

CHAPTER 8

ENVIRONMENTAL IMPACT ASSESSMENT

CHAPTER 8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 General

The Environmental Impact Assessment (EIA) for the 1st Stage Project is carried out as a part of the study of the development of the Vientiane Water Supply System.

8.1.1 Objective

The items of potential environmental impacts during the 1st Stage Project were identified in the Initial Environmental Examination in the Master Planning Stage of the study. The identified environmental items are assessed in the Feasibility Study Stage in the study. The objectives of the EIA are shown below.

- To evaluate environmental impacts of the 1st Stage Project
- To propose countermeasures for mitigating the impacts and make recommendations for environmental conservation

8.1.2 Summary of the Results of IEE

Details of the Initial Environmental Examination of the Project are described in the Master Plan. Table 81-1 shows the IEE Check Lists of the 1st Stage Project.

Table 81-1 IEE Check List for Scooping

Items	Evaluation	
	Result	Remarks (basis)
I. Sociology		
1 Resettlement	C	Land for Thangone Water Treatment Plant (WTP) is now under investigation. Selection of land to avoid resettlement is possible.
2 Economic Activities	C	Same as the above 1.
3 Transportation & Infrastructure	B	Installation of main pipes will cause traffic jams, but will cause only a temporary impact.
4 Separation of local society	D	No facilities will divide local society.
5 Ruins of ancient & Cultural property	C	There are many temples in the city. Setting pipe alignment to avoid making impact to them is possible.
6 Water right & Common right	C	Confirmation of water rights from the Nam Ngum River for Thangone WTP has not been completed.
7 Sanitary	B	Water supply will be improved, however, an increase of discharged water from the water supply may deteriorate the drainage system.
8 Disposal	B	Sludge from the existing treatment plants is disposed into the Mekong River. Sludge from the Thangone WTP will be treated at the site and disposed. Solid disposal from WTP during construction and operation will affect the existing solid disposal system.
9 Disaster (risk)	D	Construction of expanding facilities will not require large scale land development.

Items	Evaluation Result	Remarks (basis)
II. Nature		
10 Topography & Geology	D	Construction of expanding facilities will not require large scale of land development.
11 Erosion	D	Same as above 10
12 Groundwater	C	Except for temporary drainage from trench for pipe installation and raw water for existing Thadeua WTP, no groundwater exploitation will be required.
13 Lakes & marshes & River	B	Raw water intake structures at Kaolieo and Thangone WTP will be constructed at the Mekong and Nam Ngum River respectively.
14 Coast & Area of sea	D	Lao PDR is a landlocked country.
15 Fauna & Flora	C	There are six areas for preservation of nature. No construction works will be implemented in the areas, however, construction near the areas might cause some change of inhabiting conditions.
16 Climate	D	No construction works will affect the climate.
17 Landscape	C	Raw water intake structures at Kaolieo and Thangone WTP will be constructed at the Mekong and Nam Ngum River respectively. Both will affect the immediate landscape of the rivers.

Items	Evaluation Result	Remarks (basis)
III. Pollution		
18 Air pollution	C	Construction equipment will emit noxious fumes. Wind will blow dust from the exposed soil by earth works for construction. This impact will be managed by using low emission equipment and applying construction methods with care, like spreading water or covering soil piles with sheets.
19 Water pollution	B	The two existing plants, Kaolieo and Chinaimo, dispose extracted sludge into the Mekong River. The effect of sludge disposing will be negligible if compared with river discharge flow of the river. Contrary to the Mekong River, discharging sludge to Nam Ngum River from the Thangone WTP will affect water quality since the flow rate and turbidity of the river are rather small. In addition, there are many pumps set in the river to raise water for irrigation.
20 Soil pollution	C	Water seepage from the bottom of the sludge treatment plant to be constructed in the Thangone WTP will pollute soil. To avoid this seepage, a concrete slab is applicable to the bottom of the sludge treatment facilities.
21 Noise & Vibration	B	Noise and vibration will be generated from construction equipment during construction and operation of pumps and other equipment at the WTP's.
22 Subsidence	D	No ground water exploitation other than the existing Thadeua WTP.
23 Bad smell	C	Exhaust gases from heavy equipment during construction and sludge treatment facilities in operation at the WTP's will appear. Selection of land and location of sludge treatment facilities is to mitigate this impact.

Note: Symbol of evaluation result as:

A: Serious impact expected

B: Some impact expected

C: Unknown

(Consideration of the impact is required. It is also considered that impact will be

Clearer as the investigation progresses)

D: EIA is not required due to nil, or a minimum impact is expected

8.1.3 Approach to the EIA Study

As a result of the IEE, the items of potential impact during the 1st Stage project are identified as below;

- to evaluate the magnitude of impacts which may be caused by the implementation and operation of the Priority Project.
- to propose countermeasures for mitigating the magnitude of such adverse impacts.

The EIA was conducted in accordance with relevant laws, regulations and standards applicable in the Lao PDR, and the JICA Environmental Guideline, including in particular:

- "Environmental Protection Law" No.02/99/NA, dated 3 April 1999
- "Regulation on Environment Assessment in the Lao PDR", No.1770/STEA, dated 3 Oct.2000
- "Decree on the "Implementation of the Environmental Protection Law" -Ref 102/PM, dated 4/06/2001.
- Decree of the President of Lao PDR on "Historical, cultural and national heritage protection" (1994)

8.1.4 Scope of the EIA

The EIA in this study will focus on key environmental issues as identified in the IEE made earlier. Main items of the impacts are listed below:

- Transportation
- Sanitary
- River
- Water pollution
- Noise & Vibration

According to the environmental classification of a project and the requirement of assessments, and as the IEE has been carried out at an early stage, this Priority Project dealing with the water supply can be classified in "Category B". That means the environmental impacts are significant and thus, an EIA report shall be prepared.

8.2 Environmental Regulation and Environment Assessment System

The National Environment Action Plan (NEAP) was adopted in the National Assembly in 1994, the Environmental Protection Law (EPL) have been enforced since 1999, and the Decree on the Implementation of the Environmental Protection Law (2002).

In Lao PDR, the principal authority responsible for the monitoring and assessment of the environment is the "Science Technology Environmental Agency-STEA". STEA was founded after the reorganization of the "STENO" that was the first authority dealing with the environment, and was established in 1993.

According to the above Law and Decree on the Implementation of the EPL, it is stated in the following articles that:

Article 2- Environmental Protection: *"Environmental protection consists of all activities that contributed to the protection of the environment, and does not cause damage to the environment, which ensures a clear and pollution free-environment, and which do not cause a negative impact to property, human health, animal, plant,....."*

Article 3- Obligation to protect the environment: *"..... Development projects and all development activities that related to the environment shall be conducted as follow: All development projects, including State and private owned, shall have an environmental impact assessment before establishment and operation of those projects. They shall also have method for protecting or mitigating measures to protect the social and natural environment...."*

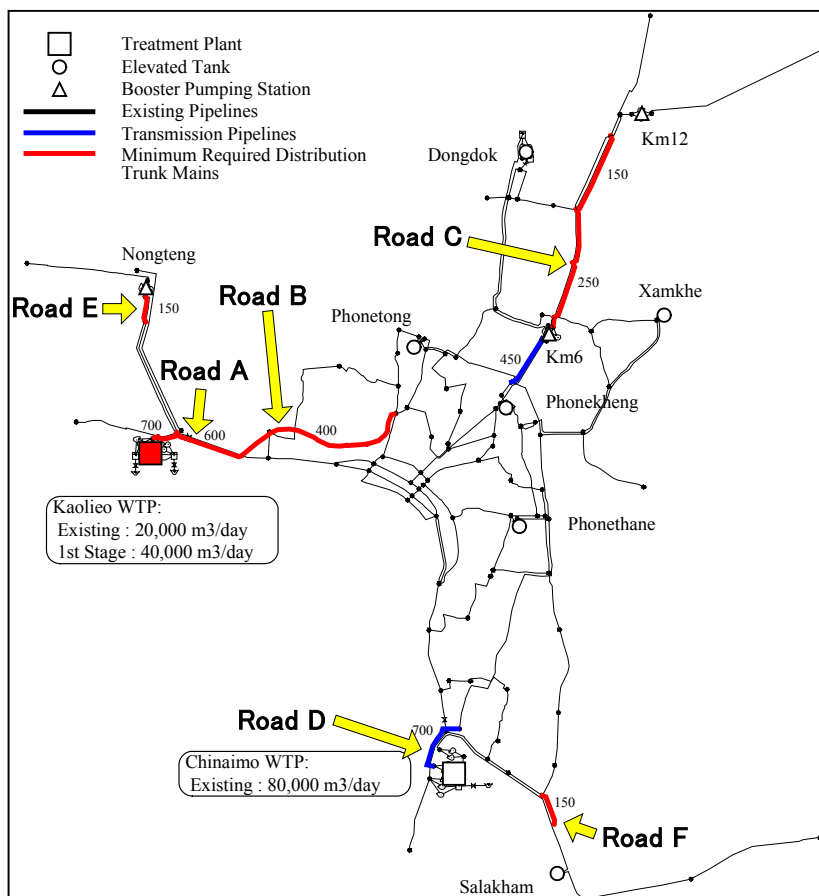
Article 9- Technical Standard for Construction and Repair: *".....The Ministry of CTPC shall issue regulations on the construction, maintenance, repair, innovation, and expansion of infrastructures such as roads, water supply systems, wastewater treatment facilities; The Ministry of Public Health shall issue regulations onconstruction works related to the treatment of solid waste and wastewater"*

The detailed regulations of the EIA for road and dam construction projects are in preparation, but no specific regulation has been issued for water supply project.

8.3 Transportation

8.3.1 Roads Affected by the Priority Projects

During the construction of the projects, there will probably be some adverse impacts on transportation along the main roads where transmission/distribution pipes will be installed, in particular along the following roads:



Road A: Kaolieo Plant-Road 13 north (Wattay)-Junction with T2 ring road where Ø600mm pipes will be installed.

Road B: T2- ring road from the junction with road No13 north to junction with road linking Phonetong elevated reservoir where Ø400mm pipes will be installed.

Road C: Road 13 south from Phonkheng bridge to KM6 BPS and to KM12 village where Ø450-250-150mm pipes will be installed.

Road D: Road from Chinaimo Treatment Plant

toward Salakham (about 1Km long from the CTP) where Ø700mm transmission pipes will be laid.

Road E: Road 13 north toward Nongteng where Ø150mm pipes are provided.

Road F: Road toward Salakham Elevated tank where Ø150mm transmission pipes will be installed.

Although there is very limited data on traffic volume available for the whole city, the recent data collected on the Thadeua road at Thatkhao junction as shown in the below table gives a rough idea

about the hourly/daily traffic volume on the main roads in Vientiane Capital City, and could be taken as an indication of the traffic volume on all the above mentioned roads affected by the project.

Table 82-1 Traffic volume on Thadeua road leaving the city collected on Monday, May 2003

Vehicle types	Number of vehicles at each hour													Total
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	
Pedestrian	0	13	12	10	2	63	0	0	5	9	5	2	4	125
Bicycles	12	20	25	7	13	52	8	8	20	17	27	25	21	255
Motor cycles	110	483	540	375	364	450	427	303	355	456	740	615	470	5688
Motorized tricycles	21	56	108	88	78	83	54	60	66	73	68	66	48	869
Passengers cars	21	85	186	122	124	157	137	118	111	127	218	178	128	1712
Pick up cars	19	88	135	102	105	100	106	103	105	108	178	121	85	1355
Bus	8	14	26	17	25	20	11	29	24	12	20	18	9	233
2-axle truck	10	25	35	44	38	33	20	38	37	37	18	37	16	388
3-axle truck	1	4	5	1	4	5	3	3	7	6	1	6	1	47
trailers	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Total	202	788	1072	767	753	963	766	662	730	845	1275	1068	782	10673

Note: According to the figures in the above table, it appears that the busiest hours of the day are between 8:00-9:00 and 16:00-18:00Hours that coincide with office opening and closing hours respectively.

These figures are not exceedingly high, and would not cause heavy traffic jams or any significant negative impacts to transportation during the construction of the Priority Projects if appropriate mitigation measures as described below were taken into consideration.

8.3.2 Present Conditions of the Affected Roads

Road A: This road is composed of 3 parts:

Part 1: From Kaolieo Treatment Plant to the junction with Road #13 North (Sikhay). This is a very narrow road (paved surface >7.5m wide; RoW(Right of Way)>20m) with a poor bituminous pavement.

Construction along this part of Road A would probably cause some inconvenience to the traffic during a very short period as the length of the pipe from Kaolieo Plant to the Road #13th North is very short (about 300m).

Part 2: From the junction with Road 13 north, to the access road at the Wattay Airport: The road is quite large (paved surface>15m; RoW>40m) and the bituminous pavement is also very poor. This

road is linked to the public market (Sikhay market), and to the northern parts of Vientiane Capital City. Therefore, it is always busy almost every day.

Pipe laying works along this part of the road would not cause significant impact to the traffic because the RoW is wide. There is no concrete sidewalk yet, and pipes could be laid in the spare space reserved for the sidewalk.

Part 3: From the junction with the access road to the Airport, to the Junction with the T2 ring road. This part of the road is also very wide (paved surface >15m; RoW >50m) but with pour bituminous pavement. There is no concrete sidewalk. Although the presence of the a central earth platform reduces somewhat the number of traffic lanes in each direction, pipe laying works will not cause any problem to the traffic due to the fact that a large free space is still available between the road and the limit of the RoW.

Road B: This is the ring road "T2", constructed by the VIUDP project in 2002. The road has received a double bituminous surface treatment (DBST) linking the Wattay Airport to the centre of the city. The paved surface has about 9m wide and the RoW varies between 20m (at the junction with Nong Douang Road) and 40-50m. There is no sidewalk, except along new commercial shops where parking areas for private cars is provided. The sidewalks there are made of concrete.

Pipe laying works along this road would not cause significant impact to the traffic as the RoW is very wide, and there is a large free space between the paved road and the limit of RoW is still available.

Road C: This road is named "Road 13 South" and its pavement is made of concrete asphalt. It was recently constructed and still in good condition. The paved surface is more than 20m wide and the RoW more than 40-50m. Sidewalks made of concrete blocks are constructed from Phonkheng bridge to the booster pumping station (about 1 Km). Pipe laying works along this road would not cause any heavy impact on the traffic as the RoW is very wide. A large free space between the paved road and the limit of RoW is still available.

Road D: This road from Chinaimo WTP has about a 9m wide paved surface, and more than 40m of RoW. It is in a very poor condition and its DBST pavement is much deteriorated. Along this road, there are some businesses which will not create any obstacle to the pipe laying works.

Pipe laying works along this road would also not cause significant impact on the traffic as the pipe

length is very short and a large free space between the paved road and the limit of RoW is still available.

Road E: This is the Road #13th North toward Nongteng presenting the same characteristics as Part 2 of the Road A.

Pipe laying works along this road would not cause significant impact on the traffic as the RoW is very wide, and a large free space between paved road and the limit of RoW is still available, except for a distance of 200m where the pipes are to be laid along the NongHeo evening market which is quite busy from 4:00 PM.

Road F: This road presents the same characteristics as Road D. The RoW is more than 50m. Due to the availability of free space between the road and the limit of RoW, and the short distance of the pipe, construction works could be carried out without causing impact to transportation, although traffic volume on this road linking the Mekong Friendship Bridge is sometimes high during peak time.

It is reported that the road from Wattay Airport to the Mekong Friendship Bridge (called “Road No1”) would probably be rebuilt in the coming year. If it is the case, the above-mentioned Road A (Part 2), Road D and Road F will form part of the new projected Road No1. Therefore, it is recommended that the consultant in charge of the detailed design of the Priority Project shall coordinate with the engineer-designer of this Road No1 so as to avoid conflict regarding the design and alignment of the water pipe lines.

8.3.3 Assessment of the Impacts on Transportation

Results of assessments concerning transportation as shown on Table 83-1.

Table 83-1 Assessment of Environmental Impacts on Transportation

Project Phase	Road No	Environmental Impacts					
		Magnitude			Duration		
		A	B	C	S	M	L
1. Construction Phase	Road A		√		√		
	Road B		√		√		
	Road C		√		√		
	Road D		√		√		
	Road E			√	√		
	Road F			√	√		

A= serious impact expected; B= some impact expected; C= no or insignificant impact;
S=short term <1 year; M=medium term, 1-10 years; L=long term., > 10 years

8.3.4 Mitigation Measures

Mitigation measures proposed to be carried out in order to reduce the negative impacts are summarized in Table 83-2:

Table 83-2 Mitigation Measures for Impacts on Transportation

Negative Impacts	Mitigation Measures
(1) reduction of traffic lanes with possible traffic jams at some locations.	(1) the selection/design of pipe alignment in a way not to reduce the traffic lanes of the roads shall be adopted. Transport of materials to and from the construction site shall be avoided during busy hours.
(2) risk of accident caused by reduction of traffic lanes	(2) during construction, traffic signs shall be installed and visible during night time.
(3) difficulty to find appropriate diversion roads	(3) before starting any excavation works, appropriate diversion roads shall be found and clearly indicated.
(4) difficulty transporting materials to and from the construction site (sand-gravel-surplus of excavated soil to discharge point.)	(4) covering dump trucks transporting sand/gravel/surplus of excavated soil with canvas.
(5) storage of pipes/materials along the roads	(5) storage of pipe and construction materials along the trenches shall be avoided.
(6) difficulty to install plant /machinery near site.	(6) plant, heavy machinery, workshop shall not be installed near the road.

8.4 Sanitary

8.4.1 Existing Conditions

In Vientiane, there are no separate systems for storm water and wastewater emitted from households. The existing drainage system was designed to drain storm water and wastewater together. The information obtained from the VUDAA (Vientiane Urban Development Administration Authority) has indicated in 1998 that 80% of urban households in Vientiane have access to satisfactory sanitation facilities (cistern flush or pour flush toilets). However, while the sanitation facilities themselves may be largely satisfactory, the methods adopted for the treatment and disposal of wastewater in some particular areas are still deficient. In almost 64% of households, soak pits are used for wastewater disposal. Soak pits are constructed offset from pour flush toilets where wastewater (from kitchen and toilets) are drained into the sub-soil.

In some sub-areas of Vientiane (Phonthan –Phonpapao area, Phonkheng, Dongpaina, Phonsaat, Sokpaluang etc.), with a high ground level, and a high absorptive capacity of soils, soakaway pits operate effectively.

But in communities built in low-laying areas where the sub-soil structure is too impermeable (with low absorptive capacity) and a high ground water table, many soak pits do not function effectively causing discharge of sewage from pits and tanks into roadside drains, or drainage channels. Consequently, the effluent overflows and pollutes surface water resulting in a poor quality environment and a hazard to public health. In addition the disposal of sludge is done directly to surface drains and from there to drainage channels and wetland or marshes, which further contributes to poor environmental conditions. This is the case in some low-laying sub-areas bordering paddy fields, and located outside the centre of Vientiane, such as: Thongkhamkham village, Thong Ouaylouay, and villages behind That Luang etc...

According to the same survey, septic tanks were used for excreta disposal by 80% of the households. Septic tanks are generally comprised of filter (charcoal, broken bricks, gravel/sand etc..). The effluents are conveyed to a seepage pit where the filtered water is drained into the sub-soil. If the soil is too impermeable, the effluent overflows to the nearest open ditch or low-lying area.

But, since the construction and completion in 2001 of some new roads, households located along these new roads connected wastewater pipes and overflow pipes from the soak pits directly to the roadside drainage pipes and then to the two main channels HongXeng and HongKe, which finally

conveys wastewater to the That Luang Marsh where an irrigation canal system has been developed. A stoplog is provided at the outlet of the channel for the storage of water, and to divert water to the irrigation canal for agriculture.

Pollution of groundwater from latrines and soak pits can be problematic in some remote localities which lack a piped water supply, and where some households rely on wells for water collection. However, only a few areas of Vientiane use groundwater due to a lack of a water pipe system. There is a strong demand for connection to the capital city water supply system in these areas, and many residents either use bottled water or boil water to obtain drinking water. In this situation the groundwater pollution can be considered as very limited.

8.4.2 Assessment of Impacts and Mitigation Measures Concerning Sanitary

After the completion of the priority projects, because of the incremental increased volume of potable water supplied by the priority projects, wastewater volume will be increased. According to the Water demand projection, the total average water demand in 2007 will be 129,625 m³/day. The increase of wastewater volume will not cause a significant impact to the sanitary environment with implementation of the mitigation measures shown below.

- to assist households in the construction of appropriate soak pits or septic tanks.
- to avoid creating ponds by connecting overflow pipes from soak pits in low-laying area.
- to incite households to connect wastewater pipes to the road side drainage pipes, where applicable.

8.5 River

8.5.1 Existing Condition

The Kaolieo Treatment Plant is located upstream of Vientiane about 5Km from the centre of the city on the Mekong river bank. Erosion is quite severe. The slope is very steep along the boundary of the plant. The expansion of the Kaolieo Water Treatment Plant will require the construction of intake facilities and river bank protection works. The assessment is aimed at confirming that there will be no significant impact on the site regarding erosion and river bank collapse.

According to the JICA study on River Bank Protection, the riverbank erosion is caused by three major causes (i) scouring at the foot of the riverbank due to the force of river flow on the river bank, and resistance to the flow of the riverbank soil, (2) a lowering river water level, (iii) slope failure due to additional loads, such as embankments and buildings that are built on the river bank.

8.5.2 Impacts due to the construction of new intake facilities at the Kaolieo Treatment Plant

There is no doubt that the construction of new intake facilities from the Mekong River located at the same place as the existing water treatment plant will cause erosion and damages to the riverbank if the appropriate measures are not taken. The degree of negative impacts will depend on the design and concept of the intake facilities. If a new tower intake of the same design/concept as the existing one is to be adopted, then the consultant in charge of the detailed design of the project should carefully study the complicated problem of turbulence caused by the high velocity of the water flow (during the flood season), and by the presence of the two intake towers located almost side by side.

8.5.3 Mitigation measures

The type of intake facilities were selected as the Intake Pipe Type which will cause minimum impact to the river bank though the technical examination during the feasibility study. This type of intake facility will not create an obstacle for the river water flow, and will not cause significant turbulence flow which will cause bank erosion.

It is recommended that the "Study on Mekong Riverbank Protection around Vientiane Municipality", made by JICA, be referred to during the detailed design phase. In fact, the GOL has implemented its riverbank protection program along the Mekong from the beginning of the last decade, by using gabions exclusively. But the gabion works are costly because the iron wire mesh basket has to be imported.

As a result of the JICA River Bank Protection study, JICA had introduced traditional river works by using local material and labour forces. These recommendations were based on the low-cost riverbank protection works successfully implemented by JICA in Bokeo Province, and tested by the Infrastructure Development Institute (IDI-Japan), at Sibounheuang in Vientiane Capital City from 1999 to 2001 by introducing "Soda" mattress method, a traditional bank protection method in Japan. Sibounheung village is located 200-300m downstream of the Kaolieo treatment Plant. The riverbank

characteristics at Sibounheuang, in terms of geology, slope, present status of erosion etc., are very similar to the Kaolieo Treatment Plant. As the riverbank protection works tested by IDI had proven favourable results, it is expected that this design or solution could be applied or adapted to the situation of the Kaolieo Treatment Plant. In addition, the construction of soda mattresses, comprised of piling spur dike piles, soda mattress, log hurdles and riprap with willow fascine, will significantly reduce the negative impacts to the environment that might be caused by the construction of gabions which require transportation of materials (stone,.), mobilization of heavy construction equipment, air pollution, noise pollution etc.

8.6 Water Pollution

8.6.1 Existing Conditions

In 1961, a master plan of the sewerage and drainage system was proposed, and in 1963 a detailed design in the central district was prepared by French consultants. Since 1963, the master plan drafted was successively revised by a short term consultant from the WHO and Japan, but no action had been taken due to a lack of funds. In 1995, a more consistent study on the sewerage and drainage plan was performed by JICA. Many alternative plans (7 Alternatives) were assessed from various aspects. The basic concept of all the alternatives was almost the same, and comprised of the following:

- No discharge of wastewater to the Mekong is permitted to protect raw water from the Mekong from pollution, assuring a clean water source for the Chinaimo Treatment Plant located about 4Km downstream of Vientiane.
- All the water (storm water and wastewater) from the urban areas of Vientiane is to be disposed by gravity to ThatLuang Marsh (EL.164.50) which is a huge swamp and the lowest place around Vientiane. The marsh is located behind That Luang Stupa and is filled through 2 main drainage channels : Hong Ke (EL.165.90 at the outflow) and Hong Xeng (EL.165.11 at the outflow).
- From That Luang Marsh , the water flows slowly north, to terminate at the discharge point called "MakHiao river" (El: 163.54 m or about 2.00m below the level of That Luang Marsh), which is the only final receiving body of water of the region located about 40Km downstream of Vientiane.
- Natural retarding ponds will be preserved at the end of the main canals to store storm water during the flooding season, in particular: Nong Chanh pond (EL.168.0), Nong Douang (EL: 168.0) and Nong Tha Nhai.

Finally, one alternative was judged to be the most preferable plan which presented the least cost and selected by the GOL as the proposed plan.

Based on the preliminary concept proposed by JICA in 1995, detailed designs of the drainage system were carried out by ADB consultants, and the construction of some main drainage channels was implemented in 1998 with ADB financing under the project known as the “Vientiane Integrated Urban Development Project-VIUDP”.

The VIUDP project consists of the construction of some main canals and branch canals to meet the fundamental drainage system. The table below summarises the existing drainage system in Vientiane. (refer to Figure 86-1):

Name of Canal	Sub-Areas served by the canal
Hong Thong	Main canal collecting storm and wastewater from the central area (old part of the city-business centre) and flowing to Nong Chanh pond (natural retention pond, near the Morning Market and Bus Terminal)
KhouaKhao	Main canal collecting storm and wastewater from the residential sub-areas located in the southern part of the study area and flowing to Nong Chanh pond.
HONG KE	Main canal conveying water from the retention pond Nong Chanh pond to That Luang marsh.
Hong OuayLouay	Collection-canal draining storm/wastewater from the villages: Naxay, Phonxay, Saphanthong, Dongpaina, Saphangmo to HongKe, and then to That Luang marsh.
Hong PhonhPaPao	Collection-canal draining storm/wastewater from the villages: Phonthan and PhonPaPao to Hong Ke, and than to That Luang Marsh.
Hong Pasak	Main canal collecting storm/wastewater from the district Chanthabouly (centre of Vientiane) and flowing to the main canal Hong Xeng , then to That Luang Marsh
Hong Thong Sang Nang / Hong Kaikeo	Collection-canal draining storm/wastewater from villages: Phonkeng, Phonsaat, Nong Bone, Thong Sang Nang.. to the main canal Hong Xeng, and then to That Luang Marsh
Hong Thong Khankham	Collection canal draining storm/wastewater from villages: Thong Sang Nang and the market place of the same name.

Water Pollution monitoring is based on the “Environmental Protection Law No:02/99/NA, dated 3 April 1999”, Chapter III-Section 1 -Pollution Control- Article 20: *“The pollution is defined as any change in the environment that leads to an increase in the chemical, biological or physical constituents in water, soil, air exceeding the ambient standards as defined in the regulations, or that causes the environment to become poisonous and leads to negative impacts on human health, human life, animals, plants and the environment.”*

Article 21: Pollution types include: *“water pollution, soil pollution, air pollution, pollution from toxic chemical, radio-active substances, waste, noise, vibrations, glare, discoloration and odour.....Water pollution is the contamination of water caused by an increase in the physical, biological and chemical constituents exceeding the prescribed standard, and leading to negative impact on human health, human life, animals, plants and the environment.*

In 1998, the Laboratory of Water Quality Analysis (Ministry of Agriculture) conducted the regular monitoring works of water quality for the Mekong river (ref: Feasibility Study On Improvement of Drainage System in Vientiane-JICA). The monitoring has been done by sampling water at various stations once every month, such as at: Kaolieo (Mekong), Hong Xeng, Hong Ke, Nong Nieng, Salakham, That Luang Marsh and Chinaimo (Mekong). Nam Papa Lao had also carried out surveys for pollutant sources of river water. The survey was to identify the condition of industry and livestock to the water pollution.

8.6.2 Ongoing sewerage/drainage projects

(1) VIUDP- Phase II

The main drainage channels improvement has been implemented and completed in 2000 under the financial assistance of Asian Development Bank (ADB) to drain the storm water in the urbanized part of Vientiane Capital City as described in the above chapter.

The second phase improvement, which aims to reduce flood damage in the same area, is planned to be implemented from 2002 to 2006. Part of this 2nd phase project will be funded by a soft loan from ADB (VIUDP-Phase II). Vientiane Urban Development and Administration Authority (VUDAA) is the Executing Agency. The proposed secondary channels in Figure 86-1 will be included in the new improvement project.

(2) NongChanh Improvement Project :

The Nong Chanh improvement project is currently being implemented and funded by Danida. The rehabilitation works will be completed by the end of the year 2004. This area of about 23.4 ha was the main retaining pond for the central zone of Vientiane, receiving storm/wastewater from Hong thong and Khouakhao canal. From Nong Chanh, water flows slowly through Hongke canal (3.28 Km long), and then discharges ultimately to That Luang Marsh.

Since 1960, Nong Chanh was illegally occupied by immigrants and illegal backfilling was carried out around its boundary, transforming this wet land into a “shantytown” in Vientiane. As a result, the original volume of water storage was substantially reduced causing frequent inundation in the ancient and lower area of Vientiane. In 2002, a resettlement plan of the GOL has permitted the evacuation of illegal residents and to restore NongChanh back to its original function.

Danida projects consists of (i) land clearing/levelling, (ii) pond excavation and reshaping; (iii) landscaping etc..

After completion of this project, it is expected that (i) Nong Chanh pond will continue to efficiently play its original function capable of storing a great volume of water, (ii) the drainage system will be improved, (iii) flooding in the centre of Vientiane during heavy raining period will be avoided.

(3) Reconstruction of "Sethathirath Road" and "Samsenthai Road".

It is known that these narrow and deteriorated roads forming the main roads inside the ancient city would be reconstructed in the upcoming year. The rehabilitation and enlargement of these roads is necessary to meet the increasing traffic requirements. In addition, it will also be an opportunity to repair/reconstruct drainage laterals.

In fact, most drainage lateral networks in Vientiane are composed of, in most cases, different sizes of channels, while some channels have a negative slope. A serious problem is the accumulation of sand in most of the drainage laterals, being easily eroded from the uncovered open space and/or unpaved roads. Sand is blocking or obstructing most of the lateral channels. As a result, storm/wastewater cannot flow through these lateral channels to the main channels at Hong thong and Hong Khouakhao, causing frequent flooding inside Vientiane.

It is expected that, after the completion of the reconstruction of these two main roads, the drainage

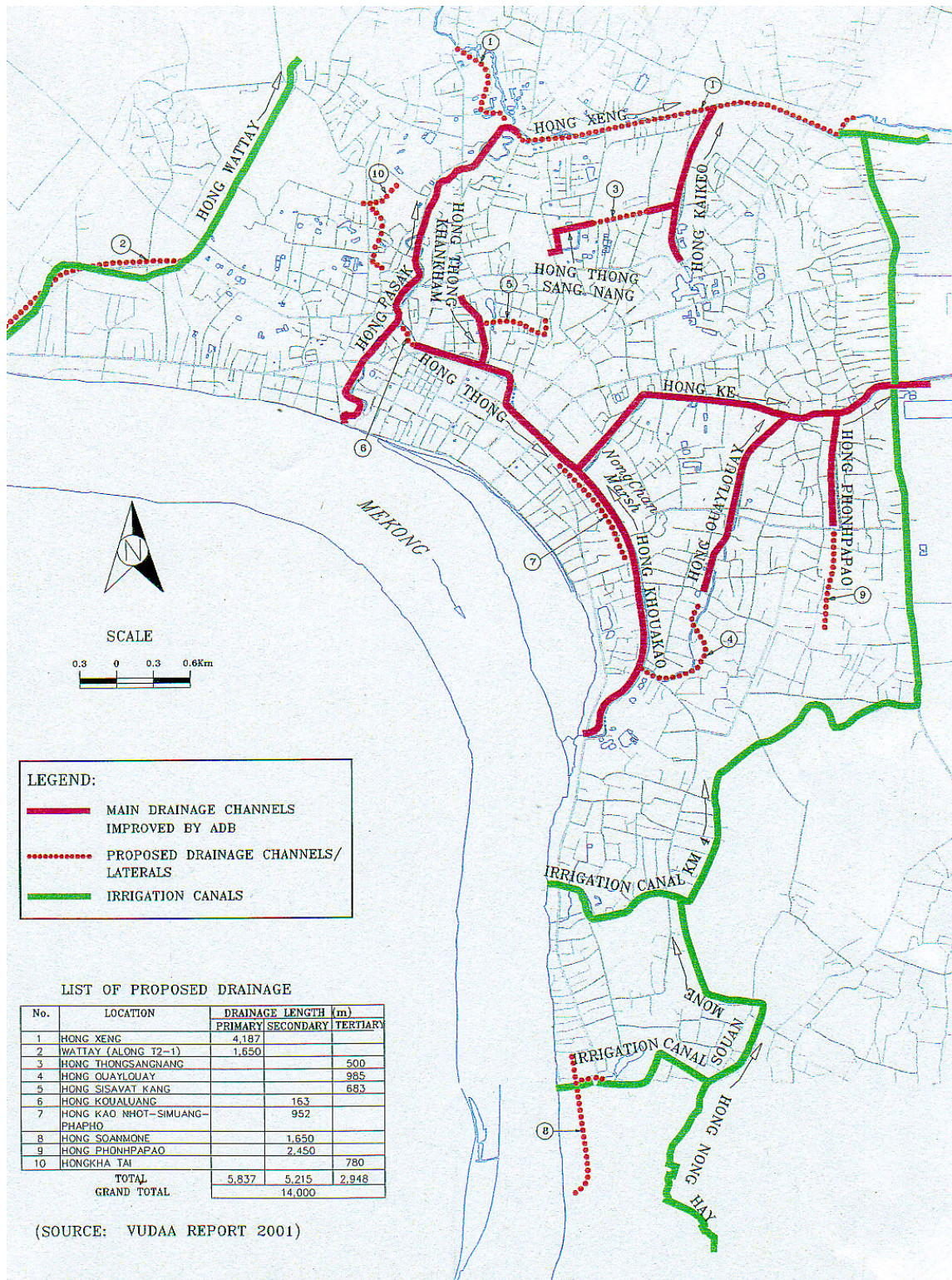
system inside the ancient city will be greatly improved and flooding can be avoided.

8.6.3 Impact assessment and mitigation measures

Based on the results of the water analysis, water pollution in 1998 was not significant in the Mekong River and ThatLuang Marsh. The values indicating the level of pollution were acceptable compared with international standards. Therefore it is assumed that there would be no significant impact on the environment regarding water pollution that might be caused by the supply of an incremental volume of potable water to the consumers, provided that the following mitigation measures are taken:

- Wastewater from Vientiane Capital City shall not be drained into the Mekong but to That Luang Marsh where natural oxidation will be occur.
- To incite households without proper wastewater disposal process to build soak pits or septic tank and to discharge the overflow effluent into a canal or a side ditch.
- Construction of additional branch canals for collecting wastewater from the urbanized areas of Vientiane as indicated in the figure below, and to connect to the main drainage channels of Hong Ke and Hong Xeng.
- To preserve the surface areas (volume of storage) of all natural retarding basins, and to protect them against illegal occupation, such as: Nong Chanh, Nong Douang, Nong Bone, Nong Tha and That Luang Marsh. The preservation of That Luang Marsh shall be combined with the development of an irrigation system for agriculture (paddy field etc..)
- To improve, enlarge and clean the existing natural drainage canal from That Luang to Nong Nieng, and then to the Makhiao river, which is the main discharge point to Mekong river located about 40Km downstream of Vientiane.

Figure 86-1 Main Drainage Channels in Urban Vientiane



8.7 Noise and Vibration

According to Article 21 of the “Environmental Protection Law”, “....*Protection from vibration, noise,is considered a nuisance when these things exceed their respective prescribed standards and lead to negative impacts on human health, human life, animals, plants and the environment..... Persons and organizations engaged in all kind of activities must strictly protect and control... vibration, noise ...*”

The implementation of the priority projects will probably cause some impacts to the environment along the pipe routes, and at the Kaolieo Treatment Plant regarding noise and vibration. Noise and vibration will be produced by dump trucks transporting construction materials to sites, heavy equipment (excavators, cranes, rollers, concrete mixers, air-compressors, concrete breakers etc...).

It is not possible to avoid such impacts during the construction phase, but it is possible to reduce their magnitude by taking the following mitigation measures:

- To avoid (if possible) night work (from 6:00 PM to 8:00 AM) in order to reduce noise.
- To use appropriate machinery and construction equipment producing less noise.
- To plan work schedules in such a way that pipe laying works be carried out rapidly in front of hospitals, schools, temples, administrative office buildings etc..
- Not to use roller with high vibration amplitude in front of old temples, old houses or historical heritage sites.
- To select the nearest quarry and borrow the pit for gravels, sand, stone, etc... so that the distance for transport and the number of vehicles could be reduced, and noise/vibration could be reduced as a consequence.
- At the Kaolieo Treatment Plant, a temporary fence shall be installed to prevent neighbouring houses from noise and dust.

8.8 Heritage in Vientiane

8.8.1 Law and Legislation Concerning Historical Heritage

In Lao PDR, the Department of Museums and Archaeology (hereinafter referred to as “DMA”) in the Ministry of Information and Culture (hereinafter referred to as “MIC”) is the governmental agency responsible for the preservation of the national heritage.

The management of the national heritage that is comprised of the national cultural, historical and natural heritage is referred to in the following Laws, Legislation and Decrees:

- Presidential Decree on the Preservation of Cultural, Historical and Natural Heritage No03/PR, dated 20.06.1997.
- Penal Code, 29/NA, 23 December 1998, Article 103.
- Law on Ownership, 01/90/NA, 27 June 1990, Articles 32 and 41
- Law on the Preservation of the Environment, 09/NA, 26 April 1999, Article 16.
- Law on the Land Use No.33,31 May 1997, Article 34.

A law on Cultural Heritage is under preparation and will be submitted to the National Assembly in March 2004.

8.8.2 Historical Heritages to be Preserved

According to the above Presidential Decree No 03/PR, the national cultural, historical and natural heritage to be preserved is classified as follows: (Art.5)

Immovable National Heritage composed of : artefacts, archaeological ruins, and national historical ruins, which may not be removed such as : That Luang Stupa, Phakeo Temple etc..

Movable National Heritage composed of artefacts which may be removed such as Buddha statues, bronze drums, ancient pottery etc..

Natural National Heritage comprises of: beautiful environment including: natural sceneries occurring naturally, panoramas of natural sites, and architecture of high historical value...such as: the water fall at Tat kuangsy (Luang Prabang) and Khon Phapeng (Champassack) etc..

The Department of Museums and Archaeology (DMA) is in charge of carrying out the surveying, search and inventory of national heritage items throughout the country. But, in fact, due probably to the shortage of funds and qualified personnel, these works are not performed continuously and effectively. In Vientiane, some archaeological sites and visible vestiges were identified (i- historical sites: monuments, temples etc.; ii- vernacular architectural specimens: traditional and colonial houses...; iii-memorial sites; ...), and some historical buried structures and objects (kiln sites, pottery, walls of ancient palaces etc.) were found during the construction of roads inside the boundary of the ancient city limited by the Khouvieng ring road and the Mekong River.

Outside this boundary, no archaeological works have been undertaken so far, and nobody can certify whether historical heritages (buried structures, objects of great value etc.) exist or not. Nevertheless, the DMA assumes that some historical heritages may be found along the second ring road boarding the That Luang Marsh. This assumption was based on buried /thick brick walls found in 2000 near Phonthanh during the construction of this road.

8.8.3 Mitigation measures for impacts on Heritage

Figure 88-1 shows the locations of the priority projects and ancient city boundary walls. As shown in this figure, all locations of the priority projects will take place outside of the ancient city boundary walls and therefore, significant impacts on those heritages is not foreseen.

However, it is important that certain mitigation measures should be taken to avoid accidental damage to these heritage areas. The mitigation measures are as follows:

- During the construction period, the project should request the MIC to dispatch 2 archaeologists to follow up and monitor any archaeological discoveries.
- If archaeological objects are encountered, construction works shall be interrupted to allow investigation and identification, recording data and removal of the archaeological objects on the spot. Contractors shall bear the expenses of archaeological intervention which enforced by the relevant Laws and Regulations.

According to the recommendations of the DMA, *“if contractors do not want to interrupt construction works, they should request an archaeological survey prior to starting excavation works at locations indicated on the drawing where buried structures and historical objects of value could be found. Archaeologist will conduct a survey and identify archaeological objects and sites, study*

and record data and remove artefacts according to scientific standards and in compliance with the law. After that, the construction site is handed over to contractors. By doing so, construction works will not be interrupted by archaeology.”

Figure 88-1 Location of Priority Project and Ancient City Boundary Walls

