Strategic Action Programme. To achieve this inter- and intra-governmental co-ordination the day-to-day management of the Rio Bravo Basin project will be undertaken by a Project Co-ordination Unit (PCU). The PCU will be responsible for the timely execution of the project components and activities, reporting technical and financial progress and for communicating / co-ordinating with the Implementing Agency (UNEP), the Executing Agency (OAS), SEMARNAT, USEPA, the National Project Execution Units (NPEU) and the GEF.

The PCU will also be responsible for co-ordinating the project oversight activities and for ensuring that all M&E requirements are implemented according to best practice (Component V).

The PCU will be supported by a number of other committees as described in Section 4 – Institutional Framework and Implementation Arrangements.

The project implementation will be under the oversight of a Steering Committee (Section 4).

Previous GEF IW projects have benefited from the development of an exit strategy to assist the countries and institutions continue the momentum created by the project. This previous ‘good practice’ will be utilised in this project to prepare the NPEUs and other national and local authorities to sustain the actions of the project and to assist with the important next steps of SAP implementation.

Activity IV.2 – Co-ordination by the EA

GS/OAS through its Department of Sustainable Development and its Integrated Water Resources Management Division will be acting as the Executing Agency for this project.

Although in general terms, GS/OAS will provide overall supervision to project implementation and manage the funds provided to the project by UNEP on behalf of GEF, in a manner consistent with UNEP financial reporting requirements, GS/OAS will provide a range of services throughout the project

execution cycle (i.e. (1) project execution and implementation supervision, (2) project monitoring and evaluation and (3) project closure.

In consultation with the PCU, the countries and UNEP as the IA and as laid down in Appendix 10 and the above mentioned section IV.1 as well as in accordance with the Project Coordination Agreement it will subsequently sign with UNEP, it will coordinate and supervise project execution in accordance with the project execution plan laid out in the project document. Specifically it will (1) ensure quality of products, outputs and deliverables, (2) compile and submit progress, financial and audit reports to the IA, (3) submit budget revisions to IA for approval, (4) address and rectify any issues or inconsistencies raised by the IA and/or the Steering Committee and (5) bring issues raised by or associated with countries to the IA and/or the Steering Committee for resolution.

With respect to Project Monitoring and Evaluation, GS/OAS will (1) ensure day to day coordination of project execution, (2) develop yearly project/program implementation reports (PIR), (3) organize mid-term reviews (MTR) as a management tool, (4) develop management response to MTR, (5) participate in and provide all information requested by independent TE, and (6) develop management response to evaluation reports and Steering Committee recommendations.

At the time of project closure, GS/OAS will (1) provide to the IA information on realized outputs, inventories, submitted reports, verification of co-finance, terminal reporting, audit and financial closure and (2) it will contribute to knowledge management exercises in relation to project.

The **overall output** will result in the completion of a well-managed program of activities culminating in formulation, publication and ministerial endorsement of the Rio Bravo SAP and supporting documents.

3.4. Consistency with national priorities or plans

The guiding concept of integrated water resources management (IWRM) as a mean of addressing the sustainable use of available water resources, underlines the water resources management efforts of both riparian countries. This concept, being increasingly operationalized by the Global Water Partnership since the latter half of the 1990s, actually was promulgated several years earlier. The initial reference to this approach was probably highlighted in the freshwater chapter (Chapter 18) of Agenda 21, and subsequently reinforced at the Johannesburg WSSD Conference. Both Mexico and the US were signatories to both conferences, thereby elevating IWRM to an integral part of the national priorities of both countries. Indeed, although passed prior to either of these global-scale events, the goals of the National Water Law of Mexico and the Clean Water Act of the US are consistent with the notion of IWRM.

Against this background, it is noted that water allocations in the Rio Bravo Basin are governed by numerous bi-national treaties, interstate compacts, reclamation projects, water rights and contracts, some inconsistent with sustainable water use in the basin. These various instruments are implemented by a bewildering range of international, national and state governmental agencies, and private organizations (most notably irrigation districts). The unique mandates and responsibilities of these various agencies and organizations ensure there is no integrated approach to managing and using the waters of the Rio Bravo. Thus, with water demands expected to increase with continuing population growth, and agricultural and industrialization activities, developing and implementing an integrated management approach, such as that embodied in IWRM, is both consistent with national water-related priorities and a paramount need for sustainable future of this badly-stressed water system. An integrated approach is especially critical for addressing a core problem within the Rio Bravo basin, namely, multiple competing uses (and overuses) of limited water resources, both surface- and groundwater, by providing a mechanism for cooperation between Mexico and the US in identifying and addressing priority border water issues. With the existing piecemeal method of managing and allocating the waters of the Rio Bravo, an integrated approach is the

only rational means of addressing the serious ecological and economic damage associated with overuse of this transboundary river, and of improving the livelihoods of basin inhabitants in this drought-prone region.

3.5. Sustainability

The sustainability of the project is both fundamental to its ultimate success, as well as ensuring bi-national cooperation in addressing sustainable use of the Rio Bravo throughout its drainage basin. The sustainability is inherent in the participation of the CNA, responsible at the federal level for Mexican water resources, and its counterpart organizations in the United States, as well as of the competent national institutions in both countries, addressing the different areas to be addressed in the project. As previously noted, the fragmentation of authority and responsibility for addressing various water allocation and pollution issues throughout the basin has been a major impediment to the development of an integrated management approach for the Rio Bravo, thereby ensuring its continuing unsustainable use throughout its basin. The cooperative mechanism envisioned with the development and implementation of a SAP by the governments and stakeholders in both riparian countries, including consideration of the need for institutional and legal harmonization to achieve this goal, will be a significant contribution to addressing this constraint to the sustainable use of this transboundary river system.

The omnipresent issue of scarce water resources in the Rio Bravo basin, as well as the exacerbating effects of continuing periodic droughts, ensure the attention of federal and State agencies in both countries in developing and carrying out agreed strategic actions and remedial programs, including provision of needed financial and personnel resources. Further, the importance afforded to this region by both riparian countries, which exhibits one of the highest population growth rates, and attendant increasing water needs for human health and economic development, also ensures a continuing attention given to this issue by CNA and its counterpart organizations in the United States.

In addition, both riparian countries are bound by environmental provisions in international agreements, especially the Commission for Environmental Cooperation, the environmental arm of the North American Free Trade Agreement, as well as the water allocation provisions overseen by the International Boundary and Water Commission. The latter organization has recently begun to emphasize the sustainable use of the Rio Bravo, and all the implications associated with this recognition, in carrying out its duties under the 1944 Treaty. Additional organizations whose participation will help ensure a sustainable focus on the Rio Bravo include the Boundary Environment and Cooperation Commission, with a mandate to preserve, protect and enhance human health and environment of the Mexico-U.S. border region, by strengthening cooperation among interested parties and supporting sustainable projects through a transparent bi-national process, in close cooperation with the North American Development Bank, federal, state and local agencies, the private sector, and civil society.

The commitment of the different institutional and jurisdictional entities of the participating countries with competence in integrated water resources management (water-earth-climate), as well as relevant organizations of civil society, also will strengthen this process. Indeed, the urgent need to address the issues surrounding sustainable use of the scarce water resources in this arid region of both countries, particularly in view of continuing water shortages that have resulted in expressed concerns reaching even to the office of the President in both countries, ensures that this issue will receive concerted attention once the project is implemented. There is no shortage of interest, but rather only the lack of a comprehensive, integrated approach for addressing the relevant bi-national water resource issues.

3.6. Replication

Although there are unique geographic and socioeconomic elements associated with this project, the project will provide valuable experience in regard to identifying the basic issues hindering sustainable use of a transboundary river system in a region experiencing one of the fastest population growth rates in

both riparian countries, as well as being a major region of economic development and attendant natural resource needs as a result of the North American Free Trade Agreement.

Given the headwaters of the river originate in mountain streams in south eastern Colorado in the United States, flow through one of the most arid parts of both riparian countries, form an international border for a good portion of its journey, and eventually drainage into the Gulf of Mexico, the range of problems to be addressed, and their root causes, is substantial. The project will provide experience on a wide range of management issues and needs in a transboundary context, which should prove valuable in other contexts as well. Indeed, the sheer range of issues to be addressed, and the manner in which they will be met, in this joint project between a developed country and a country with an economy in transition should provide invaluable, almost unique, experience and management guidance applicable to other transboundary water systems.

It also should allow for demonstration of the utility of the international waters project indicators proposed by the GEF in assessing progress made in addressing the transboundary environmental problems associated with this important river system. Further, to ensure the widest utility of the project results, it is anticipated that dissemination of the project outcomes will initially be coordinated with the opportunities for stakeholder involvement in the total project. Responsible participation of the Basin's educated population will be encouraged through relevant workshops and seminars. Such opportunities will be incorporated in each activity included in the project preparation phase, as well as each of the major project components.

It is anticipated that an interactive Internet page, guided virtual dialogues on topics and matters of interest relating the project, and similar opportunities for participation of the general populace also will be provided early in the project. It is further anticipated that project documents will be posted on a world-wide web site to be designed and managed by a consultant specialised in social communication and engaged for this purpose. Utilizing such Internet media as the IWRN and IW:LEARN, the results and outputs of the project can be widely disseminated. Additional opportunities for sharing the project results and outputs are provided through anticipated inter-governmental meetings, scientific symposia, and events such as the World Water Forum. Such dissemination efforts of project elements and results will work to ensure the opportunity for project replicability in other geographic locations and water resource situations, particularly to the benefits of water managers and decision-maker

The project will also participate at the biannual GEF IW Conferences to present the activities and lessons learned from the implementation of this project further encouraging replication of the overall approach and the specific activities undertaken in the Pilot projects.

3.7. Public awareness, communications and mainstreaming strategy

The project is devoting significant effort to raising public awareness on the issues of transboundary concerns and to the principles of IWRM and ecosystem management approaches in the Rio Bravo Basin. Active stakeholder involvement will be central to the TDA and SAP process to ensure an overall acceptance of the SAP. Through Sub-Project III.3 (Communication Strategy and Multi-Stakeholder Participation) a wide range of communication and public engagement activities will be undertaken, resulting in information about the project being available in the press, public consultations, GEF IW:LEARN and via the project web site. In addition, Sub-Project III.1 (Pilot Projects to Facilitate Integrated Water Resources Management in the Rio Bravo Basin) has identified a number of activities to facilitate increasing public awareness and communications of environmental issues to a wider public.

The formation of Inter-sectoral Committees and the role of the National Project Execution Units (Section 4 – Institutional Framework and Implementation Arrangements) will aid the main-streaming of IWRM and ecosystem management approaches throughout the Rio Bravo Basin.

3.8. Environmental and social safeguards

The development of a Transboundary Diagnostic Analysis and Strategic Action Programme for the Rio Bravo Basin is based on identifying constraints to sustainable use of the water resources of the river, the root causes of these constraints, and identifying environmentally-sound and socio-economically acceptable solutions to handle the related transboundary concerns. It is not anticipated that the actions and programs likely to arise from this activity will result in significant environmental and socio-economic impacts to the extent that safeguards to address these issues will be required. In fact, because the TDA/SAP approach is inclusive of all basin stakeholders, and its implementation will reflect a joint Mexico-US approach to reconciling environmental and social conflicts, it is anticipated the natural and human populations on both sides of the border will ultimately benefit from this project,

To this end, the Rio Bravo Project was designed to have positive environmental and social impacts. Through creation of a Vision for the sustainable use of the Rio Bravo, emphasizing both environmental and socio-economic goals, creation of sustainable financing mechanisms for SAP implementation, the implementation of a basin-scale communication strategy, enhanced possibilities for significant stakeholder involvement, and knowledge gained through the various pilot demonstration projects and the targeted research efforts. Several of the pilot demonstration projects, for example, are directed specifically to enhancing environmental sustainability, including the transboundary biodiversity corridors in the Trans-Pecos reach of the river, and the rehabilitation of native wetland forests in the lower Rio Bravo Basin.

The need to consider the interactions between the environmental and socio-economic needs of the water resources of the Rio Bravo Basin also will be addressed via the education and awareness-increasing pilot projects to be undertaken on both sides of the border, including both high school curriculum directed to the problems of the Rio Grande, and the communications strategy included within the project. Such education and information activities will increase awareness of the need to address the various constraints to the sustainable use of this transboundary water resource for sustainable use.

The need to consider both environmental and social safeguards also will be among the core activities of the PCU and its staff, as well as the national committees convened for the project. This will include monitoring and evaluation of project interventions during the project, as well as beyond the duration of the project, while will enable needed adjustments to interventions if any unforeseen negative impacts occur, thereby providing opportunities for adaptive management. The project also will provide an M&E system with the objective of providing timely feedback on project implementation and performance to facilitate adaptive management, in order to prevent and address issues as they arise, thereby strengthening both the environmental and social outcomes of the project (Appendix 27).

Further, all stakeholder-related activities are designed to facilitate consideration of both the environmental and social impacts of any project interventions. Ensuring major stakeholder participation will provide substantial opportunity to incorporate such concerns into the design of the Rio Bravo Basin Vision, as well as in SAP formulation. In fact, all pilot projects have been developed in line with environmental and social priorities in the respective countries as identified through stakeholder consultations, thereby contributing to both environmental and social stability and sustainability.

SECTION 4: INSTITUTIONAL FRAMEWORK AND IMPLEMENTATION ARRANGEMENTS

The GEF Rio Bravo Basin project will be implemented through UNEP and executed by OAS with national support from SEMARNAT and USEPA. Local execution will be undertaken through a National Project Execution Unit (NPEU) with support from Mexican institutions and Texas State University. The overall project will be under the direct oversight of a Project Steering Committee (SC) with technical

and administrative support from a Regional and Technical Advisory Group (R-TAG) and a joint committee comprising of the EAs and IAs. Inter-Sectoral Committees will be established in Mexico and US to co-ordinate the current project with other on-going and previous activities, and to ensure consistency with national policy of the region and ecosystem /IWRM management. The project will be managed on a day-to-day basis by a Project Co-ordination Unit (PCU).

An overview diagram of the institutions and committees together with their decision making process is shown in Appendix 10. A summary of these institutions' and committees' responsibilities is presented below.

Project Steering Committee

A Steering Committee (SC) will be assembled at the inception of the project to guide overall project execution and to approve key steps and outputs. The SC, as main project authority, will establish the execution baselines, and consider and approve annual operations plans and budgets, as well as quarterly and annual technical and financial reports and final technical reports. The SC will operate on the basis of consensus among its members. UNEP, as Implementing Agency, will be responsible for final decisions about budgetary programs, terms of reference, and contracts proposed for the project's execution. The designation of the SC chair will be determined during the assembly of the committee, which will be composed of: National Co-ordinators, SEMARNAT, USEPA, UNEP and OAS. Non-voting members will include representatives from IMTA, CONAGUA, TX State University, the Technical/ Scientific Advisory Chair and the Stakeholder/Community Advisory Chair. The binational Project Coordinator (PC) will be present at SC meetings and other agencies/authorities will participate as required. The Steering Committee will meet twice annually and will operate on the basis of member consensus.

Project Co-ordination Unit

A Project Coordination Unit (PCU) will be established in a border community such as El Paso or Laredo to manage the activities throughout the basin. The PCU will comprise of: the Project Coordinator, Financial Management/Administration Professional, Technical Specialist, and support staff. The Project Coordinator will be responsible for the day-to-day activities of the project, including providing direction to support staff, national counterparts, and consultants to the project, as well as communicating with the National Project Coordination Units (NPCUs), and potentially members of the National Project Execution Units (NPEU). The Project Coordinator specifically will coordinate and supervise all technical activities undertaken at the national level by each of the NPCUs, and will be responsible for presenting progress to the SC. In addition, the PC will ensure the preparation of project reports, other outputs and all necessary financial and technical reports to UNEP and GEF. The PCU will be responsible for preparing all terms of references for consultants and organizations undertaking work for subsequent approval by the OAS and UNEP, with the full co-operation of the National Project Execution Units. Additional responsibilities include development of a project exit strategy and coordination of M&E requirements implemented according to best practices including development of indicators for ongoing environmental monitoring, development of adaptive management actions, development of ToRs, and facilitating the work of the mid-term evaluation and terminal evaluation. Core members of the PCU will consist of SEMARNAT, IMTA, USEPA, and TX State University representatives (Appendices 8, 9, 11, 26, 27).

National Project Execution Units

The local execution of project activities will be undertaken by National Project Execution Units (NPEUs). Each NPEU will have a National Co-ordinator responsible for the in-country coordination of project activities, including organization of meetings and briefings of related agencies and potential policy changes at national level in order to facilitate the efficient and effective conduct of project activities. The National Co-ordinators will identify and recommend qualified country- and local-level

staff to undertake project activities, which will be contracted for specific tasks, with the approval of UNEP.

Technical/Scientific and Stakeholder/Community Advisory Committees

Two advisory committees will be formed to provide institutional, technical or financial support and input, as well as stakeholder input and collaborative efforts to both the NPEUs and the PCU. The Technical/Scientific Advisory Committee will be comprised of representatives from CILA/IBWC, BECC/NADBank, WWF Mexico, other universities, researchers, and consultants. City, county, state and municipio representatives, irrigation and farming district members and other relevant organizations will comprise the Stakeholder /Community Advisory Committees. Chairs of each of the two committees will serve as non-voting members on the Steering Committee.

UNEP

UNEP, as the GEF Implementing Agency of this project, will be responsible for overall project supervision to ensure consistency with GEF and UNEP policies and procedures, and will provide guidance on linkages with related UNEP- and GEF-funded activities as well as technical guidance on specific issues. UNEP also have the responsibility for regular liaison with the GS/OAS on substantive and administrative matters and participating in meetings and workshops as appropriate. The UNEP/GEF Division will provide assistance and advice to the GS/OAS in project management (e.g. revisions of work plans and budgets) and policy guidance in relation to GEF procedures, requirements and schedules.

The UNEP/GEF Division will be responsible for clearance and transmission of financial and progress reports on the relevant portions of the project to the Global Environment Facility Secretariat. UNEP/GEF retains responsibility for review and approval of the substantive and technical reports and products produced in accordance with the schedule of work.

OAS

The GS/OAS will provide overall supervision and coordination to project implementation and manage the funds provided to the project by UNEP on behalf of GEF, in a manner consistent with UNEP financial reporting requirements. The GS/OAS will be responsible for timely production of financial and progress reports to UNEP.

Inter-Ministerial and Inter-Agency Communications

Specific communications links will be established between the Project Steering Committee and the regional national co-ordinators (National Project Execution Units) with Inter-Ministerial Representatives (in Mexico) and Inter-Agency Representatives (in the US) to ensure improved co-ordination and awareness of project activities with national actions. This is also intended to improve the uptake of project pilots assisting with replication (Appendix 10).

SECTION 5: STAKEHOLDER PARTICIPATION

The focus of Sub-Project I.1 is on surveying stakeholders and developing a consensus based Vision for the Rio Bravo Basin (Appendix 16). Sub-Project III.3 will build on this analysis and seeks to develop a Communications and Outreach Strategy as a means of achieving proper dissemination of information and data, in order to increase community understanding, and facilitate stakeholder “buy-in” to the project (Appendix 23). It also will facilitate the exchange of information and data between stakeholders, and stimulate, orient and engage civil society, thereby increasing their receptiveness to the need for an integrated, ecosystem-based management approach for the Rio Bravo Basin.

SECTION 6: MONITORING AND EVALUATION PLAN

The project will follow UNEP standard monitoring, reporting and evaluation processes and procedures. Substantive and financial project reporting requirements are summarized in Appendix 8.

The project M&E plan is consistent with the GEF Monitoring and Evaluation policy. The Project Results Framework presented in Appendix 4 includes SMART indicators for each expected outcome as well as mid-term and end-of-project targets. These indicators along with the key deliverables and benchmarks included in Appendix 6 will be the main tools for assessing project implementation progress and whether project results are being achieved. The means of verification and the costs associated with obtaining the information to track the indicators are summarized in Appendix 7. Other M&E related costs are also presented in the costed M&E Plan and are fully integrated in the overall project budget.

The M&E plan will be reviewed and revised as necessary during the project inception workshop to ensure project stakeholders understand their roles and responsibilities. Indicators and their means of verification will be fine-tuned at the inception workshop. Day-to-day project monitoring is the responsibility of the PCU but other project partners will have responsibilities to collect specific information to track the indicators.

The project Steering Committee will receive periodic reports on progress and will make recommendations to UNEP concerning the need to revise any aspects of the Results Framework or the M&E plan. Project oversight to ensure that the project meets UNEP and GEF policies and procedures is the responsibility of the Task Manager in UNEP-GEF. The Task Manager will also review the quality of draft project outputs, provide feedback to the project partners, and establish peer review procedures to ensure adequate quality of scientific and technical outputs and publications.

Project supervision will take an adaptive management approach. The Task Manager will develop a project supervision plan at the inception of the project which will be communicated to the project partners during the inception workshop. The emphasis of the Task Manager supervision will be on outcome monitoring but without neglecting project financial management and implementation monitoring. Progress towards delivering the agreed project global environmental benefits will be assessed with the Steering Committee at agreed intervals. Project risks and assumptions will be regularly monitored both by project partners and UNEP. Risk assessment and rating is an integral part of the Project Implementation Review (PIR). The quality of project monitoring and evaluation will also be reviewed and rated as part of the PIR. Key financial parameters will be monitored quarterly to ensure cost-effective use of financial resources.

A mid-term management evaluation will take place as indicated in the project workplan (Appendices 5, 7). The review will include all parameters recommended by the GEF Evaluation Office for terminal evaluations and will verify information gathered through the GEF tracking tools, as relevant. The review will be carried out using a participatory approach whereby stakeholders will be consulted. The project Steering Committee will participate in the mid-term review and develop a management response to the evaluation recommendations along with an implementation plan.

An independent terminal evaluation will take place at the end of project implementation. The Evaluation and Oversight Unit (EOU) of UNEP will manage the terminal evaluation process. The standard terms of reference for the terminal evaluation are included in Appendix 9. These will be adjusted to the special needs of the project.

The GEF tracking tools are attached as Appendix 15. These will be updated at mid-term and at the end of the project.

LIST OF APPENDICES

- Appendix 1: Budget by project components and UNEP budget lines**
- Appendix 2: Co-financing by source and UNEP budget lines**
- Appendix 3: Incremental cost analysis**
- Appendix 4: Results Framework**
- Appendix 5: Workplan and timetable**
- Appendix 6: Key deliverables and benchmarks**
- Appendix 7: Costed M&E plan**
- Appendix 8: Summary of reporting requirements and responsibilities**
- Appendix 9: Standard Terminal Evaluation TOR**
- Appendix 10: Decision-making flowchart and organizational chart**
- Appendix 11: Terms of Reference**
- Appendix 12: Co-financing commitment letters from project partners**
- Appendix 13: Endorsement letters of GEF National Focal Points**
- Appendix 14: Draft procurement plan**
- Appendix 15: Tracking Tools**
- Appendix 16: Vision subproject description**
- Appendix 17: Legal and Institutional Strengthening subproject description**
- Appendix 18: Targeted Research subproject description**
- Appendix 19: Information System subproject description**
- Appendix 20: Transboundary Diagnostic Analysis subproject description**
- Appendix 21: Pilots in the US with co-financing**
- Appendix 22: Pilots in Mexico subproject description**
- Appendix 23: Communication and Outreach subproject description**
- Appendix 24: Financial strategy subproject description**
- Appendix 25: SAP subproject description**
- Appendix 26: Project Management subproject description**
- Appendix 27: M&E subproject description**