2 Review of the NPVC Master Plan

The NPVC Master Plan recommends the construction of a new treatment plant in Thangone which will have a capacity of 50,000 m3/day in Phase 1. The plan also recommends installing transmission pipelines in Phase 2 of the plan, and expansion of the existing Kaolieo Treatment Plant to 40,000 m3/day (an additional 20,000 m3/day expansion) in Phase 3. This will achieve a total capacity of 170,000 m3/day (Chinaimo: 80,000 m3/day, Kaolieo: 40,000 m3/day, Thangone: 50,000 m3/day). However, the hydraulic network analysis, for the short term plan, targeted for 2005, when completed all phases from Phase 1 to 3, included in the NPVC Master Plan, production capacities of three treatment plants are as follows:

Existing Chinaimo Treatment Plant	897.591 l/sec (77,552 m3/day)
Expanded Kaolieo Treatment Plant	461.574 l/sec (39,880 m3/day)
New Thangone Treatment Plant	230.895 l/sec (19,949 m3/day)

At the Chinaimo and Kaolieo Treatment Plants, the production outputs of the plants are similar in their design capacity and expanded capacity. However for the new Thangone Treatment Plant, water flow from the plant is about 20,000 m3/day, less than half (40%) of the design capacity. Unfortunately, the NPVC master plan does not explain this ambiguous point and if this is the case, the new Thangone Treatment Plant will have 60% idling capacity and the actual water production will be 140,000 m3/day in total (Chinaimo: 80,000 m3/day, Kaolieo: 40,000 m3/day, Thangone: 20,000 me/day). This total output is absolutely the same as the planned plant capacity of the 1st Stage proposed by the JICA Study Team.

According to information from the NPVC, the capacity of the new Thangone Treatment Plant was revised at30,000 m3/day, unfortunately the revised master plan has not been prepared, and details concerning the changes of plant capacity are not available.

A comparative study of several alternatives was not conducted, and the reason why the construction of Thangone Treatment Plant was proposed as the first priority in the NPVC master plan, was not clearly discussed in the plan. However, the master plan did point out the following advantages of the new Thangone Treatment Plant.

(1) Water quality (turbidity) is much better than that of the Mekong River
(2) The scale of treatment facility will be smaller than the existing two plants because of low turbidity
(3) The planned location of the plant is ideal considering water supply to the northern parts of the capital city where low water pressure and intermittent supply are common problems. It

is also an area that will be developed as new housing and industrial areas.

(4) A dual-source water supply system can be established and the risk of accidents at the water source is lower than the existing single-source water supply system which relies entirely on the Mekong River.

(1) Available water quality (turbidity) is much better than from the Mekong River

This advantage will be evaluated in aspect of costs required for chemicals (O/M costs) in the following cost comparison. Lower turbidity will require fewer coagulants compared with the amounts of coagulants used at the existing two treatment plants.

(2) The scale of the treatment facility will be smaller than the existing two plants because of low turbidity

This advantage will be evaluated in view of construction costs of the treatment plant in the following cost comparison. Lower turbidity will require less capacity (shorter detention time) of water in the sedimentation basin compared with existing two treatment plants.

(3) The location of the plant will be ideal considering water supply to the northern part is suffering low water pressure and intermittent supply, and is an area that will be developed as new housing and industrial areas.

This advantage will be evaluated in view of the installation costs of transmission and distribution pipelines in the following cost comparison as all pipe network systems for all alternatives are planned to secure water distribution in same service area. If the location of the new Thangone Treatment Plant is ideally situated to supply water to the northern part of the capital city, pipe installation costs will be low compared with other alternatives.

(4) A dual-source water supply system can be established and the risk of accidents at the water source is lower compared to the existing single-source water supply system which relies entirely on one source, the Mekong River.

With the construction of the new Thangone Treatment Plant, the Vientiane water supply system will have access to two water supply sources, the Mekong River for the existing two plants, and the Nam Ngum River for the new treatment plant. Reduction of risk in water source accidents will be reduced by the introduction of a new water source for the Vientiane water supply system.

There are two kinds of accidents possible in the treatment of raw water, accidents with the quality of water, and accidents that affect the quantity of water. Quality accidents may occur by the discharging of toxic substances into the river. However, since the construction of the first treatment plant at Kaolieo in 1964, no such quality accidents have occurred. Although it can never be said

that such quality accidents will never occur in the huge international river basin, such toxic substances will be diluted because of the size of the river basin and the huge amount of water flow of the Mekong River.

Water quantity accidents are about the availability of raw water for the treatment plants and, in particular, concern the eventuality when water flow becomes too low for the treatment plants to be able to access the water supply. However, there have been no such quantity accidents in the last 40 years in the case of the Mekong River. According to the data of water flow from the Mekong River in Vientiane from 1960 to 2001, the minimum flow was observed in 1999 and the flow rate at that time was 598 m3/sec. In the water demand forecast of the JICA study, the total amount of water in 2020 is forecasted to be about 250,000 m3/day (2.9 m3/sec), and if the total water requirement is taken from the Mekong River, it is equivalent to 0.5 % of the minimum flow in the last 40 years.

At the new Thangone Treatment plant, the advantages of a dual-source water supply system are obvious. However, as mentioned above, the probability of risks of water quality accidents and water quantity accidents are very low. The study team considers that these risks are not an imminent threat and which should make the introduction of additional investments unnecessary.

3 Screening of Alternatives

The water supply system of Vientiane Capital City, which is facing a shortage of its supply capacity, should be developed continuously and gradually to meet the increasing water demand. According to the water demand projection described in Chapter 4.4, the water supply capacity should be increased up to 200,000m3/day by 2015, twice the existing water supply capacity.

Alternative locations for expansion of the production capacity are as follows;
- Expansion of the existing Chinaimo treatment plant,
- Expansion of the existing Kaolieo treatment plant, and
- Construction of new Thangone treatment plant.

For the comparative study of these alternatives, it is necessary to examine these alternatives from a multi-dimensional aspect to include social, environmental, technical, and economical view points. Furthermore, organization, management, financial condition, and human resource development should be carefully examined for sound NPVC management in future. For the above three alternatives, preliminary comparison and evaluation methods are as shown in Table 1.

As is shown in Table 1, although each alternative has advantages and disadvantages, significant factors to exclude certain alternatives from the comparative study were not found except in the case of the 60,000 m3/day expansion in the existing Chinaimo Treatment Plant.

The expansion of capacity in each stage is discussed above and as follows;

1st Stage: Expansion of 40,000 m3/day
2nd Stage: Expansion of 60,000 m3/day

Alternatives are selected considering a combination of the above alternative locations and stages of expansion. For the 1st Stage, capacity expansion of 40,000 m3/day, three alternatives are considered as follows (Figure 3).

- Alternative C (Chinaimo): Expansion of the existing Chinaimo Treatment Plant (40,000 m3/day),
- Alternative K (Kaolieo): Expansion of the existing Kaolieo Treatment Plant (40,000 m3/day), and
- Alternative T (Thangone): New Construction of a treatment plant at Thangone (40,000 m3/day)

Table 1 (1/2) Preliminary Comparison and Evaluation of Alternatives

	Chinaimo Treatment Plant	Kaolieo Treatment Plant	Thangone Treatment Plant	Evaluation Method
Raw Water Source	Mekong River	Mekong River	Nam Ngum River	
Quantity	Enough and secured	Enough and secured	Enough and secured	No difference among alternatives
Quality in aspect of Chemicals Required	High turbidity in rainy season, and more chemicals will be required	High turbidity in rainy season, and more chemicals will be required	Low turbidity on average and less chemicals will be required	Difference of raw water turbidity will be evaluated in aspect of chemical costs (O/M costs) in following cost comparison
Quality in aspect of capacity of sedimentation basin	Same detention period as existing facility will be required	Same detention period as existing facility will be required	Capacity of sedimentation basin can be reduced compared with existing facilities	Difference of treatment facilities will be evaluated in view of construction costs in following cost comparison
Water Level [1)]	Max. +170.64 m, Min. +158.11 m, Fluctuation = 12.53m	Max. +170.64 m, Min. +158.11 m, Fluctuation = 12.53m	Max. +169.00 m, Min. +154.48 m, Fluctuation = 14.52m	No difference among alternatives Water fluctuation in Nam Ngum River is rather bigger than the one of Mekong River, however, construction costs of the intake facilities will not be affected by the small difference and judged no difference among alternatives
Intake Facilities	Intake Pump replacement will be required	Additional Intake facilities will be required	New Intake facilities will be required	Difference of intake facilities will be evaluated in aspect of construction costs in following cost comparison
Treatment Plant				
Location	South of the town centre	West of town centre	North of town centre	Location of plant will be evaluated from the aspect of pipe installation costs of pipelines and operation costs (electricity costs) in following cost comparison

1) Data of Mekong River obtained from 1991 to 2002, data of Nam Ngum River obtained from 1990 to 2002

Table 1 (2/2) Preliminary Comparison and Evaluation of Alternatives

	Chinaimo Treatment Plant	Kaolieo Treatment Plant	Thangone Treatment Plant	Evaluation Method
Land space for expansion or new construction	Space for 40,000 m3/day expansion will be available within the existing plant premises. Expansion of 60,000 m3/day will not be able to be accommodated within the existing plant premises.	Space for 40,000 m3/day and 60,000 m3/day expansion will be available within the existing plant premises. However, in the case of 60,000 m3/day expansion, no space for a distribution reservoir will be available	Proposed site of plant is occupied by Thangone Irrigation College, Ministry of Agriculture and Forestry. Other land space will be provided according to the information from WASA, but not yet confirmed.	60,000 m3/day expansion in Chinaimo Treatment Plant should be excluded from alternative. In case of 60,000 m3/day expansion in Kaolieo, an additional distribution centre outside of the plant will be required and this will be evaluated as construction costs in following cost comparison. According to the information form WASA, land space for new Thangone will be acquired but the time taken for land acquisition is not yet known.
Distribution and Transmission System	Additional pipelines are required	Additional pipelines are required. Distribution centre will be required in the case of a 60,000 m3/day expansion	Additional pipelines and distribution centre will be required	Difference of distribution and transmission system will be evaluated from the aspect of pipe installation costs, construction costs of distribution centre, and operation costs (electricity costs) in following cost comparison
Booster Pumping Station	Improvement will be required	Improvement will be required	Improvement will not be required when capacity is 40,000 m3/day expansion	Difference of booster pumping stations will be evaluated from the aspect of improvement costs of booster pumping stations, and operation costs (electricity costs) in following cost comparison
Power Supply	No problem	No problem	No problem	No difference among alternatives
Chemical Supply	No problem	No problem	No problem	No difference among alternatives
Staff required for Plant Operation and Maintenance	Additional staff required is less than 10 staff, OJT at existing plant is possible	Additional staff required is less than 10 staff, OJT at existing plant is possible	New organization for new plant should be established with about 35 staff. Recruiting and freshmen training will be required	Difference of staff required will be evaluated from the aspect of operation costs (salary) in following cost comparison In the case of Thangone, recruiting and freshmen training should be completed before completion of new plant construction.