**TERMS OF REFERENCE**

**HA-T1179**

**WATER AVAILABILITY, QUALITY AND**

**INTEGRATED WATER RESOURCES MANAGEMENT IN NORTHERN HAITI**

# **BACKGROUND**

The IDB has financed the Caracol Industrial Park (PIC) through two grants of 55,000,000 USD and 50,000,000 USD in 2011 and 2012, respectively. The PIC is currently being developed as part of a longer term program for northern Haiti. This 250-ha development includes factory sheds, a water treatment plant capable of processing 2,500 m3/d, an 18 MW diesel generated power plant, a wastewater treatment plant and other associated infrastructure (e.g., dormitories, canteens, training center, offices, clinic, storage facilities).

A key information gap that has been identified as development of the PIC has progressed is a reliable quantitative assessment of water availability and quality for the industrial park. This assessment needs to consider the water availability and quality of contributing surface watersheds, groundwater sources and their surrounding ecosystems, and to recognize the needs and demands of all water users as well as possible impacts of climate change. For instance, the PIC site's primary source of surface water, the Trou du Nord watershed, feeds into Caracol Bay, a potentially sensitive ecological resource. Challenges include a lack of data on the ecological conditions and characteristics of Caracol Bay, the absence of data to assess critical environmental flows to the bay, and extremely limited hydrometeorological and water quality data for the region, specifically for the Trou du Nord watershed. The potential for adversely impacting the surface hydrology was sufficient for a recent study (ENVIRON 2011[[1]](#footnote-1)) concluded that there are enormous institutional and policy gaps and barriers for the integrated watershed management, both at national and local level.

At national scale, the major salient feature of watershed management has been the confusion between the respective roles if the ministries of agriculture to recommend against the use of surface water to meet the anticipated demands of the PIC. Further, although preliminary estimates suggest there is ample groundwater available within the underlying Massacre Transboundary Aquifer (MTA) to meet the PIC's water demands, the aquifer is believed to be unconfined and overlain by highly porous, alluvial sands, rendering the aquifer vulnerable to contamination.

Furthermore, climate change has the potential to further strain the availability and quality of water resources in the area. Global climate models indicate increasing temperatures for Haiti, while a rising sea level and an increased intensity and frequency of hurricanes are likely in the future. It is therefore deemed crucial to include existing climate projections and their impacts in the water management plans in order to provide a basis for successful adaptation in the area of the PIC and its surrounding Trou du Nord/MTA system.

## CONSULTANCY OBJECTIVES

Based on this background, the primary objective of this TC is to *quantitatively assess current and future water availability and quality and water demand by all stakeholders as key inputs to integrated water resources management (IWRM) in northern Haiti* at three connected scales:

* *within the industrial park*: improve the ability to analyze existing (baseline) conditions and potential impacts associated with the PIC development currently and over time, while promoting improved water resources management practices in the industrial park itself;
* *within the watershed*: support the development of an integrated water resources management (IWRM) plan for the Trou du Nord Watershed/MTA area in Northern Haiti;
* *within the country*: serve as a pilot project for a future program designed to assess water availability at the watershed level throughout the country, by scaling up the IWRM approach to the regional and national levels.

This project is aligned with the lending targets of: (i) "small and vulnerable countries"; (ii) poverty reduction and equity enhancement", and (iii) “climate change, sustainable energy and environmental sustainability” of the report of the ninth general increase in the resources (GCI9) of the Bank.

## SCOPE OF WORK

The scope of work for this project entails the following activities:

**Activity 1. Institutional and governance analysis of in-country water resources management**

Overlapping responsibilities, weak public institutions and low cost recovery are typical challenges in the water and sanitation sectors of many developing countries, and Haiti is not an exception. According to the country's 2009 national water framework law, municipalities are responsible for water supply, but due to a lack of capacity, water supply is largely managed by NGOs, private operators and water user associations; the sector depends largely on external financing. USAID´s report (2009) regarding watershed management in Haiti[[2]](#footnote-2) concluded that there are enormous institutional and policy gaps and barriers for the integrated watershed management, both at national and local level.

At national scale, the major salient feature of watershed management has been the confusion between the respective roles if the ministries of agriculture and environment. The result is a dysfunctional leverage of responsibility and resources between the two ministries, making that the situation with respect to the management of watersheds in Haiti is that the Ministry of the Environment has most of the responsibility but very few resources while the Ministry of Agriculture has much less responsibility but higher capacity in term of resources and means. At the practical level it means that the Ministry of the Environment has almost no human and material resources for the enforcement, and the local and rural authorities do not pay any attention to the regulations or laws.

Adding complexity to this situation, in 2006. the Haitian government promulgated a decentralization decree giving the local communities (Communes) the authority to prepare and implement “environmental action plans” and considerable authority to protect biodiversity and habitat. This decree seems to not have been put in place and the responsibilities are still undefined.

There is no clearly articulated government policy on watershed management that establishes how management plans have to be developed and by which institutions, how these plans should be approved, authorized, and funded; and which government agency or collectivity will work with the communities to implement the plans.

In terms of organization, watershed policies are not coordinated between the two main ministries (Environment and Agriculture), as well as other ministries linked to watershed policy and planning (Planning, Public Works…). Government policies on watershed and environment management are also not well coordinated with local bodies of government (communes and rural communal sections).

Regarding the institutional capacity, both ministries have only limited experience with expertise in watershed planning and almost no experience in implementing watershed management plans, and public policies related with watersheds are generally not implemented or not implementable, due to the budgetary restrictions at both national and local levels (communes) and the gap of political will and leadership required to develop and implement a coherent watershed management policy.

Taking into consideration the conditions described above and the recommendations of the referred USAID report, the consultant will carry out an institutional and governance analysis focusing on the needs for ensuring the suitability and the sustainability of the technical tools to be provided by this TC.

The proposed analysis entails:

* An evaluation of the legal and institutional issues related to the management of water resources at national and local levels for the Trou du Nord/MTA system. This evaluation will need to include the analysis of the existing regulation at both scales (including rights for water uses), as well as the sector´s organization (user committees, irrigation districts, public entities with jurisdiction over water management issues). The consultant will also describe for each one of the key institutions their responsibilities, human resources, capacities (institutional, technical and fiduciary), representativeness, activities developed in the watersheds, budgetary conditions, regulations, information systems and cultural background and context. This evaluation should include the analysis of possible conflicts between different water uses for the Trou du Nord/MTA system.
* An analysis of current roles, interactions and levels of participation in water resources management by different users in the Trou du Nord/MTA system (including policy and decision makers, private sector, irrigation sector, NGOs), as well as the coordination between users.
* An analysis of the management and technical capacity of the different institutions and entities responsible for water resources management in the Trou du Nord/MTA system, identifying the main weaknesses and constraints, as well as possible issues that may limit sound management of water resources. Special attention will be paid to the lack of technical tools and skills for the design of watershed management plans, identifying the institution that could be the host for the modeling tools proposed by this TC and potential training and capacity building needs in order to ensure a sustainable use of such tools and an effective knowledge transfer.

In summary, this activity will encompass not only the legal water and sanitation policy, regulation and provision framework, but also the actual performance and capability of the diverse existing actors. It will review the organizational structure and functions of existing institutions, identification of governance gaps, and recommendations towards implementation in the Trou du Nord/MTA system as a model for IWRM in the country.

**Activity 2. Data gap analysis and review of available modeling data in the PIC and its contributing watershed**

This activity comprises the review of current hydro-climate data, availability of information related to water quantity, and quality, demand in the Trou du Nord/MTA system, and assessment of data needs for detailed hydrologic modeling purposes.

This information will consist of the following data:

* Preparation of basemaps of the basin (suggested scale 1:25,000)
* Definition of priority watersheds, according to approved methodologies under national law and applicable international standards.
* 1:25,000 scale thematic maps showing the current land use, production activities (agriculture, livestock, forestry, mining, etc.), relevant ecosystems (e.g., mangroves and coastal wetlands), current conservation/land degradation data.
* Analysis of economic activities in PIC and surrounding watershed, and its relation to environmental services generated in the watershed. In particular, focus is to be placed on the PIC development plans, any livestock farming, aquaculture, industrial and cultural activities and their interactions with the environment, and particularly with water resources.
* Water balance of the catchments (current situation) within the Trou du Nord/MTA system
* Inventory or surface water sources and groundwater, based on analysis of available information and field work.
* Analysis of water supply (water sources: rain, groundwater) for current conditions.
* Analysis of water demand: user identification and actors related to water management, current use.
* Identification of population and communities in the watershed, and current social issues and projected future (eg conflicts over water use).
* Observed major climate hazards (drought, heavy rain, extreme events, sea level rise, storm surges) and how they have affected production activities and ecosystems in recent history.
* Identification and selection of future climate scenarios based on secondary information, and projected impacts on productive activities and ecosystems.
* Perceptions of the population regarding observed changes in climate and how these have altered the environmental services and productive activities in the area of ​​interest.
* Identification of natural disaster risks.

The methodology followed for reporting of this data analysis effort will be chosen in order to fit with local standards and coordinated with national communications, depending on the sector and ensuring the reporting of basic data baseline.

Based on the information collected, this activity will highlight priority areas of future monitoring, water quality hotspots and pollution reduction potentials that will empower local authorities and other stakeholders in their commitment to tackle water resources management. This characterization and analysis of hydrologic and climate information will contribute to determine the vulnerability of the PIC and the surrounding Trou du Nord/MTA system, which will provide the basis to simulate the existing conditions and propose the most appropriate intervention options within a IWRM plan.

The data gap analysis and review results will be disseminated through a capacity building workshop that will summarize the findings of the project up to this activity. This workshop will contribute to solidify the integration of stakeholders and institutions that carry out water resources management activities through building capacity that is specific to this project.

**Activity 3. Development of hydrologic models**

This activity will focus on the development, testing and implementation of hydrologic (including water quality) modeling tools, devised with the specific purpose of their use in quantitatively-based water resources management activities.

Hydrologic and water quality modeling is proposed as a quantitative tool to identify specific water resources management issues in the area of the PIC, its surrounding Trou du Nord/MTA system and regionally in Northern Haiti. This modeling effort should encompass both long-term water resources management issues (e.g., allocation, water quality impairments, salinity intrusion, sea level rise) as well as impacts of include hydrologic and climate extreme events (e.g., tropical cyclones, storm surge, extreme rainfall, flooding, heat waves, drought).

This activity pursues a dual purpose. On one hand, there is an immediate and concrete need to assess water resources in the PIC as an integral part of the Bank's commitment to the country. On the other hand, it is clearly understood that water resources availability and quality in the PIC are part of the larger issue of overall water resources management in the Trou du Nord - MTA system, so proceeding with a narrow focus on the PIC and its near surroundings would be insufficient to assess the medium-to-long term sustainability of water resources and other natural and built infrastructure in the area.

In addition to this dual purpose, this project presents a unique and timely opportunity to develop an analysis template to tackle water resources management issues in other basins and aquifers across the country. The integration of institutional governance (Activity 1) data analysis (Activity 2), and hydrologic modeling (this activity) allows the formulation of a template that can be later applied to other parts of the country. Because of this, and due to the fact that extending the modeling effort to the rest of the country can be achieved here through economies of scale, it is proposed that the modeling tools developed through this activity are extended spatially to cover the entire country of Haiti. In particular, it is critical that this activity be conducted in close collaboration with key local stakeholders in the Trou du Nord/MTA system, as identified under Activity 1.

It is envisioned that three nested models will be developed:

* The first model will be a detailed hydrologic model at the scale of the PIC which will serve to quantify current and future water availability and quality for the industrial park. This model should be developed with a spatially-distributed formulation, and have integrated surface water - groundwater simulation capabilities.
* The second model will be a basin-level model for the Trou du Nord-MTA system. Preferably, this model should be spatially lumped (basin hydrology).
* The first model will be nested within the second, and an automated link should be develop to interface the two.
* Each model will address the following specific technical components: (i) surface and groundwater availability (water balance); (ii) water use; (iii) impacts under different climate and development (localized climate projections, land use, water allocation) scenarios; (iv) flood risk analysis, in particular, for the PIC; (v) discrete water quality; and (vi) the potential for salinity intrusion.
* The second model will be developed so that it is nested within a third hydrologic model that covers and is able to simulate all the watersheds of Haiti. This third model will be developed using the recently IDB-released HC-LAC system, and should be parameterized so that it becomes a modeling template for future extensions of hydrologic assessment activities in the country.

Pilot utilization of the HC-LAC modeling system has been implemented already in Argentina, and the consultant should review this application study to become familiarized with the tool, its structure and I/O user interface. This activity also entails a coordinated approach with stakeholders in the Trou du Nord/MTA system to define common protocols and to visualize and present the overall modeling results.

The hydrologic model development results will be disseminated through a capacity building workshop that will summarize the findings of the project up to this activity. This workshop will contribute to solidify the integration of stakeholders and institutions that carry out water resources management activities through building capacity that is specific to this project.

**Activity 4. IWRM plan for the Trou du Nord - MTA System**

This activity entails the development of an IWRM plan and specifications for its implementation in the Trou du Nord-MTA system. This will include a watershed committee/strengthening of the water user’s association (WUA), preparation of an IWRM plan and support for implementing the plan. It is expected that the development and implementation plan under this task can serve as a pilot for future implementation within other watershed systems in the country.

The specific sub-activities to be carried out are proposed as follows: (i) engagement of IWRM stakeholders (identified under Activity 1) and assessment of Trou du Nord-MTA system’s hydroclimatic vulnerability (Activity 2); (ii) use of this forum and the results of "base" scenario model simulations (Activity 3) for the identification and prioritization of water resources issues and definition of a set of actionable solutions, including those actions prioritized and previously conceptualized and designed; and (iii) formulation of the IWRM plan and a strategic financial plan for major initiatives.

The prioritized issues, along with their solutions, will be structured into the action plan with clear goals (short/medium/long term). Also, conceptualization at the prefeasibility level of the IWRM plan implementation and the identification of estimated resources to execute this plan, as well as an estimate of investment amounts and schedules at a level of detail that is sufficient for preliminary loan preparation at the IDB will be performed.

The IWRM Plan should include the following:

* Intervention options for efficient use of water resources, soil conservation, improvement of PIC water use practices, agricultural systems in general and sustainable management of natural resources in a context of climate change in the area.
* Mapping of intervention options (land use zoning).
* Detailed information for each intervention option (beneficiaries, budget, implementation schedule, expected benefits, etc.).
* For each intervention, the plan should detail what the expected impact and how it contributes to the integrated management of the basin.
* Institutional strengthening and governance of local organizations required for the formulation and execution of plans.
* Monitoring and evaluation of the Plan (and outcomes of proposed interventions).
* Sustainability strategy for implementation of the Plan (resources, institutional commitments, other).
* Documentation of participatory processes undertaken to formulate the Plan (photos, attendance lists, agreements reached, other).

The IWRM plan and specifications for implementation results will be disseminated through a capacity building workshop that will summarize the findings of the project up to this activity. This workshop will contribute to solidify the integration of stakeholders and institutions that carry out water resources management activities through building capacity that is specific to this project.

## EXPECTED WORK PRODUCTS AND SCHEDULE OF DELIVERY

The table below summarizes the deliverables and schedule for this contract.

|  |  |  |
| --- | --- | --- |
| **Project Activity** | **Deliverable** | **Target Due Date (beyond NTP: Notice-to-Proceed)** |
| General | Detailed Work Plan | NTP + 1 mo |
| Activity 1: Institutional and governance analysis | Product 1A: Report on analysis of the institutional and governance information.  Product 1B: Report on analysis of the capacity of local institutions for IWRM.  Product 1C: Technical Memorandum on dissemination and engagement meeting | NTP + 4 mo  NTP + 4 mo  NTP + 6 mo |
| Activity 2: Data gap analysis and collection of model required information | Product 2A: Technical Memorandum on data required as input for hydrologic modeling, with data gaps identified.  Product 2B: Technical memorandum on Capacity Building Workshop | NTP + 4 mo  NTP + 6 mo |
| Activity 3: Development of hydrologic models | Product 3A: Report in local scale (PIC) hydrologic model developed and calibrated.  Product 3B: Report on watershed scale (Trou du Nord - MTA) hydrologic model developed and calibrated.  Product 3C: Report on national scale (all basins in Haiti) hydrologic model developed and parameterized.  Product 3D: Technical Memorandum on Capacity Building Workshop | NTP + 12 mo  NTP + 16 mo  NTP + 20 mo  NTP + 21 mo |
| Activity 4: IWRM for the Trou du Nord - MTA watershed | Product 4A: Report on IWRM Plan for the Trou du Nord - MTA watershed.  Product 4B: Technical Memorandum on IWRM knowledge transfer and capacity building workshops delivered. | NTP + 24 mo  NTP + 27 mo |

## CONTRACTOR ELIGIBILITY INFORMATION

Proposals in response to these Terms of Reference may only be submitted by the following:

* Non-profit, non-academic organizations: Independent research institutions, observatories, research laboratories, non-governmental organizations, professional societies and similar organizations associated with research activities.
* Academic institutions: Universities and academic research centers, acting on behalf of their researchers and faculty members.

Proposals from individual consultants will not be accepted.

## CONDITIONS AND TIME OF COMPLETION

## The proposed project timeline is shown in Section IV. The work will start upon receipt of a formal Notice to Proceed (NTP) by the IDB.

## Draft deliverables will be delivered to the IDB within 30 calendar days of the proposed deliverable due dates. The contractor assumes that the IDB will review and prepare written comments within fifteen (15) calendar days of submittal. Upon receipt of comments from the IDB to such drafts, the contractor will submit the final version within fifteen (15) calendar days of receipt of such comments.

## The contractor will submit a more detailed work plan and schedule within thirty (30) calendar days after the receipt of the Notice to Proceed.

Other conditions applicable to this research and development contract are as follows:

* During the proposed capacity building workshops, the participants will have a chance to evaluate the facilitators and presenters. The IDB has included this component in the budget for this TC.
* During the proposed capacity building workshops, the participants will be involved in hands-on exercises, which will be evaluated by IDB staff. The participants will receive feedback on these exercises as a result of this evaluation. The IDB has included this component in the budget for this TC.

## COMPENSATION

The compensation for this consultancy contract described under Tasks (1)-(3) shall be a lump sum amount as approved during negotiations between the IDB and the contractor. Payments will be made corresponding to progress towards the following deliverables and contract allocation.

|  |  |
| --- | --- |
| **Product ID** | **Percentage Budget Allocation** |
| Product 1A: Report on analysis of the institutional and governance information. | **5** |
| Product 1B: Report on analysis of the capacity of local institutions for IWRM. | **5** |
| Product 1C: Technical Memorandum on dissemination and engagement meeting | **5** |
| Product 2A: Technical Memorandum on data required as input for | **7.5** |
| Product 2B: Technical memorandum on Capacity Building Workshop | **7.5** |
| Product 3A: Report in local scale (PIC) hydrologic model developed and calibrated. | **15** |
| Product 3B: Report on watershed scale (Trou du Nord - MTA) hydrologic model developed and calibrated. | **15** |
| Product 3C: Report on national scale (all basins in Haiti) hydrologic model developed and parameterized. | **10** |
| Product 3D: Technical Memorandum on Capacity Building Workshop | **5** |
| Product 4A: Report on IWRM Plan for the Trou du Nord - MTA watershed. | **15** |
| Product 4B: Technical Memorandum on IWRM knowledge transfer and capacity building workshops delivered. | **10** |

The IDB will be invoiced monthly, based on the percentage of completion method and meeting the date of each deliverable as stated in Section IV, as well as the conditions specified in the table above.

The contractor will submit monthly invoices, substantiated by written monthly status reports.

1. *ENVIRON, 2011:*  [↑](#footnote-ref-1)
2. *Watershed Management in Haiti; Recommended Revisions to National Policy*. USAID. 2009 [↑](#footnote-ref-2)