LAO PDR. COUNTRY REPORT

For

Wastewater Production, Treatment, and Use in Lao PDR

By

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Lao PDR is in the midst of relatively rapid economic growth and natural resource development. Hydropower, mining and forestry are major areas of activity, while tourism, agriculture and fisheries are also developing and changing. Urban areas are also growing as population shifts and commercial and industrial development takes place. As a result there are increasing pressures on the environment and an increasing need to manage natural resources in a sustainable manner.[1]

Food security still is and will be the highest priority strategy to stabilize economic development and sociopolitical security. With the pressure of rapid demographic growth, socio-economic development and urbanization, however, the water quality is increasingly exposed to deterioration. Currently there are some problems related to waste and polluted water in major urban areas from varied community use (residential density, hotels, hospitals and entertainment centres). In addition there is water pollution from agricultural and industrial sectors, including mineral exploitation.

The cultivable area is an estimated 2 million ha, composed of narrow valleys and the floodprone plain of the Mekong river and its tributaries. In 2009 the total cultivated area accounted for 1 468 000 ha, around 6 percent of the total area of the country. Arable land was an estimated 1 360 000 ha and the area under permanent crops was 108 000 ha (Table 1).

TABLE 1
Basic statistics and population

Physical areas			
Area of the country	2009	23 680 000	ha
Cultivated area (arable land and area under permanent crops)	2009	1 468 000	ha
• as % of the total area of the country	2009	6	%
• arable land (annual crops + temp fallow + temp meadows)	2009	1 360 000	ha
• area under permanent crops	2009	108 000	ha

Wastewater production and treatment: Recent estimate on the volume of wastewater generated by municipal and industrial sectors (million/billion cubic meters per year); dominant wastewater treatment type (primary, secondary, or tertiary); Major constraints to wastewater treatment (Maximum 150 words):

In Lao PDR, treated industrial effluent is estimated at 15% of total.

The information of recent estimate on the volume of wastewater generated by municipal and industrial sectors (million/billion cubic meters per year) and dominant wastewater treatment type (primary, secondary, or tertiary) is limited. However, as a matter of fact the population

growth in cities, towns and villages leads to extensive municipal waste and organic matter release to waterways. No urban centers have access to comprehensive piped sewerage systems. Treatment and disposal of urban waste water is generally not satisfactory; most households rely on soak pits for wastewater disposal. Urban drains act as secondary sewers, carrying industrial discharges and septic tank seepage and overflow in the rainy season. As a result, water in the drainage system is invariably contaminated with faecal matter from latrines and coliform from septic tank effluent.

The growing number of industries has increased the incidence and risk of pollution. The larger mills and industries of concern in Lao PDR are pulp and paper, timber, food processing, garment manufacturing and cement factories and gravel pits. Most of these have only limited wastewater treatment systems for reducing waste concentrations and loads in the final effluent discharge to waterways.

The organic and nutrient pollution and sediment can be discharged from agricultural areas. These contaminants tend to increase during the rainy season's high runoff and river flows. The use of agricultural chemicals in Lao PDR is still relatively low and is expected to remain so during coming years, apart from areas of more intensive, commercial production, including animal production. Increased irrigation can lead to increased nutrients, pesticides and sediment entering waterways through agricultural drainage. An increase in the extent of irrigation can also open new areas for waterborne disease vectors (mosquitoes, snails).

Major constraints to wastewater treatment:

- Inadequate legal framework and unclear institutional responsibilities;
- The access to "normal" toilet facilities is relatively good, but it is assumed that maintenance is poor;
- Wastewater from domestic areas, hospitals, industrial operations are discharged directly to urban environment;
- The hygienic situation is worsened by flooding in many urban areas;
- Lack of access and monitoring of wastewater services;
- Lack of awareness among communities and authorities on the benefits of improved wastewater;
- Lack of capacity among public institutions;
- Poor wastewater conditions will become a major drawback in order to encourage investment and tourism activities.

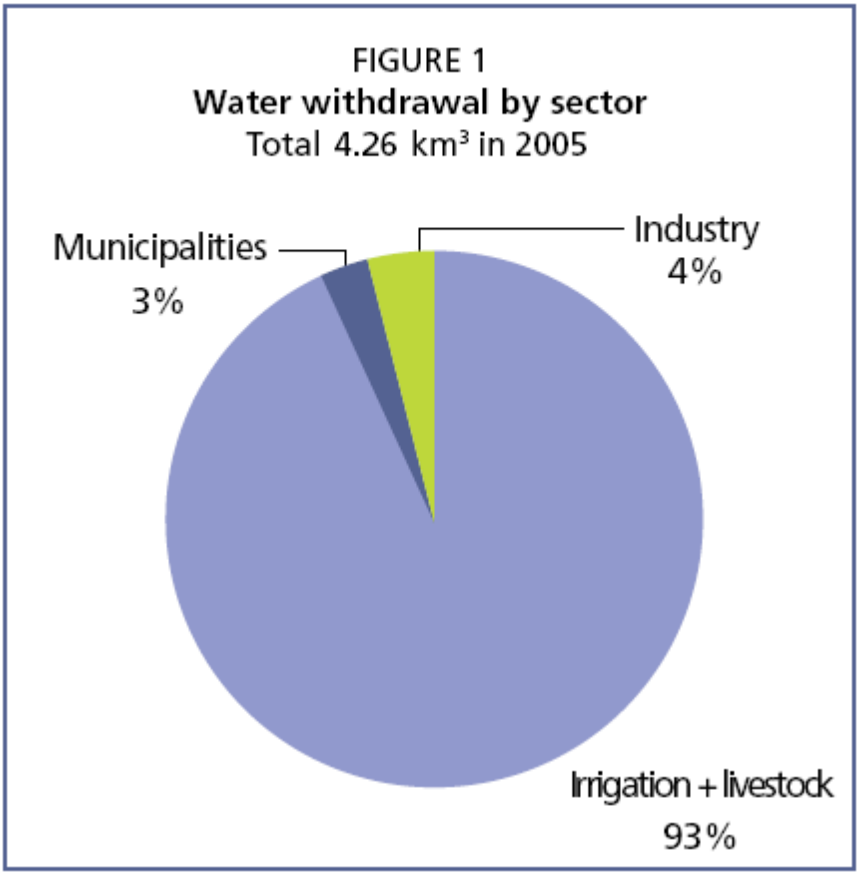
Wastewater use/disposal: Information on area (estimates of number of hectares) irrigated with different forms of wastewater in formal sector (treated wastewater), and informal irrigation sector (untreated, inadequately treated, and/or diluted untreated wastewater); reason(s) if estimates on wastewater irrigation are not available or old; major crops and crop rotations irrigated with treated or untreated wastewater (Maximum 200 words)

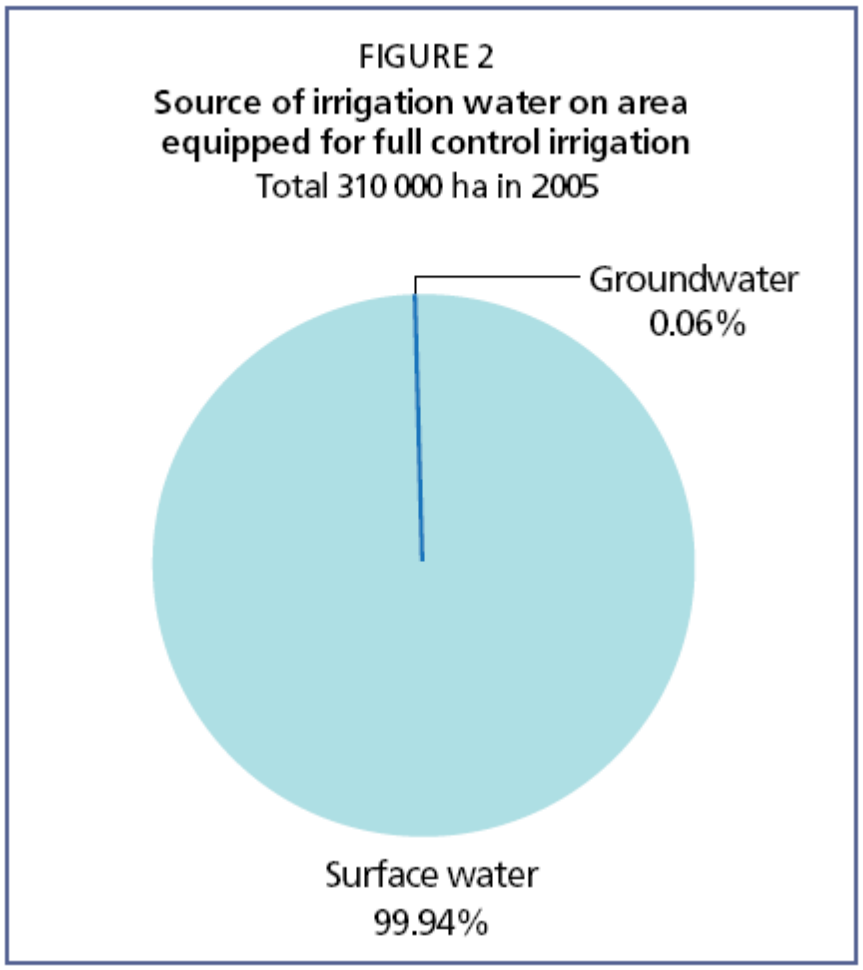
In 2005, total water withdrawal was an estimated 4.26 km³, which is only 1 percent of the total actual renewable water resources (Table 2). Water withdrawal for agriculture was approximately 3.96 km3, while for municipalities and industries it was an estimated 0.13 km3 and 0.17 km3 respectively (Figure 1). A rough estimate of the irrigation potential for Lao People's Democratic Republic is 600 000 ha (Table 2).

TABLE 2
Water: sources and use

Renewable freshwater resources			
Precipitation (long-term average)	-	1 834	mm/yr
	-	434 290	million m^3/yr
Internal renewable water resources (long-term average)	-	190 420	million m^3/yr
Total actual renewable water resources	-	333 550	million m^3/yr
Dependency ratio	-	42.9	%
Total actual renewable water resources per inhabitant	2009	54 565	m^3/yr
Total dam capacity	2005	7 811	million m^3
Water withdrawal			
Total water withdrawal	2005	4 260	million m^3/yr
- irrigation + livestock	2005	3 960	million m^3/yr
- municipalities	2003	130	million m^3/yr
- industry	2003	170	million m^3/yr
• per inhabitant	2005	740	m^3/yr
Surface water and groundwater withdrawal	2005	4 260	million m^3/yr
• as % of total actual renewable water resources	2005	1.3	%
Non-conventional sources of water			
Produced wastewater		-	million m^3/yr
Treated wastewater		-	million m^3/yr
Reused treated wastewater		-	million m^3/yr
Desalinated water produced		-	million m^3/yr
Reused agricultural drainage water		-	million m^3/yr

FIGURE 1
Water withdrawal by sector
Total 4.26 km³ in 2005





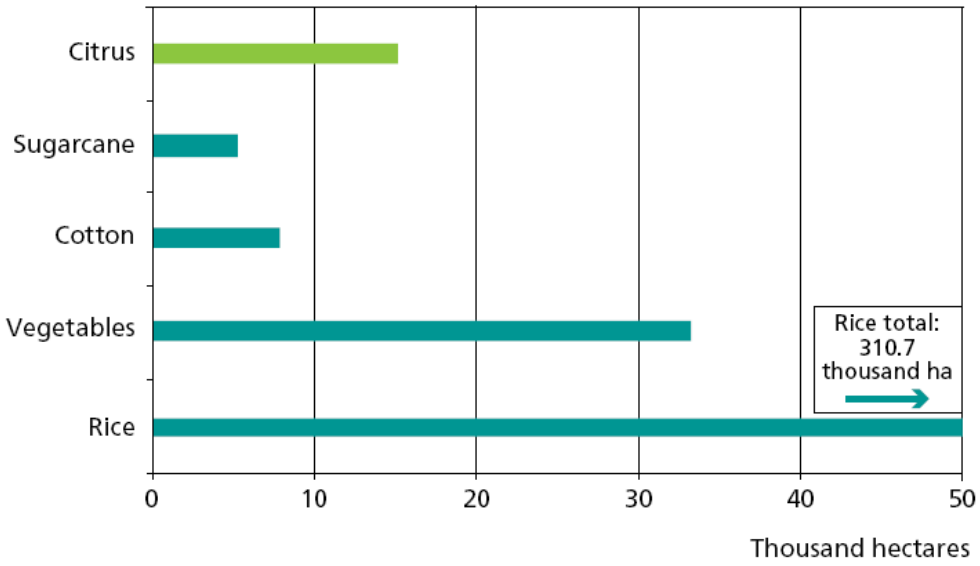
In 2005, the total area equipped for irrigation was 310 000 ha. Irrigation by groundwater covers only 200 ha (Figure 2). The actually irrigated area in the wet season has increased from 138 077 ha in 1995 to 270 742 ha in 2005, while in the dry season the area has increased from 36 282 ha in 1995 to 100 934 ha in 2005. While wet season irrigation is common throughout the country, dry season irrigation is mainly concentrated near major cities. It has been noted that after poor yields during rainy seasons, the irrigated area in the dry season are higher than the average to compensate for the low production of the previous season. In 1995, non-equipped flood recession cropping area was an estimated 231 500 ha.

In 2005, total harvested irrigated cropped area was an estimated 371 676 ha, of which 270 742 ha in the wet season and 100 934 ha in the dry season. The major irrigated crops are rice, which account for 310 676 ha (245 676 ha in the wet season and 65 000 ha in the dry season), vegetables 33 000 ha, cotton 8 000 ha, citrus 15 000 ha and sugarcane 5 000 ha (Table 3 and Figure 3).
The country also has a large area of non-irrigated rice cultivation (estimated as 450 000 ha in 1994), of which about half is estimated to be upland rice (shifting cultivation), and the other half lowland flooded rice on the alluvial plains (Table 3).
Table 3

Irrigation and drainage

Irrigation potential		600 000	ha
Irrigation			
1. Full control irrigation: equipped area	2005	310 000	ha
- surface irrigation	2005	310 000	ha
- sprinkler irrigation	2005	0	ha
- localized irrigation	2005	0	ha
• % of area irrigated from surface water	2005	99.94	%
• % of area irrigated from groundwater	2005	0.06	%
• % of area irrigated from mixed surface water and groundwater		-	%
• % of area irrigated from non-conventional sources of water		-	%
• area equipped for full control irrigation actually irrigated	2005	270 742	ha
- as % of full control area equipped	2005	87.3	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)		-	ha
3. Spate irrigation		-	ha
Total area equipped for irrigation (1+2+3)	**2005**	**310 000**	**ha**
• as % of cultivated area	2005	27	%
• % of total area equipped for irrigation actually irrigated	2005	87	%
• average increase per year over the last 10 years	2000-2005	0.96	%
• power irrigated area as % of total area equipped	1995	15	%
4. Non-equipped cultivated wetlands and inland valley bottoms		-	ha
5. Non-equipped flood recession cropping area	1995	231 500	ha
Total water-managed area (1+2+3+4+5)	**2005**	**541 500**	**ha**
• as % of cultivated area	2005	48	%
Full control irrigation schemes:	**Criteria:**		
Small-scale schemes	< ha	-	ha
Medium-scale schemes	> ha and < ha	-	ha
Large-scale schemes	> ha	-	ha
Total number of households in irrigation		-	
Irrigated crops in full control irrigation schemes:			
Total irrigated grain production (wheat and barley)		-	metric tons
• as % of total grain production		-	%
Harvested crops:			
Total harvested irrigated cropped area	2005	371 676	ha
• Annual crops: total	2005	356 676	ha
- rice	2005	310 676	ha
- Vegetables	2005	33 000	ha
- Cotton	2005	8 000	ha
- Sugarcane	2005	5 000	ha
• Permanent crops: total	2005	15 000	ha
- Citrus	2005	15 000	ha
Irrigated cropping intensity (on actually irrigated area)	2005	137	%
Drainage - Environment:			
Total drained area		-	ha
- part of the area equipped for irrigation drained		-	ha
- other drained area (non-irrigated)		-	ha
• drained area as % of cultivated area		-	%
Flood-protected areas		-	ha
Area salinized by irrigation		-	ha
Population affected by water-related diseases		-	inhabitants

FIGURE 3
Irrigated crops on area equipped for full control irrigation
Total harvested area 371 676 ha in 2005 (cropping intensity on actually irrigated area: 137%)



Policies and institutional set-up and needs for wastewater management: Institutions involved and their approach in wastewater collection, conveyance, treatment, and use in agriculture or for other purposes; status on the implementation of international and/or national guidelines for safe use of wastewater; handling, marketing, and mechanism for quality control of wastewater-irrigated produce/products; Policies and institutional needs (Maximum 200 words)
There is no policy or strategy for wastewater management.

The Prime Minister's Office is responsible for:

- The Water Resources Coordination Committee (WRCC), which provides advice to the government on matters related to water resources. It was established in 1997.
- The Lao National Mekong Committee (LNMC), which formulates policy, strategic plans, projects and programs related to water resources development in the Mekong Basin.
- The Ministry of Natural Resources and Environment (MONRE), which monitors and inspects environmental parameters concerning development activities for adherence to environmental standards.

The Ministry of Agriculture and Forestry (MAF) is responsible for:

- The Integrated Watershed Management Unit (IWMU), which assists MAF in watershed management and rural development planning on a sub-watershed (sub-basin) area.
- The Department of Irrigation (DoI), which carries out the testing and analyses of water quality based on MRC standard, and develops irrigated agriculture and drainage, flooding and drought prevention plans.

The Ministry of Industry and Handicraft is responsible for:

- The Industrial Environment Division (IED), which is responsible for industrial environment management, occupational health and safety, industrial waste, mineral resource management, hydropower and regulations to protect and control pollution from industrial factories (wastewater, smoke, odour, radiation, vibration, noise, etc.).

The Ministry of Public Work and Transportation is responsible for:

- The Waterway Administration Division (WAD), which is responsible for data collection (water quality sampling at some hydrological stations such as Luangphrabang, Savannakhet and Pakse), then forwarding it to Water Quality Laboratory, Irrigation Survey Design Center under Department of Irrigation, MAF.
- The Water Supply Authority (WASA), mainly develops regulations concerning urban water supply, and provides technical assistance to water supply operations for the whole country.

The Ministry of Health is responsible for:

- The National Center for Environment Health and Water Supply (NCEHWS), which regulates control of solid waste and waste water; defines disposal methods for solid and liquid waste, and supplies water and sanitation services to non-urban locations.
- The Environmental Health Division (FMD), which sets and monitors standards for drinking water supplies.

In 1996, the Water and Water Resources Law was enacted and implemented . In 2001, a Decree was enacted on the Implementation of the Water and Water Resources Law to implement the Law on Water and Water Resources and to establish the responsibilities of different ministries, agencies and local authorities regarding the management, exploitation, development and use of water and water resources.

- Agreement of the Minister on Good Agriculture Practices for Environmental Management Standard, No 0538/MAF, Vientiane, Date 09/02/2011.[2]
- **LAW ON THE PROCESSING INDUSTRY. Article 19. Factory Waste Disposal Areas .** All types of factory waste and wastewater must be disposed of and treated according to the method and at the place determined by regulations.[3]
- The Decision on the Management of Quality Standards for Drinking Water and Household Water Supply (2005) defines standards for drinking and household water supply, including bacteriological, physical-chemical (aesthetic), and health-significant chemical parameters.[4]

1994 Regulation for Industrial Waste Discharge (No. 180/MIH):

- defines effluent standards like e.g. BOD and TSS for different types of industries

1996 Law on Water and Water Resources (No. 126/PO):

- Article 42: "…Polluted water, waste water, [and] waste that exceed the discharge standard must first be treated before they may be dumped or discharged into water sources …."

1999 Environmental Protection Law (No. 09/PO):

- Article 23: "…It is forbidden to discharge waste water, or water that exceeds the prescribed standards into canals, natural water bodies or other places without proper treatment. …"

1999 Management and Development of the Water Supply Sector (No. 37/PM) – Prime Minister Decision:

- Article 2: "…Provincial Governments will be responsible for: …; collaboration with the Department of Communication Transport Post and Construction (DCTPC) of the province concerned in finding out suitable solution to assist low income households which cannot afford the cost of sanitary facility;… direction of water supply and sanitation sector project implementation in the province concerned; … ; institutional arrangements for the implementation and management of centralized wastewater management systems as for water supply when these systems become economically and financially viable, but until such time onsite treatment will be pursued and the implementation and management of the facilities shall be the responsibility of the: individual owner; … "

2001 Law on Hygiene, Disease Prevention and Health Promotion (01/NA):

- Article 17 – Hospitals, Dispensaries and Clinics shall be equipped with a system for waste-water treatment, and a system for waste separation, storage and disposal in accordance with the principles of hygiene
- Article 19 – Hygiene in Production: "… It is forbidden to release waste, chemicals or waste water from factories, including other production sites, into water bodies or elsewhere without undergoing a treatment process."

Research/practice on different aspects of wastewater: List of major recent past (less than 5 years) and ongoing research projects related to safe wastewater irrigation with web links to results, if available (Maximum 200 words)

- **First Decentralized Wastewater Treatment System in Lao PDR**

A study on wastewater management and building in Vientiane (2004) reported that, with a rapidly growing population in the urban area of Vientiane Capital City, sewerage is becoming a serious problem because of the lack of a sufficient drainage system and lack of sewerage systems, while on-site sewerage disposal or septic tanks are often poorly designed. Further contributing to the problem in urban area is stagnant untreated wastewater from households and some small industries with open road-side drains, flowing directly into marsh or natural channels. This mixing of sewerage in the storm drainage system will continue to have a detrimental impact on public health (WEPA, 2010).

A recent study on Wastewater Management and Building in Vientiane Capital City Using GIS, supported by UNESCO/KEIZO OBUCHI Research Fellowships Programme – 2004, reported that "as the economy and communication networks develop, the number of people in urban area of Vientiane Capital City begins to grow more rapidly continue to improve urban condition. The lack of insufficient drainage system, Vientiane does not have sewerage systems and on-site sewerage disposal or septic tanks are often poorly designed. Further, contributing to the problems in urban area with are now stagnant wastewater from households and some small industrial and other sector without treated with open road-side drains, flow directly into marsh or natural channels such a system will continue to have a detrimental impact on the public health by mixing sewerage in the storm drainage system". Water Environment Partnership in Asia. **State of water environmental issues. Lao PDR**

Status and need for the knowledge and skills on the safe use of wastewater: Specific capacity gaps on the safe use of wastewater in irrigation by individuals or institutions dealing with wastewater management; individual level knowledge and skills urgently needed (prioritize the needs) (Maximum 150 words).

References

1. Aquastat. FAO. Lao People's Democratic Republic.

2. Souphasay Komany. Water Quality Monitoring and Management in Lao PDR: The Case Study of Nam Ngum River Basin
3. Ministry of Agriculture and Forestry. Agreement of the Minister on Good Agriculture Practices for Environmental Management Standard. No 0538/MAF, Vientiane, Date 09/02/2011
4. National Assembly. LAW ON THE PROCESSING INDUSTRY. No. 01/99/NA , 3 April 1999.
5. Ministry of Health. Minister's Decision on the Management of Water Quality for Drinking and Domestic Use in Household. October 2005.
6. URBAN WASTEWATER STRATEGY & INVESTMENT PLAN (2009-2020). Conference on Sewerage and Wastewater Treatment in Southeast Asia-Towards Sustainable Development, 12-13 October 2011, Vung Tau City, Ba Ria Vung Tau Province, Vietnam.
7. Industrial water Use. Mekong River Commission Basin Development Planning Regional Sector Overview 2002.
8. Lao Institute for Renewable Energy. WASTE WATER SITUATION in the Urban Area of VIENTIANE CAPITAL CITY. Kick-Off Workshop DEWATS-CBS, Vientiane 16th June 2009.