



Improvements to the Monte del Estado Vacation Center

Civil and Environmental Engineering Senior Design Project: WI-17 & SP-18

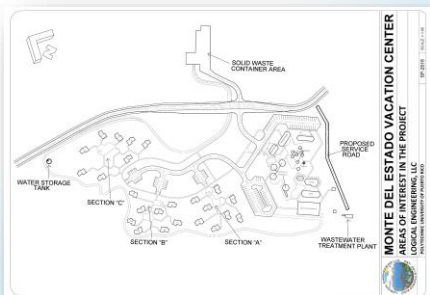
Members: Patricia González Maldonado, Yazaira Manzano López, José Mejía Borrero, Carlos Rodríguez Latoni, Pablo Rodríguez Ramos, Nelson Sánchez Núñez, Noel Solá Sánchez, and Francisco Vázquez Ortiz
Mentor: Prof. José Borrageros Lezama

Abstract

Logical Engineering, LLC was assigned by the Puerto Rico Department of Sports and Recreation to improve the wastewater treatment plant (WWTP) of the Monte del Estado Vacation Center (MEVC). Upon several site visits, the team encountered other problems at the facility and improvement alternatives were proposed. These include the replacement of the existing sanitary sewage pipes, a rain harvesting and treatment system to increase drinking water availability, soil erosion control measures, and an integrated solid waste management plan. The alternatives were evaluated considering environmental and economical feasibility aspects. The selected alternatives include: modification of the WWTP using a Moving Bed Biofilm Reactor (MBBR) system, a system that collects and treats rainwater from the roofs of the cabins, and segregation/processing of organic and inorganic materials.

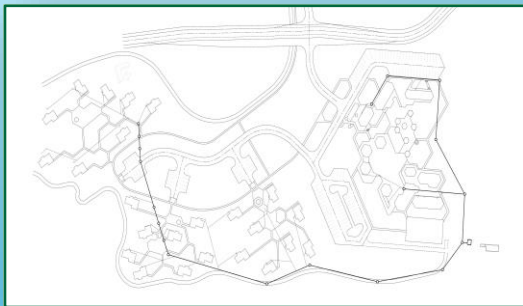
Objectives

- Retrofit the WWTP.
- Replace the sanitary sewage pipes.
- Increase drinking water availability.
- Provide erosion control measures.
- Implement an integrated solid waste management plan.



Replacement of sanitary sewage pipes

The alternative of replacing all sewage pipes is due to the collapse of many of the collection lines, which represents a problem to the WWTP because of the excess infiltration and sediments that enter into the system. The replacement of all collection lines to PVC pipes, as well as the elevations and slopes of the collection system, ensure a proper wastewater flow.



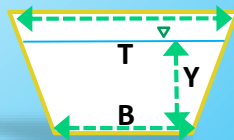
Retrofit of the WWTP

The existing WWTP will be modified by transforming the existing aeration tank into a MBBR, sealing the existing clarifier and furnishing a solid separation and dewatering unit, and installing an UV radiation system.



Stormwater runoff channels

A system of open channels for stormwater runoff is proposed to redirect the flow to an adjacent creek.



Rain harvesting and treatment system

The proposed solution for the drinking water supply is an integrated rain water harvesting system with filtration and disinfection. The system will be connected to a new 100,000 gallons water storage tank.



Integrated solid waste management plan

Solid wastes will be managed by separating the organic from the inorganic material. The organic matter will be treated in a continuous flow-through vermicomposting system. Aluminum cans will be segregated from the inorganic material to be sold.



Costs, savings, and profits

	WWTP retrofit	Replacement of sanitary sewage pipes	Stormwater runoff channels	Rain harvesting and treatment system	Integrated solid waste management plan
Capital Costs*	\$178,702	\$21,644	\$31,194	\$65,512	\$44,474
Savings* (annual)	***	***	***	\$6,400	***
Profits* (daily)	***	***	***	***	\$1,064

* Estimated values

Conclusion

Innovative solutions, such as a MBBR system for the existing wastewater treatment plant, a roof rainwater harvesting and treatment system, and a vermicomposting flow-through system to handle organic wastes, were selected and developed.

