GLOBAL WATER STEWARDSHIP

Global Water Stewardship; La Fortuna, Costa Rica

2019-2020 Problem Statement

Parque La Fortuna with Arenal Volcano in Background

Project Understanding

- Location: La Fortuna, Costa Rica
- Population: 15,500
- Number of Water Services: 3,000
- Water Usage: See Project Considerations Section
- Average Precipitation: 3500mm
- Average Temperature: 25 Degrees Celsius
- Typical Influent Characteristics;
    - Parameter
        - BOD_5 = 280 mg/l
        - TSS = 220 mg/l

- Required Effluent Characteristics;
    - Parameter
        - BOD_5 = 50 mg/l
        - TSS = 50 mg/l
        - Total Nitrogen= 50 mg/L
        - Fecal Coliform = only applicable for water reuse, refer to "Reglamento de Vertido y Reuso de Aguas Residuales" Table 7.

Costa Rica has very few centralized treatment systems. In rural areas, septic tanks are a common way of treating wastewater; greywater is often discharged directly overland. The leach fields are very small and very shallow. The law states the leach fields must stay within each individual property, however they often do not. Shallow bedrock and poor soils, as well as poor design, cleaning and maintenance practices, often contribute to improper treatment of septic tank effluent. Further exasperating the issue, it is not uncommon for sludge cisterns to dump collected material in rural areas (polluting) instead of trucking the sludge to a distance WWTF

The area of concern is a collection of communities known as La Fortuna, Costa Rica. La Fortuna is located in north central Costa Rica in the Alajuela Province. It is located 18 kilometers from Arenal Volcano National Park and 140 kilometers from San Jose. It is officially known as La Fortuna de San Carlos. La Fortuna is significantly developed compared to a typical rural Costa Rican community.

The planning area is composed of several smaller communities including La Fortuna, Zeta Trece, and Barrio Dora. These areas are mainly residential with a heavy dependence on tourism (hotels, restaurants and shops). The region hosts roughly 250,000 tourists per year. Roughly 3/4 of the tourists visit between November and June. A centralized sanitary wastewater solution is desired along with a reliable collection/conveyance system.

The residential population is relatively steady with no current plans for major developments, or significant residential population growth. However, as tourism grows in the region, more businesses and residents may move in. Assume a residential population growth of no more than 2% per year, and tourism growth of no more than 4% growth per year.

Although almost every home and business own a private septic tank, there are three (3) private treatment plants within the community. Costa Rica's electrical grid consists of 110-volt power, a combination of single phase and three phase and unexpected power outages do occur. For the La Fortuna design, assume that three-phase power will be readily available.

The local utility has been proactive in seeking a centralized wastewater treatment solution and would like a preliminary conceptual design of a treatment system along with a collection system. The design team must propose three (3) locations for the treatment site. Additionally, the design team must propose three (3) alternative treatment systems (each system may be one type of treatment or a series of treatment processes). The community is very interested in the idea of an energy neutral treatment process and the design team should hold this community interest in high

regard while considering treatment alternatives. A feasibility report must be developed that examines an energy neutral system.

Given the complexity and status of the project, the design team must work on **an optimal site selection** and **a preliminary design proposal**. The design should be as intensive as possible (design the actual hp of pumps, actual diameter of pipes, accurate elevations and stationing, etc.).

La Fortuna, unlike most Costa Rican communities, has one government owned site that has been set aside for a future wastewater treatment site. When considering three (3) locations for the centralized treatment site, **note that the government owned site should be one (1) of the three (3) proposed sites.** For the design team's final recommendation for ideal site location one should consider proximity to the La Fortuna community while also considering cost to acquire new land.

In Costa Rica, especially in rural areas, toilet paper is not disposed of in the toilet. This is due to low water pressure, smaller pipe sizes and general goal to reduce solids entering into septic tanks or treatment systems. Used toilet paper is typically collected in trashcans and is disposed of along with other solid waste. Design of wastewater collection and treatment improvements should follow Costa Rican design standards as much as possible, otherwise typical U.S standards.

It is Costa Rican law that the property owner is responsible for their individual connection to the sewer main, however, it is necessary to plan for funding the entire connection. It is also Costa Rican law that if you have water service once a sewer main is constructed in front of a property, the property owner must pay for the service whether they chose to connect to the system or not.

Project Considerations

- La Fortuna has provided water consumption data. This data is available in the Google Drive folder. The community has also provided the official design standards for potable and sanitation treatment systems. Section 5 of the design standards cover sanitation systems.

  Minimum water consumption per Costa Rican design standards are as follows:

  Rural Areas: 200 Liters/person/day

  Urban Areas: 300 Liters/person/day

  Coastal Areas: 375 Liters/person/day

  Metropolitan Area: 375 Liters/person/day

- Wastewater production can be estimated assuming 80% of water consumed/person will be sent to the sanitary system. For more information, refer to Section 5.3 of the Costa Rican design standards.
- Water consumption data should be analyzed and compared to the given minimum water consumption guidelines.
- Infiltration flow for PVC pipe material is 0.25 Liters/sec/km

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Project Approach

For this project, CSWEA is soliciting designs for a long-term solution to the sanitation problem in this region. In general, the solution approach should be to design a centralized treatment system with a complete collection system.

Additional Information can be found by using the following link. Note that the link may need to be copy-pasted into the URL.

https://drive.google.com/drive/folders/1ArG23ijt1XRVDx_9rZWTKS3no9efUstI

Additional Project Considerations

The specific areas of concern with the collection and wastewater treatment system are described as follows:

1. The treatment facility must be adequately sized for anticipated flow, future growth, with seasonal rainfall variability taken into account.
2. Seasonal variability of flows due to tourism should also be taken into account.
3. Treatment facility should be designed to be able to treat the effluent to meet the limits as described in this document.
4. Due to the socioeconomic status of the community, user fees must be lower than 5,000 colones, per month.
5. The location of the treatment facility needs to be easily attainable and needs to be located in an area that is not at risk of flooding and landslides. Additionally, be aware of and protect existing drinking water sources. Treatment site location also needs to be evaluated for ease of construction and potential impacts on nearby homes and businesses. The average and maximum flows for the proposed collection system need to be determined.

Design Objectives & Constraints

The following are the items that should be discussed or implemented as part of the design project. The design that best accomplishes these goals will have the highest likelihood of long-term success.

1. The project must take into consideration the local climate (temperature and heavy rainfall) and high variability due to tourism.
2. Avoid offensive odors and minimize impacts on landscape aesthetics.
3. The equipment must have a level of redundancy to maintain treatment if some equipment is in temporary disrepair.
4. The solution must utilize a minimum of space and energy. Special consideration will be given to designs that are energy efficient and/or partially self-sustaining from an energy standpoint.
5. The project capital cost must be minimized.
6. The system must be easy to operate and maintain. There is no wastewater training available in the area or wastewater operators' associations. Local staff will have to be trained on the system operation and maintenance, but may be available only on a part-time basis, so the system should be fairly self-operational.

7. The wastewater treatment equipment must be easily replaceable with parts readily available.
8. Treatment equipment must be compatible with the existing electrical system.
9. Consider simplicity (less O&M the better) in design whenever possible.
10. It is recommended that the teams design for the year 2040 (20 years). Provide justification with any variances.
11. Use best engineering judgement in consideration of separation requirements for potable water and sewer main. Potable water typically runs along the road Right-of-Way.
12. Design must follow Costa Rican design standards for wastewater systems, refer to section 5 of the document.