Urbanization and Water Quality Control in Vientiane Capital

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Water Resources and Environment Administration
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II. Situation of quantity and quality of the water source

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Main characteristics

- Lao PDR: land locked
- Area: 236,800 km²
- Population: 5.8 million (in 2006)
- Density: about 24/km²
- Climate Condition: Tropical, influenced by the Southeast monsoon
- 80% of which are mountainous, mainly in the Northern region,
- the remaining 20% comprising mostly flat floodplains along the Mekong River,
- 35% of flow contribution to the MeKong River
Background

- Vientiane Capital City contains almost 1,500 km² of permanent and seasonal water bodies, floodplains, swamps and marshes. The wetland areas supply a wide range of economically valuable goods and services, including fishery products, farming and natural resource collection activities, maintenance of water quality and supplies, and treatment of domestic, agricultural and industrial wastes.
Vientiane City

- Water quality of river and marsh is getting worse and water quantity is increased due to inflow of domestic waste water from urban area, rapid economic growth, increased population, huge infrastructure construction.
- Need formulation of master plan for improvement of water environment in Vientiane City.
Socio-economical and natural conditions

- Area: 3,920 km²
- Number of Population in Vientiane Capital:
  - 1980: 196,731 Density: 50 p/km²
  - 1990: 474,000 Density: 121 p/km²
  - 2000: 680,000 Density: 173 p/km²
  - 2005: 692,900 Density: 176 p/km²
  - 2010: 788,165 Density: 201 p/km²
• Mean annual precipitation in VT C is approximately 1,700mm (JICA, 2002), the whole country ranges from 900 mm to 3,500 mm and about 90% of precipitation occurs from May through October.

• RGDP: 350 USD and 490 USD in 2000 and 2005 respectively

• 58% of population has access to water supply at the national level while 62% in Vientiane City.
<table>
<thead>
<tr>
<th>Table 2.1.4 GDP Projection of Lao PDR until 2020</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>GDP (2002 price, billion KIP)</td>
</tr>
<tr>
<td>GDP growth rate (%)</td>
</tr>
</tbody>
</table>

Source: Preparatory Survey on Industrial Zone Development in The Lao People's Democratic Republic, Progress Report, 2009, JICA
Socio-economical and natural conditions

Stormwater and wastewater originated from the Vientiane city area are collected through the open sewer system and are conveyed via That Luang marsh, Nakai marsh and the Mak Hiao river to the Mekong mainstream. Thatluang Marsh is currently performing wastewater treatment services for domestic wastewater and plays a significant role in both flood control and wastewater purification for the city.
II Background to That Luang Marsh
Situation of quantity and quality of water source

- Volume of abstracted water: no information available
- Water use for the whole country: 82% for agriculture, 10% for industry and 8% for domestic / municipal use
- Surface water in VT C (reservoir’ name): 334,719 m³
- (river’ name): 78,714,530 m³
  - Ground water: 3,958,117 m³
  - Domestic use: 67.57%
  - Industrial use: 8.30%
Table 4. Land use in TLM (dry season, 2006)

<table>
<thead>
<tr>
<th>No.</th>
<th>Land use</th>
<th>Area (ha)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Swamps</td>
<td>65.91</td>
<td>3.93</td>
</tr>
<tr>
<td>2</td>
<td>Ponds</td>
<td>68.00</td>
<td>4.05</td>
</tr>
<tr>
<td>3</td>
<td>Canals</td>
<td>29.00</td>
<td>1.73</td>
</tr>
<tr>
<td>4</td>
<td>Rice fields*</td>
<td>1434.10</td>
<td>85.47</td>
</tr>
<tr>
<td>5</td>
<td>Grass</td>
<td>33.54</td>
<td>2.00</td>
</tr>
<tr>
<td>6</td>
<td>Roads</td>
<td>1.80</td>
<td>0.11</td>
</tr>
<tr>
<td>7</td>
<td>Settlements</td>
<td>26.88</td>
<td>1.60</td>
</tr>
<tr>
<td>8</td>
<td>Factories and stores</td>
<td>18.60</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1677.83</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Sources: National Geographic Department, Prime Minister’s Office (estimation from Vientiane city map (updated in 2006)); * = rice cultivation area estimates obtained from village statistics.
Effluent load to the source

- Land use around the water source:
  Most of land uses are converted to economic value especially for construction of infrastructure according to the government policy how to convert land use into investment
The wastewater from individual households in Vientiane is discharged into open drains along the roads and into the natural wetlands in and around the city.

There are 1,256 households discharged their sewage directly into the surface water and 501 households with no toilet at all within areas that are draining into Hong Ke and That Luang Marsh.
Table 2. An example of wastewater disposal

<table>
<thead>
<tr>
<th>Wastewater discharge to</th>
<th>Sihom</th>
<th>Muang Va Thong</th>
<th>Nong Duang Thong</th>
<th>Si Muang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open drain</td>
<td>75%</td>
<td>30%</td>
<td>35%</td>
<td>31%</td>
</tr>
<tr>
<td>Road</td>
<td>6%</td>
<td>5%</td>
<td>29%</td>
<td>44%</td>
</tr>
<tr>
<td>No drainage</td>
<td>13%</td>
<td>55%</td>
<td>24%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
<td>10%</td>
<td>12%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Effluent load to the source

- Biological Oxygen Demand was 2.0.
- BOD values observed were not so high, allowing that the data were all in the rainy season.
- Domestic wastewater, actual data is not available in Vientiane City, 45 g/capita/day, is applied.
- In 2002, industrial wastewater in VT City is about 8,224,000 m³/year and in 2020, assumed as 9,490,000 m³ ¥ year or 26,000 m³ /day.
Situation of domestic wastewater treatment in the areas without access to central domestic wastewater treatment plant.

The poor drainage of wastewater from septic tanks and poorly designed on-site sanitation has created a major concern for public health, causing widespread pollution of surface water and groundwater.
BOD Load to water source

- The BOD values in the downstream points of the Hong Pasak and Hong Wattay Drainage Canals were considerably decreased, as compared with the values in the upstream points. Almost 70% of the BOD value was decreased in the Hong Pasak Drainage Canal, and almost 50% of the BOD value was decreased in the Hong Wattay Drainage Canal.
BOD Load to water source

- The highest BOD of 15.4 mg/l was observed at downstream end of Hong Thong, of Hong Pasak and of Hong KhouaKhao with the BOD values of 14.3 mg/l and 11.6 mg/l, respectively.

- There is a limitation of BOD data monitored only in the rainy season, BOD values were not so high, especially in the lower part.
Current measures on quality control for the water source

- Lao National Environment Standard No. 2734¥PMO. WERE A dated 7¥12¥2009
- Water quality standards:
  - Standard for drinking water: organic
  - Standard for drinking water in container: physic and chemistry
  - Standard for ground water in general
  - Standard for ground water (drinking water)
  - Standard for surface water
Water quality monitoring

- Standard for wastewater discharge from industry (in general)
- Standard for wastewater discharge from sugar cane industry
- Standard for wastewater discharge from textile and garment with dying industry
- Standard for wastewater discharge from paper mill industry
Water quality monitoring

- Water quality monitoring (February 2009)
  - two monitoring activities:
    - (1) periodical monitoring in two times in the dry season and once in the rainy season,
    - (2) longitudinal simultaneous monitoring to clarify water quality changes along the canal network once in the every rainy and dry season.
Current issues on water quality control for the water source

- Wastewater from poorly operating household septic tanks still predominantly discharge into open drains along the roads and into natural wetlands.
- Raising public awareness
- Lack of ground water data
Current issues on water quality control for the water source

- Uncontrolled land use due to migration and rapid growth of population
- Lacking a proper sanitation network, which is seriously threatening the health situation of the population due to discharge of wastewater into low-land areas.
Current issues on water quality control for the water source

- Shortage of qualified human resources
- Lack of appropriate legal instrument
- Lack of sufficient budget for conducting the samples.
- Lack of appropriate instruments to measure water quality
- Need to improve laboratory for water quality control