# GEF-IWCAM Project Experience Note # 6

## TITLE

**Wastewater Wetland Treatment System**

## PROJECT TITLE

**Protecting watershed services and developing management incentives in the Fond D'or Watershed area of Saint Lucia.**

## PROJECT DESCRIPTION

The overall objective of this project is to contribute towards improving the quality of life, health and sanitation through better management, capture, and distribution of available water resources in the Fond D'Or Watershed in Saint Lucia.

The Fond D'or Watershed feeds into the District of Dennery, which covers an area of approximately 70 sq km, and had a population of 2,760 households and 29 scattered settlements at the time of project conception (WRMU-GOSL, 2001). The Fond D'or Watershed is the second largest in St. Lucia comprising 10,230 acres. There are 15 communities within the Fond D'Or Watershed which comprises Despinoze, La Caye, La Perle, Limiere, Gardette, La Resource, Richfond, Thomazo, Grand Rivière, Belmont, Au Leon, Grand Ravine, Morne

Panache, Bois Jolie and Dernière Rivière. Water quality is often poor as a result of inadequate management techniques leading to siltation, chemical pollution from the once thriving banana industry and biological impacts from animal husbandry as well as improper sewage disposal systems and practices.

## DESCRIPTION OF ISSUES

The findings of a baseline survey[1] of sewage management in Au Leon, one of the more populated communities in the Fond D'or watershed, revealed that the waste management practices of residents were a major challenge. The main purpose of this one-on-one survey was to establish baseline information on the nature and extent of access to faecal waste management systems existing within the community of Au Leon. For this reason, the project introduced the Wastewater Wetland Treatment System (WWTS) to this community.

A stream water survey conducted by the Caribbean Environmental Health Institute (CEHI) during the period 2007-2009[2] revealed that rivers and streams within the Fond D'or Watershed suffer from borderline to extremely high levels of faecal contamination. This was confirmed by the revelation in the needs assessment survey that a significant number of persons living in the area had no access to toilet facilities and therefore practised very basic waste disposal. Addressing this need was fundamental to improving river and stream water quality in the area. In response, the project managers agreed to provide assistance in rehabilitating existing public toilet facilities in the community, as a priority activity.

[1] Digna G. (2009) **Baseline Survey on Sewerage Management in Community of Au Leon**, GEF-IWCAM.

[2] CEHI (2010) Certificate of Analysis issued following stream water survey to compare data collected over sampling period 2007 to 2009 and to assess the effectiveness of management interventions.

The WWTS project was intended to provide a management system for faecal waste in the community. To this end, the project had the following primary objectives:

- To conduct public awareness and sensitization activities, including community consultations; field trips; school programme; the mass media; etc.
- To undertake an assessment of the type of pollutants that enters into the waterways, as well as the sources of those pollutants.
- To promote and introduce new septic tank technologies, including the WWTS, to the Au Leon community, by targeting contractors and builders in the community and its surrounding environs.
- To undertake water quality monitoring of waterways before and after construction of the WWTS.
- To construct demonstration WWTS.

## RESULTS AND LEARNING FROM EXPERIENCE

The WWTS project proposed was originally meant to intercept the run-off from Au Leon and Despinoze streams with one large wetland unit at La Perle (the drainage area). However this idea was aborted for two main reasons: (1) Management and maintenance of the proposed single system which would treat run-offs from the upper region presented a major challenge; and (2) It was observed that untreated water between the proposed system and the source of the contaminants would still expose residents to harmful pathogens. In light of this, the decision was made to construct smaller communal wetland units next to private septic tanks in Au Leon. These adaptive management practices were employed in response to the community's pressing need, and the gravity of existing waste management problems.

### Project Results:

The major project output was the construction of demo wetland compilation of a Reed bed system/Subsurface flow/Wetlands/Root Zone treatment

plants/Horizontal Gravel Filter and Evapotranspiration beds using the Sewage Needs Assessment Report as a guide. To facilitate this, an assessment of the type of pollutants entering the waterways, as well as the source of the pollutants was conducted. Water quality monitoring of the waterways before and after construction of the wetland was another project output.

Another major achievement was the establishment of the Au Leon Constructed Wetland Project Committee among community members to oversee the implementation of the waste water treatment demonstration systems. Additionally, there were public awareness and outreach programmes which included community consultations, field trips, school programmes and use of mass media. They also engaged in the promotion and introduction of the new WWTS technologies to the Au Leon community, by targeting contractors and builders in the community and its surrounding environs.

**Design of WWTS**

The WWTS was designed to be 8 feet long and 6 feet wide (with a surface area of 48 ft $^2$) with plants playing a significant role in the treatment process. A WWTS of this size can treat black waste water originating from an average of 4 households, with an average density of 3 persons per household. Some residents have expressed interest in adopting such a system when constructing new homes, but there was no evidence at the time of project conclusion to confirm the scale of this uptake. However, the project was able to demonstrate how cost effective and easy it is to manage this technology.

**Assessment of pollutants and source**

During a visual assessment, the Au Leon Wetland Project (ALCW) Committee observed that the major source of pollution appeared to be domestic (grey and black water) associated with homes and public facilities such as Laundromats. The Committee also observed that a number of households did not have any soakaways and that in many cases, black water was deposited directly into a nearby ravine with no prior treatment.

As revealed in the baseline study[3] conducted in support of this project, rivers and streams within the Fond D'or watershed suffer from borderline to extremely high levels of faecal contamination. This was confirmed by the revelation in the need assessment survey[4] that a significant number of persons had no access to toilet facilities. It was felt further, that if this practice was not addressed and discontinued then any number of wastewater treatment units constructed in Au Leon would not create the desired impact.

**Training of Contractors and installation of systems at selected locations**

Initially some of the WWTS units were not properly constructed, resulting in leaks. Workers (masons) external to the immediate community had to be hired to repair the badly constructed units. In one case an entire system had to be condemned. Additionally, a total of twenty-three contractors, artisans and tradesmen attended two workshops hosted by GEF-IWCAM Project in association with the Environmental Health Department of the Ministry of Health. These workshops sought to impart knowledge of the basic design of septic tank construction, Environmental Health Department procedures and the structural requirements and functions. A group of students and Wastewater Specialists from the University of Vermont also networked and collaborated with GEF-IWCAM St. Lucia Demonstration Project Management Unit in designing the wetlands, teaching locals how to construct the units and assisting in the execution of the WWTS Project.

[3] Serville, M. (2009) **Towards characterizing pollutants affecting river water quality in the Fond D'Or watershed, and determining possible impacts on the health of watershed residents**, GEF-IWCAM

[4] GOSL (2006) **Poverty Assessment Report**, Ministry of Social Transformation, Government of Saint Lucia, Castries.

### Community education and public awareness

In order to ensure that there was buy-in and support for the Constructed Wetlands Project, it was decided very early to get the community involved in the development of the project. In light of this, informal meetings were held with community members to discuss the problem of wastewater treatment and disposal in Au Leon and how the Constructed Wetlands Project would attempt to address some of these problems. Following the meeting a number of community members decided to come together to form the Au Leon Constructed Wetland Project Committee to oversee the implementation of the waste water treatment demonstration systems.

The GEF-IWCAM Project also participated in two exhibitions during the project period. They included the National Independence Exhibition and the Saint Lucia Water Week Exhibition. During both exhibitions a glass model of the constructed wetland was displayed so that the public could get a better understanding of how the wetland system functioned.

## Learning from the experience:

### Community Participation

As a result of the early involvement of the community, as well as their buy-in and endorsement of the project, which was achieved through a concerted effort to involve the community, the Project reported no negative incidents with community members during implementation. In fact, community members who demonstrated interest were encouraged to reach out to other community members to inform them of the project. This outreach and early involvement resulted in the formation of a local community organization which took on project management responsibilities at the immediate community level. This community group took responsibility for raising awareness of the project as well as identifying locations for the placement of the constructed wetlands.

## Technology Adaptation

The project was implemented in a rural community in Saint Lucia, and the transfer of this technology is also expected to take place in other rural communities, even though it could easily apply to very urban residential communities on a larger scale. Given the need therefore, for easy rural application, it was essential that readily available local resources were incorporated in the design of the constructed wetland. This was a deliberate strategy to ensure manageable construction cost of the wetland as well as to ensure that the technology was adaptable to the local environment.

But adaptation has its own challenges. Some materials such as the plastic used to line the wetland base, proved to be difficult to replace. The local material used to substitute the plastic lining was a concrete sealant, which proved problematic when used on areas that were not concrete-based. For example, the connection between the pipes entering and leaving the wetland experienced continuous leaking problems during the commissioning of the WWTS.

With respect to commissioning the system, another critical lesson was learnt. It was realised that by adapting the wetland technology through the use of local materials, time and resources for testing the resiliency of the adaptations, must also be considered. As such, it is essential when attempting to adapt technologies to local conditions, that additional time and financial resources are factored in to the project to allow for testing and refinement.

## Needs Assessment

It is not uncommon, for a needs-assessment to be conducted in a community identified for project support or intervention with little consideration given to the adjoining communities. During the pollutant assessment, the project focused on the drainage area that fed into a ravine where an existing water quality sample point was located. The hope was that with the existence of the constructed wetlands within the project area, water quality would improve. However, midway

through the project, it was discovered that persons from the adjacent drainage basin utilized an area in the ravine just above the water quality sample point for the disposal of faecal matter. This revelation could compromise the integrity of the project as other unknown sources of pollution would be entering the basin and compromise what would have otherwise been positive results. It was also discovered that the bordering community appeared to have a more serious waste disposal challenge than the study area.

The lesson learnt from this revelation was that baseline and needs assessment studies should be conducted in a holistic fashion with the recognition that communities are seldom isolated entities but often have links to neighbouring settlements and activities which may not visibly impact them, but do.

**Capacity Building**

Although the study engaged the services of a foreign engineering firm, *Eco Solutions*, as well as students from the University of Vermont, to design the constructed wetland, this was done in collaboration with local engineers and contractors. Further, during the construction phase, only local individuals from the community were engaged in the construction of the wetland. By doing so, the project ensured that there was technology transfer at the local level, thereby ensuring capacity building for both local contractors and engineers, who now have the knowledge of this technology and can continue to improve on its appropriateness to the local environment.

# REPLICATION

The conditions for replication of good practice or lessons learnt are often dependent on the local conditions that facilitate this. It was essential from the onset that available local resources were incorporated in the design of the constructed wetland. This was seen as a mechanism to cut down the construction cost of the wetland as well as to ensure that the technology was adaptable to the local environment. Notwithstanding this, some materials still

proved to be difficult to replace, for example the plastic used to line the wetland base. The local material used to replace the plastic lining was concrete sealant. However, it proved to be problematic in sealing areas that were not concrete, for example the connection between the pipes entering and leaving the wetland. This resulted in leakage problems, as well as difficulty in the commissioning of the wetland. It became evident that by adapting the wetland technology through the use of local materials, certain things were not considered, such as allocating additional time and financial resources for testing the resiliency of the adaptations.

The early engagement of the local community augured well for the sustainability of the project. The establishment of a community organisation, headed by a community member, was responsible for raising awareness and local placement of the constructed wetlands facilitated buy-in by the community. It was also determined from the onset that users of the units would assist in the construction process. This, it was hoped, would result in increased community interest and participation of the project.

Ideally the wetland unit can be constructed within fourteen days at a cost of EC $5,340.68. This cost is admittedly prohibitive for any rural private home, however as the technology is mainstreamed, and if these could be constructed to service more than five homes, then the unit cost could become more affordable.

## SIGNIFICANCE TO GEF-IWCAM

The GEF–IWCAM approach is a strategy that incorporates watershed and coastal areas management in achieving improved overall watershed management objectives. The strategy covers coastal area management and biological diversity conservation; tourism development policy and planning; protection of water supplies; and land and marine-based sources of pollution. The experiences from this sub-project do not speak directly to all of these objectives, but have particular relevance to the “land and marine-based sources of pollution”. The WWTS project speaks directly to the development and

implementation of improved and coordinated water resource management and conservation practices. It provides a potentially inexpensive option for managing faecal waste and to address the pollution of nearby waterways. Successful replication of this technology could potentially help to address social inequities which exist, particularly with regard to access to waste disposal and wastewater treatment services.