Construction of a water treatment plant and sewer system for the Guaqui town, Department of La Paz / Municipality of Guaqui

Roberto Méndez, Daniel Maselli
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Overview

General Information

Contributors
Roberto Méndez, COSUDE-Ayuda Humanitaria, Bolivia
Daniel Maselli, Swiss Agency for Development and Cooperation SDC, Switzerland
Moritz Krüger, Swiss Agency for Development and Cooperation (SDC), Thailand
Michael Fink, Swisscontact
Tobias Sommer, SDC, Switzerland
GENTIANE SCHWARZER, SDC - DRR Network, Switzerland
nadia benani, SDC, Switzerland

Overall goal
Improve the current living conditions of Guaqui’s inhabitants through the implementation of an appropriate sewage system, benefiting the overall population

Country
Bolivia

Budget
Bs. 7'000'000 (approximately USD 1'000'000)

Duration
September 2016 - July 2017 (approximately 10 months)

Summary

Description
Due to the absence of a sewage treatment plant in the Guaqui town, wastewater is discharged directly to Lake Titicaca, causing serious water pollution. Through the construction of a sewage treatment plant, the water pollution will be reduced along with an improvement of the living conditions of the local population. As a result of frequent lake level fluctuations, however, the sewage treatment plant might suffer negative impacts from flooding. In addition, frosts during the cold winter months can affect the plant's components such as (i) the sewage collection system and inspection chambers, (ii) emissary, (iii) pumping chamber, (iv) pressure pipe, (v) treatment plant, and (vi) infiltration ditches.

Keywords
Wastewater treatment system  sewage collection system
emissary  water pumps
lake contamination  Bolivia
Floods  frosts

Sectors of Intervention

Health
Tourism
Water and sanitation
Documents

Project Information (pdf, 5.24 MB)

Images

Project_Location

General_project_data

Location

Coverage and extension

Components

Flood map

Components and flood map

Hazard map - Frosts

Guaqui pictures
CEDRIG Operational Construction of a water treatment plant and sewer system for the Guaqui town, Department of La Paz / Municipality of Guaqui
Risk perspective

Natural hazards (hydro-meteorological and geological)

<table>
<thead>
<tr>
<th>Hazard name</th>
<th>Flash floods, floods</th>
</tr>
</thead>
</table>

**Consequence**: Due to extreme lake level fluctuations, the plant's components could be damaged and filled with sediments. The service would be interrupted. This happens in average every 15 years.

**Selected Risk**

- **Severity**: Extremely harmful
- **Likelihood**: Likely
- **Significance**: High risk

**Vulnerabilities**: Disconnected communities, increased pressure on soils and water resources, fragile incomes, relationship between municipality and Risk Management Unit, additional health risks

**Potential Measure**

- **Capacity building in DRR for local communities**
  - Score (optional) 3.40
  - Comments: The local community has no experience in DRR and should be included in the steering mechanisms (social control)

- **Strengthen operation and maintainance**
  - Score (optional) 3.20
  - Comments: DRR-related aspects were not considered for plant's operation and management

- **Early warning system**
  - Score (optional) 2.00
  - Comments: It is vital to observe the lake level fluctuations as well as the river discharge

- **It is vital to observe the lake level fluctuations as well as the river discharge**
  - Score (optional) 2.20
  - Comments: Dykes to protect the plant's components
**Reduction of river discharge (river deviation)**

Score (optional) 1.60  
Comments Consider structural measures that permit the diversion of inflowing river water

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Severity</th>
<th>Likelihood</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to flood events, the equipment can not be used and/or broken parts have to be replaced</td>
<td>Extremely harmful</td>
<td>Likely</td>
<td>High risk</td>
</tr>
</tbody>
</table>

Vulnerabilities

Skills: weak technical knowledge, replacement of spare parts, insufficient access to credits and insurance solutions, lack of ownership of the municipality, emerging local markets and trade

**Potential Measure**  
**Use of water-resistant, robust equipment**

Score (optional) 1.80  
Comments Consider extreme events  
> Selected Measure

**Risk transfer measures (insurance solutions)**

Score (optional) 2.20  
Comments Taking into account the socio-economic situation of the municipality and the local population, an insurance solution could be appropriate  
> Selected Measure

**Consequence**  
During a flood event, the wastewater could contaminate the river water and cause health problems for the local population. Due to the topography, contaminated water would flow into the lake and not to the urban zone.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Likelihood</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slightly harmful</td>
<td>Likely</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

Vulnerabilities

Health: health education, social hygiene, health stations, health networks, unprotected water sources, precarious health situation

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**Hazard name** Extreme cold

**Consequence**  
Malfunction of the plant and drastic efficiency reduction of the oxidation basins. 90 to 180 days per year with frosts, 3835m a.s.L, average temperatures of 4°C , minimum temperatures -10°C (on average every 2 years)

<table>
<thead>
<tr>
<th>&gt; Selected Risk</th>
<th>Severity</th>
<th>Likelihood</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful</td>
<td>Likely</td>
<td>Medium risk</td>
<td></td>
</tr>
</tbody>
</table>
Vulnerabilities
Operation and efficiency: communities with respiratory infections, lack of maintainance, low technical capacity, frequent interruption of service

Potential Measure

<table>
<thead>
<tr>
<th>Change to appropriate materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score (optional) 2.40</td>
</tr>
<tr>
<td>Comments Identify materials that support extreme cold temperatures</td>
</tr>
</tbody>
</table>

> Selected Measure

<table>
<thead>
<tr>
<th>Heating system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score (optional) 1.40</td>
</tr>
<tr>
<td>Comments Identify a technical solution that allows the plant's operation within the material's optimal temperature range (e.g. heating system)</td>
</tr>
</tbody>
</table>

Adapt your project

Multi-criteria analysis of identified measures (xlsx, 13.04 KB)
Adapted Logical Framework (in Spanish) (pdf, 59.96 KB)
Impact perspective

Impact on climate change

<table>
<thead>
<tr>
<th>Component of the project</th>
<th>Potential negative impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water treatment plant (oxidation basins)</td>
<td>Greenhouse gas emissions from the oxidation basins</td>
<td>Taking into account the seize of the water treatment plant, high levels of GHG emissions can be expected. Even higher emissions are possible during a malfunction of the system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Measure</th>
<th>Artificial cover of the oxidation basins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score (optional)</td>
<td>2.20</td>
</tr>
<tr>
<td>Comments</td>
<td>Storage of gases and burning with appropriate technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential negative impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission of additional other gases by the water treatment system</td>
<td>According to studies, the risk of problems arising from additional gas emissions is low in our study area.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component of the project</th>
<th>Power systems of the plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential negative impact</td>
<td>The generators of the different pumping systems run with diesel causing high emissions of GHG and black carbon</td>
</tr>
<tr>
<td>Significance</td>
<td>Taking into account the plant's increasing utilization (close to its limits), the pumping hours will increase in the future along with emissions of GHG and black carbon</td>
</tr>
</tbody>
</table>

> Selected impact
### Potential Measure

**Use of alternative energies, energy generation through burning trapped gases from the oxidation basins**

**Score (optional)** 1.60  
**Comments** Strong winds in the study area (high potential for wind energy), and solar power

> Selected Measure

**Connection to the national power supply system**

**Score (optional)** 1.20  
**Comments** This measure would imply the installation power supply lines over long distances

### Impact on the environment

<table>
<thead>
<tr>
<th>Component of the project</th>
<th>Water treatment plant (oxidation basins) and pumping chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential negative impact</td>
<td>Bad odors could disturb the surrounding population</td>
</tr>
<tr>
<td>Significance</td>
<td>Worsening of the quality of life for the local population and related health issues</td>
</tr>
</tbody>
</table>

> Selected impact

<table>
<thead>
<tr>
<th>Potential Measure</th>
<th>Artificial cover of the oxidation basins</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Score (optional)</strong></td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Comments</strong></td>
<td>Prevents odor emissions</td>
</tr>
</tbody>
</table>

> Selected Measure

<table>
<thead>
<tr>
<th>Component of the project</th>
<th>Location of the water treatment plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential negative impact</td>
<td>Landscape changes due to the different construction sites</td>
</tr>
<tr>
<td>Significance</td>
<td>The water treatment plant could have an negative impact on the number of tourists visiting the Lake Titicaca region</td>
</tr>
</tbody>
</table>

> Selected impact
### Impact on disaster risks

<table>
<thead>
<tr>
<th>Component of the project</th>
<th>Water treatment plant (oxidation basins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential negative impact</td>
<td>New settlements around the plant in the future</td>
</tr>
<tr>
<td>Significance</td>
<td>Structural measures to protect the plant (e.g. through dams) could attract people and lead to new settlements in flood-prone areas</td>
</tr>
</tbody>
</table>

#### Selected impact

- **Security strips**
  - Score (optional): 3.20
  - Comments: To be included in the territorial plans

- **Purchase of land in surroundings**
  - Score (optional): 1.20
  - Comments: Acquisition of land to avoid new settlements in flood-prone areas

### Potential negative impact

- Exposure of the Guaqui’s local population to greater risks from natural hazards and increase of vulnerability
**Significance**

The planned structural protection measures could lead to a shift of risks more towards the urban areas. Scientific studies estimate a medium risk for this development.

**Adapt your project**

Adapted Logical Framework of the project (pdf, 58 KB)
Multi-criteria analysis of identified measures (xlsx, 13.04 KB)