

# COLEGIO LUIS ESPINAL

## ON-SITE WASTEWATER TREATMENT



International Senior Design  
May 2008

### Background

International Senior Design (I.S.D.) is a program designed to expand the senior design program at Michigan Technological University to align students capstone design projects with the needs of developing countries. In May 2008, Joe Dammel, Steve Wright and Pam Brushaber traveled with 7 other ISD students to Santa Cruz, Bolivia to conduct research and prepare an engineering report for a school with a need for a proper functioning septic system. The team is comprised of two environmental engineering students and one civil engineering student.

### Project Scope

Colegio Luis Espinal is located in District 12 of Santa Cruz, Bolivia. It is a public school educating children from kindergarten through adults. The school contains 3500 students and teachers, and currently has no functioning toilet facilities. Students and faculty are exposed to untreated wastewater on the schoolyard. There is a high level of health problems. This is evidenced at the school by a documented epidemic of typhoid fever in 2007. A municipal sanitary sewer is expected in the next five to ten years. Spam Jammel performed a topographic survey, collected data and researched the situation and viable alternative options in order make a recommendation until the sewer is installed.

#### Existing conditions



Figure 1: Existing conditions (a) Septic system (b) Pozo ciego (c) Flooding (d) Toilet (e) Toilet house (f) Existing system sketch

### Design Concerns

- Could the system...
  - Function in an area with **clay soil**?
  - Handle a wastewater volume of at least **9,500 gpd**?
  - Function with a water table depth of **1.7 m**?
  - Fit within the **area available** within the schoolyard?
  - Be **inexpensive** to construct, operate and maintain?

#### Sand Filters

- Recirculating
- Split-bed recirculating
- Single pass



Figure 2: Sand Filters

#### Drainfields

- Standard, Gravity
- Pressure Distribution
- Dripline effluent

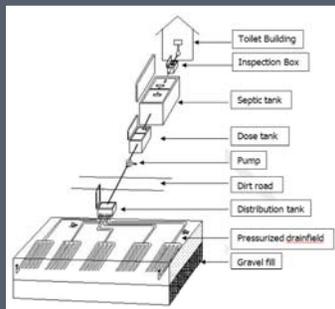
System	Cost (US \$)
Pressure Drainfield	\$25,000
Recirculating Sand Filter	\$180,000

Figure 3: Cost analysis

### Final Options

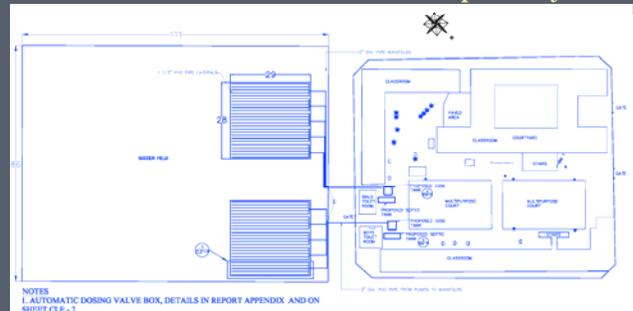
After assessing all the systems applicable for the needs of the school, Spam Jammel narrowed the options to recirculating sand filters and standard, or pressure, drainfields. The **pros** of the **sand filters** included functionality, location and feasibility since the system could be contained within the schoolyard. The **cons** to this system are that it occupies much of the usable area within the school grounds, creates unusable land, and is complex to maintain. **Drainfields** were researched as a second option, due to the concerns with the recirculating sand filter. The **pros** of the drainfield are reduced costs, simpler to maintain and construct, and will not interfere with land use. The **con** is the assumed social acceptability of using the adjacent soccer field for the drainfield.

### Final Recommendation



Pressure Distribution

#### Proposed system



### Conclusion

Spam Jammel recommends the construction of a septic tank system combined with a pressurized drainfield. The system has lower maintenance, simpler construction, lower cost, does not restrict the use of the soccer field, occupies the minimal amount of schoolyard and is a proven system. Spam Jammel recommends connecting to city sanitary sewers as soon as they are available, as the maximum life span of the drainfield is ten years.