CHAPTER 4

MASTER PLAN

CHAPTER 4   MASTER PLAN

4.1   Basic Policy and Strategy

4.1.1   Basic Principles

The Master Plan for the Vientiane Water Supply Development Project has been prepared to solve existing problems of the NPVC and their customers and to increase the water supply capacity with an adequate transmission/distribution system designed to meet future water demands. The aim of the plan is to secure the sustainable development of Vientiane and to maintain a hygienic living environment for the citizens of Vientiane.

For the improvement of the water supply system, the future water supply system needs to be planned to take into account the development plan of Vientiane, socio-economic conditions, and existing problems. Several alternative plans for water supply system development are prepared considering not only the locations of treatment plants but also their combination within a certain time span until the target year, 2015. In the course of the Mater Plan Study, these alternative plans are carefully examined and compared from the viewpoint of the technical, financial, economical capacity of the NPVC to select the best alternative.

Unaccounted-for water reduction is recognized as one of the crucial aspects for the future development plan of a water supply system. The reduction program for UFW should be prepared simultaneously with system expansion planning.

The master plan is prepared not only for the improvement and expansion of the physical system but also for financial/economic improvement, for capacity building, and for public relations. The NPVC, one of the Nam Papa State-Owned Enterprise, is defined as an enterprise which should be managed on the basis of commercial principles. Therefore, planned projects should be financially and economically viable and impacts on the NPVC financial situation needs to be carefully examined. To secure sustainability of the project, capacity building (human resource development) and promotion of public relations are recognized as vital aspects of the Master Plan.

4.1.2   Strategy of the Master Plan

(1)   Population Forecast

Future population is forecast at three levels; 1) capital city population forecast, 2) district level population forecast, and 3) village level population forecast. The first level, capital city population forecast takes into account past trends, other population forecasts conducted by agencies and projects, the average population increase in Lao PDR, and the application of statistical curves and lines to the forecasts. After forecasting the total capital city population until 2020, district level population is forecast considering past trends of population increase in the respective districts. District level population is forecast so as to be same as the forecast for the capital city population in total. The ratio of population increase for each village is also examined and based on past trends. Future populations in each village are forecast so as to be same as forecast for the district population in total.

(2)   Service Area

The most important information for the planning of the future service area expansion of the NPVC is an accurate projection of future land use and an urban development plan. This information is fortunately included in the Vientiane Urban Development Master Plan prepared by the Urban Research Institute of the MCTPC. The planned industrial area and reserved area for forest are taken into account to to outline the future water service area. A priority area of expansion for the service area is also studied, considering on-going projects such as expansion of the distribution network with French aid. Expansion of the future service area is finalised in consultation with WASA and the NPVC.

(3)   Water Demand Projection

Future water demand is projected for domestic and non-domestic purposes separately. For the domestic water demand, future water demand is calculated from village level populations, service ratios, the calculated served population and the per capita water demand. Usually per capita water demand will increase in the future, however, the per capita water demand is planned to decrease from the current level of 174 lpcd, to 170 by 2010. This is because about 20% of households have in-house leakages which are not being repaired. This situation will be improved through adequate public relation activities promoted by the NPVC. Also, there will be some influence on water use as a result of planned tariff increases which are proposed in this master plan. Non-domestic water demand is projected from past trends and the consideration of industrial area development by the Vientiane Capital City. It is strongly recommended that the NPVC promotes water conservation activities and a reduction of UFW to avoid over-scaled project formation.

(4)   Comparative Study of Alternatives

According to the existing NPVC master plan, the water supply capacity should be increased up to 200,000m3/day by 2015, which is about twice the existing water supply capacity. To increase the water supply capacity, the following four alternatives will be considered;

1.   Expansion of the existing Chinaimo treatment plant,
2.   Expansion of the existing Kaolieo treatment plant,
3.   Construction of a new Thangone treatment plant, and
4.   A combination of the above three alternatives.

To compare these alternatives, the study team has prepared water supply facility plans including intake facilities, treatment plant facilities, clear water transmission pipelines, distribution pipelines, construction costs and operation and maintenance costs. These factors are calculated and compared between the respective alternatives. This is because the comparison of alternatives should be based on the comparison of whole systems, not only by comparison of treatment plant facilities.

For the comparative study of these alternatives, it is necessary to examine these alternatives from multi-aspects such as social, environmental, technical, and economic view points. Furthermore, the organization, management, financial condition, and human resource development within the NPVC should be carefully examined for the soundness of the future NPVC management. As a result of the comparative study, the best alternative will be recommended.

(5)   Preliminary Cost Estimates

Costs for the projects are estimated during the comparative study. However costs utilised in the comparative study will not include costs incurred by small size distribution pipelines, house connection installation, consulting services, physical and price contingencies, and administration costs. The preliminary cost estimates for the total project costs including the above mentioned costs have been executed.

(6)   Implementation Schedule

The implementation schedule is prepared based on standard international procedures including budgetary arrangement period, detailed design period, and construction period. The schedule is prepared for each stage. Based on the schedule, the disbursement schedule is prepared and will be a basis of the financial projection.

(7)   Selection of Priority Projects

Among the projects including the best selected alternative, the priority projects are selected based on their urgency and their importance for the improvement of the water supply. The scale of the priority projects are also important from the financial aspect, therefore the project scale will be carefully examined considering the NPVC's financial capabilities and future tariff schedules.

The JICA study will select priority projects for treatment plant facilities and clear water transmission pipelines. Other components of the priority projects such as distribution systems and house connections will be selected as priority projects under the study conducted by the AFD. However, the minimum requirements of the distribution system which will be necessary to distribute water from the expanded/new treatment plants will be selected by the JICA as priorities.

(8)   Initial Environmental Examination

Although significant environmental impacts by the implementation of the priority projects are not foreseen, possible environmental impacts are listed and screened for the forthcoming environmental impact assessment, to be conducted during the next feasibility study period.

(9)   Evaluation of the Master Plan and Recommendations

The prepared master plan is evaluated from the technical, socio-economical, environmental aspects to confirm the adequacy of the plan. Based on identified issues of existing conditions, recommendations will be prepared. These recommendations will include actions required for the implementation of the priority projects.

4.2   Population Forecast

4.2.1   Vientiane Capital City Population

Past population trends of Vientiane Capital City are shown in Table 42-1 and Figure 42-1. As shown in Table 42-1, the population increase for the 15 years from 1985 to 2000 was 3.05 % on average and the total population was about 600,000 in 2000.

Table 42-1   Past Capital City Population Trends

Year	1985	1990	1995	1999	2000
Population	381,000	464,000	532,000	583,000	598,000
Average Increase Ratio from 1985 to 2000					3.05%

Source: National Statistical Centre (NSC)

Figure 42-1   Past Capital City Population Trends
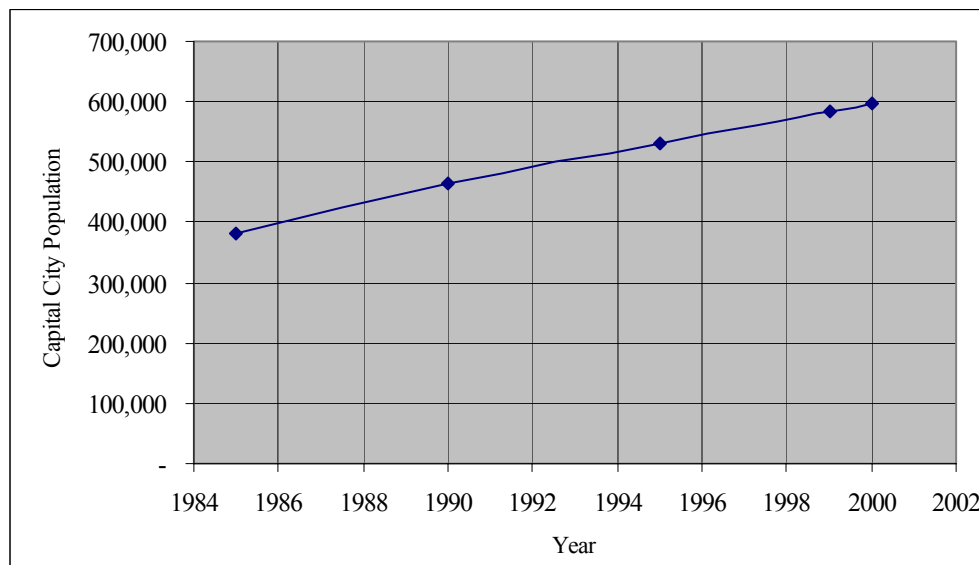
Source: NSC

From the data of past populations, the future capital city population was estimated applying four formulas of statistical curves and lines. The results of the statistical calculations for the future capital city population is shown in Table 42-2 and Figure 42-2

Table 42-2   Results of Statistical Calculation of Future Capital City Population

Year	Data Population	Ratio	Arithmetic Linear Population	Ratio	Geometric Curve Population	Ratio	Exponential Curve Population	Ratio	Power Curve Population	Ratio
1985	381,000		387,772		393,440		383,375		352,237	
1986	397,600	4.36%	402,007	3.67%	405,130	2.97%	399,438	4.19%	396,908	12.68%
1987	414,200	4.18%	416,241	3.54%	417,168	2.97%	415,220	3.95%	425,622	7.23%
1988	430,800	4.01%	430,476	3.42%	429,563	2.97%	430,725	3.73%	447,245	5.08%
1989	447,400	3.85%	444,710	3.31%	442,326	2.97%	445,958	3.54%	464,771	3.92%
1990	464,000	3.71%	458,945	3.20%	455,468	2.97%	460,925	3.36%	479,600	3.19%
1991	477,600	2.93%	473,179	3.10%	469,001	2.97%	475,629	3.19%	492,506	2.69%
1992	491,200	2.85%	487,414	3.01%	482,936	2.97%	490,076	3.04%	503,966	2.33%
1993	504,800	2.77%	501,649	2.92%	497,286	2.97%	504,269	2.90%	514,295	2.05%
1994	518,400	2.69%	515,883	2.84%	512,061	2.97%	518,214	2.77%	523,715	1.83%
1995	532,000	2.62%	530,118	2.76%	527,276	2.97%	531,914	2.64%	532,384	1.66%
1996	544,750	2.40%	544,352	2.69%	542,942	2.97%	545,374	2.53%	540,424	1.51%
1997	557,500	2.34%	558,587	2.62%	559,074	2.97%	558,598	2.42%	547,927	1.39%
1998	570,250	2.29%	572,821	2.55%	575,686	2.97%	571,591	2.33%	554,967	1.28%
1999	583,000	2.24%	587,056	2.49%	592,790	2.97%	584,356	2.23%	561,602	1.20%
2000	598,000	2.57%	601,290	2.42%	610,404	2.97%	596,897	2.15%	567,880	1.12%
2001			615,525	2.37%	628,540	2.97%	609,218	2.06%	573,842	1.05%
2002			629,760	2.31%	647,215	2.97%	621,324	1.99%	579,520	0.99%
2003			643,994	2.26%	666,446	2.97%	633,217	1.91%	584,942	0.94%
2004			658,229	2.21%	686,247	2.97%	644,902	1.85%	590,134	0.89%
2005			672,463	2.16%	706,637	2.97%	656,382	1.78%	595,114	0.84%
2006			686,698	2.12%	727,633	2.97%	667,661	1.72%	599,902	0.80%
2007			700,932	2.07%	749,253	2.97%	678,743	1.66%	604,514	0.77%
2008			715,167	2.03%	771,515	2.97%	689,630	1.60%	608,962	0.74%
2009			729,401	1.99%	794,438	2.97%	700,326	1.55%	613,259	0.71%
2010			743,636	1.95%	818,043	2.97%	710,835	1.50%	617,416	0.68%
2011			757,871	1.91%	842,348	2.97%	721,160	1.45%	621,443	0.65%
2012			772,105	1.88%	867,377	2.97%	731,303	1.41%	625,349	0.63%
2013			786,340	1.84%	893,148	2.97%	741,269	1.36%	629,140	0.61%
2014			800,574	1.81%	919,686	2.97%	751,061	1.32%	632,825	0.59%
2015			814,809	1.78%	947,012	2.97%	760,681	1.28%	636,410	0.57%
2016			829,043	1.75%	975,150	2.97%	770,132	1.24%	639,900	0.55%
2017			843,278	1.72%	1,004,123	2.97%	779,417	1.21%	643,301	0.53%
2018			857,513	1.69%	1,033,958	2.97%	788,540	1.17%	646,617	0.52%
2019			871,747	1.66%	1,064,679	2.97%	797,503	1.14%	649,854	0.50%
2020			885,982	1.63%	1,096,313	2.97%	806,309	1.10%	653,016	0.49%

Results of the calculations from the power curve seem to be too low compared with past population increases, which were about 3 %. Therefore, it is assumed that the future capital city population will be between the ranges of the Exponential Curve and the Geometric Curve.

Figure 42-2   Results of Statistical Calculation on Future Capital City Population
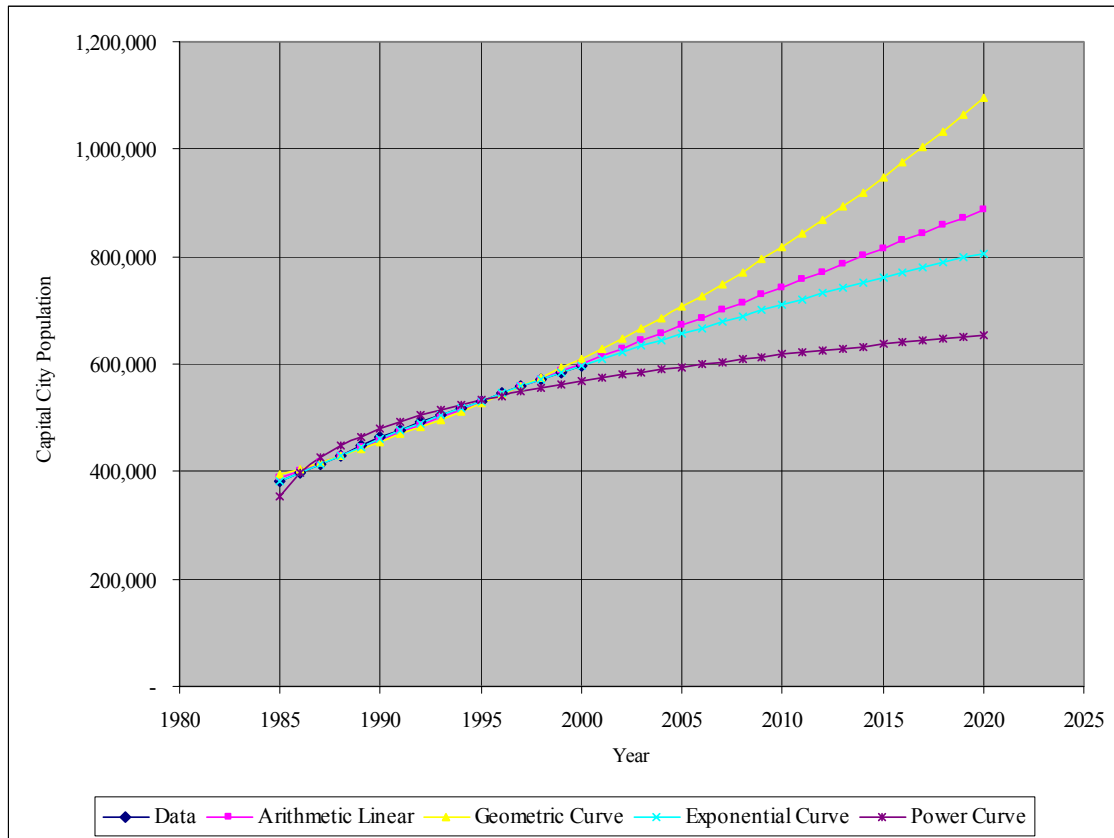

Table 42-3 and Figure 42-3 show future population forecasts by the statistical calculation mentioned above, and forecasts by the National Statistical Centre (NSC), the NPVC master plan, Vientiane Capital City and the ADB Project.

Forecasts by the ADB Project and Vientiane Capital City are rather high estimates of the rate of population growth, comparatively higher than past trends of population increase would indicate.

The population increase rate in the NPVC master plan is about 2.5 % and seems to be low taking into account the national average increase rate is 2.5 % per year. It can be assumed that as Vientiane is the capital city, the rate of population growth will be higher than the national average.

Table 42-3   Comparison of Statistical Population Forecast and other Population Forecast by different agencies

Year	Data Pop.	Ratio	Arithmetic Linear Pop.	Ratio	Geometric Curve Pop.	Ratio	Exponential Curve Pop.	Ratio	Power Curve Pop.	Ratio	NSC Pop.	Ratio	NPVC M/P Pop.	Ratio	V. C. City Pop.	Ratio	ADB Proj. Pop.	Ratio
1985	381,000		387,772		393,440		383,375		352,237									
1986	397,600	4.36%	402,007	3.67%	405,130	2.97%	399,438	4.19%	396,908	12.68%								
1987	414,200	4.18%	416,241	3.54%	417,168	2.97%	415,220	3.95%	425,622	7.23%								
1988	430,800	4.01%	430,476	3.42%	429,563	2.97%	430,725	3.73%	447,245	5.08%								
1989	447,400	3.85%	444,710	3.31%	442,326	2.97%	445,958	3.54%	464,771	3.92%								
1990	464,000	3.71%	458,945	3.20%	455,468	2.97%	460,925	3.36%	479,600	3.19%								
1991	477,600	2.93%	473,179	3.10%	469,001	2.97%	475,629	3.19%	492,506	2.69%								
1992	491,200	2.85%	487,414	3.01%	482,936	2.97%	490,076	3.04%	503,966	2.33%								
1993	504,800	2.77%	501,649	2.92%	497,286	2.97%	504,269	2.90%	514,295	2.05%								
1994	518,400	2.69%	515,883	2.84%	512,061	2.97%	518,214	2.77%	523,715	1.83%								
1995	532,000	2.62%	530,118	2.76%	527,276	2.97%	531,914	2.64%	532,384	1.66%	528,395							
1996	544,750	2.40%	544,352	2.69%	542,942	2.97%	545,374	2.53%	540,424	1.51%	542,597	2.69%						
1997	557,500	2.34%	558,587	2.62%	559,074	2.97%	558,598	2.42%	547,927	1.39%	556,799	2.62%						
1998	570,250	2.29%	572,821	2.55%	575,686	2.97%	571,591	2.33%	554,967	1.28%	571,001	2.55%						
1999	583,000	2.24%	587,056	2.49%	592,790	2.97%	584,356	2.23%	561,602	1.20%	585,203	2.49%						
2000	598,000	2.57%	601,290	2.42%	610,404	2.97%	596,897	2.15%	567,880	1.12%	599,405	2.43%	597,806		597,000		640,815	
2001			615,525	2.37%	628,540	2.97%	609,218	2.06%	573,842	1.05%	616,955	2.93%	613,517	2.63%	619,177	3.71%	663,404	3.53%
2002			629,760	2.31%	647,215	2.97%	621,324	1.99%	579,520	0.99%	634,504	2.84%	629,228	2.56%	641,354	3.58%	685,994	3.41%
2003			643,994	2.26%	666,446	2.97%	633,217	1.91%	584,942	0.94%	652,053	2.77%	644,940	2.50%	663,531	3.46%	708,583	3.29%
2004			658,229	2.21%	686,247	2.97%	644,902	1.85%	590,134	0.89%	669,602	2.69%	660,651	2.44%	685,708	3.34%	731,173	3.19%
2005			672,463	2.16%	706,637	2.97%	656,382	1.78%	595,114	0.84%	687,151	2.62%	676,362	2.38%	707,885	3.23%	753,762	3.09%
2006			686,698	2.12%	727,633	2.97%	667,661	1.72%	599,902	0.80%	707,270	2.93%	694,138	2.63%	734,181	3.71%	779,476	3.41%
2007			700,932	2.07%	749,253	2.97%	678,743	1.66%	604,514	0.77%	727,388	2.84%	711,914	2.56%	760,477	3.58%	805,190	3.30%
2008			715,167	2.03%	771,515	2.97%	689,630	1.60%	608,962	0.74%	747,506	2.77%	729,690	2.50%	786,773	3.46%	830,905	3.19%
2009			729,401	1.99%	794,438	2.97%	700,326	1.55%	613,259	0.71%	767,624	2.69%	747,466	2.44%	813,070	3.34%	856,619	3.09%
2010			743,636	1.95%	818,043	2.97%	710,835	1.50%	617,416	0.68%	787,742	2.62%	765,242	2.38%	839,366	3.23%	882,333	3.00%
2011			757,871	1.91%	842,348	2.97%	721,160	1.45%	621,443	0.65%	810,806	2.93%	785,354	2.63%	870,546	3.71%	911,435	3.30%
2012			772,105	1.88%	867,377	2.97%	731,303	1.41%	625,349	0.63%	833,869	2.84%	805,466	2.56%	901,726	3.58%	940,536	3.19%
2013			786,340	1.84%	893,148	2.97%	741,269	1.36%	629,140	0.61%	856,932	2.77%	825,577	2.50%	932,906	3.46%	969,638	3.09%
2014			800,574	1.81%	919,686	2.97%	751,061	1.32%	632,825	0.59%	879,995	2.69%	845,689	2.44%	964,087	3.34%	998,739	3.00%
2015			814,809	1.78%	947,012	2.97%	760,681	1.28%	636,410	0.57%	903,059	2.62%	865,801	2.38%	995,267	3.23%	1,027,841	2.91%
2016			829,043	1.75%	975,150	2.97%	770,132	1.24%	639,900	0.55%	929,498	2.93%	888,556	2.63%	1,032,239	3.71%		
2017			843,278	1.72%	1,004,123	2.97%	779,417	1.21%	643,301	0.53%	955,938	2.84%	911,310	2.56%	1,069,210	3.58%		
2018			857,513	1.69%	1,033,958	2.97%	788,540	1.17%	646,617	0.52%	982,377	2.77%	934,065	2.50%	1,106,182	3.46%		
2019			871,747	1.66%	1,064,679	2.97%	797,503	1.14%	649,854	0.50%	1,008,817	2.69%	956,819	2.44%	1,143,153	3.34%		
2020			885,982	1.63%	1,096,313	2.97%	806,309	1.10%	653,016	0.49%	1,035,256	2.62%	979,574	2.38%	1,180,125	3.23%		

Figure 42-3   Comparison of Statistical Population Forecast and other Population Forecasts by different agencies
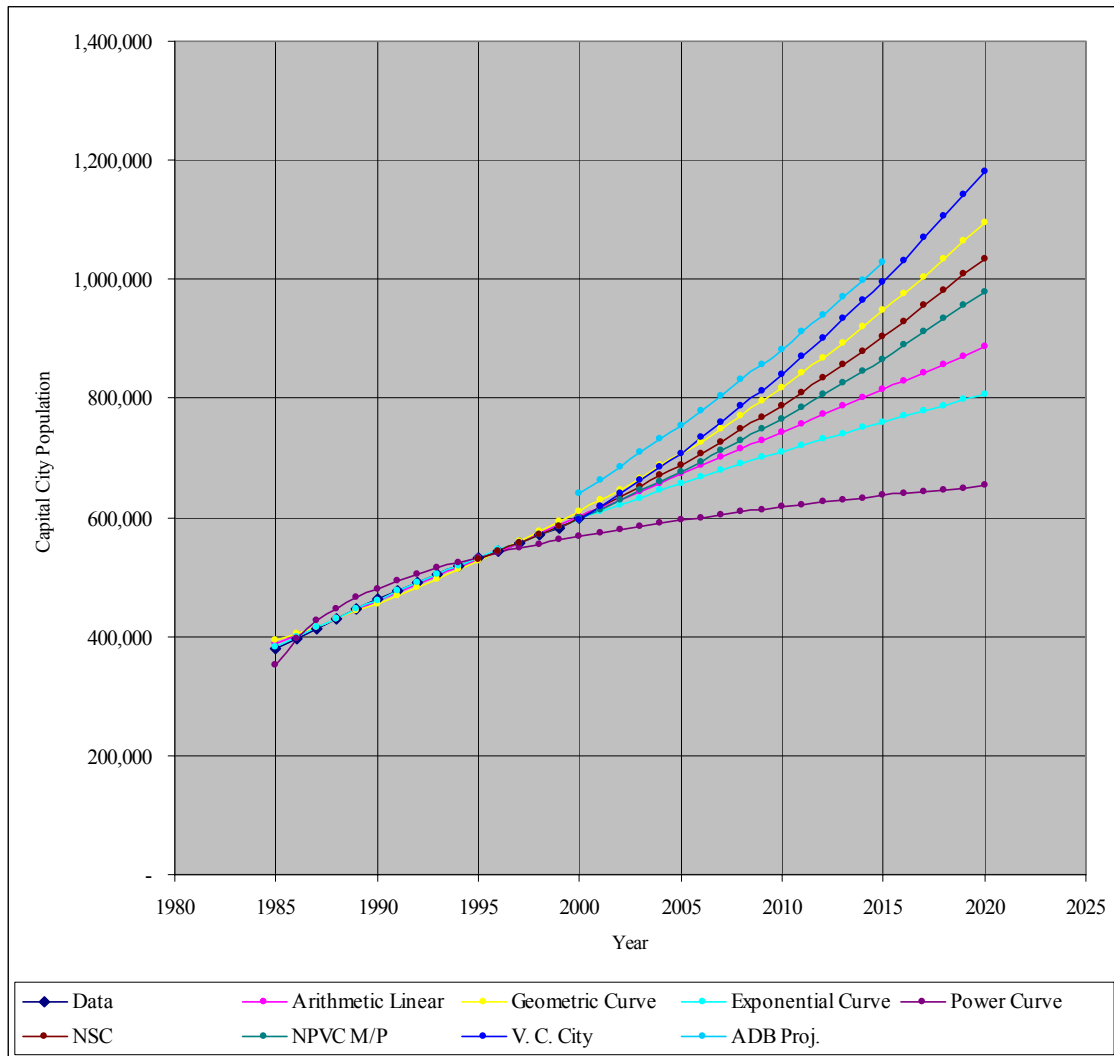

From the above comparison of population forecasts, it is considered that the most reasonable forecast will be higher than the NPVC master plan, and lower than the Geometric Curve calculation. The study team decided that the forecast by the NSC is the most probable future population growth rate pattern. Table 42-4 and Figure 42-4 show the future capital city population which is the basis of the master plan.

Table 42-4   Future Population of Vientiane Capital City

Year	Population	Inrease Ratio
2000	599,000	
2005	687,000	2.8%
2010	788,000	2.8%
2015	903,000	2.8%
2020	1,035,000	2.8%

Figure 42-4   Future Population of Vientiane Capital City
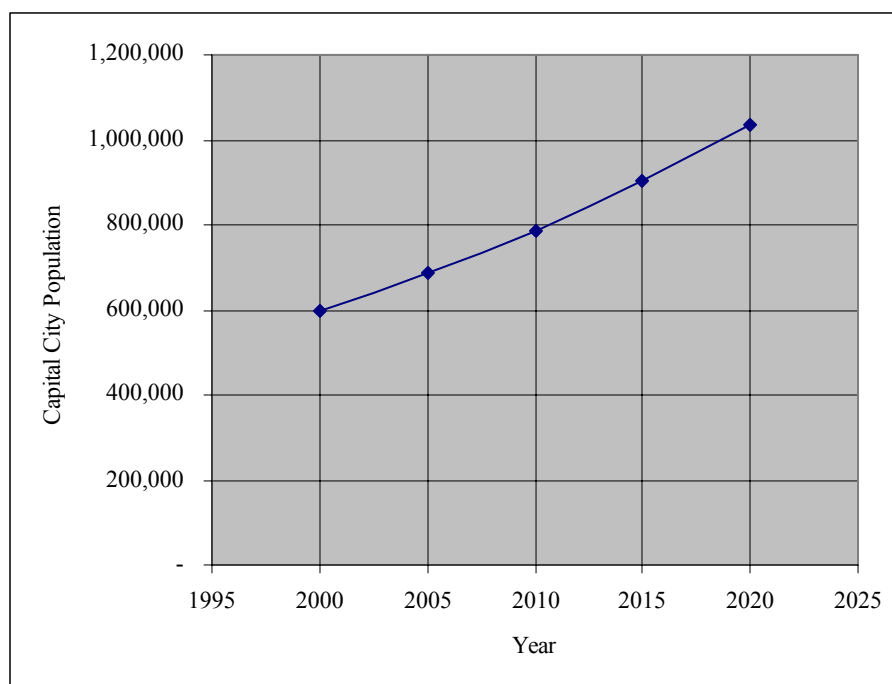
4.2.2   District Population in Vientiane Capital City

Table 42-5 shows the district population in Vientiane Capital City in 1995 and 2000. As shown on the table below, population growth rate of respective districts varies from 0.92 %, to 5.47 %, the highest.   In the central part of the capital city, districts such as Sisattanak, Chanthabouli, Sikhottabong Districts show a low population growth rate. On the other hand, fringe districts such as Naxaithong, Xaythany, Sangthong and Mayparkngum districts show higher population growthrates and it is noted that development activities are taking place in these districts, a possible cause of the higher growth rate.

Table 42-5   District Population in 1995 and 2000

|		1995	2000		
	District Name	Population	Population*	Increase Ratio	
01	Chanthabouli	58,855	64,508	1.85%	Low
02	Sikhottabong	74,251	81,360	1.85%	Low
03	Saysettha	75,255	83,413	2.08%	Middle
04	Sisattanak	58,178	60,894	0.92%	Low
05	Naxaithong	44,104	52,240	3.44%	High
06	Xaythany	97,829	119,740	4.12%	High
07	Hadxaifong	64,962	74,089	2.66%	Middle
08	Sangthong	16,728	21,829	5.47%	High
09	Mayparkngum	33,945	40,927	3.81%	High
	Total	524,107	599,000	2.71%	

Note: Population in 2000 was calculated by a summation of the village population provided by the NSC in each village and adjusted to conform to the total population which is shown in Table 42-4.

Based on the population growth rate from 1995 to 2000 which is shown in the table above and the future capital city population, shown in Table 42-4, the future projected population of each district up to 2020 is estimated as shown in Table 42-6 and Figure 42-5.

Table 42-6   Future District Population

		2000	2005	2010	2015	2020
	District Name	Population	Population	Population	Population	Population
01	Chanthabuli	64,508	70,703	77,493	84,936	93,094
02	Sikhottabong	81,360	89,149	97,684	107,037	117,284
03	Saysettha	83,413	95,345	108,984	124,574	142,394
04	Sisattanak	60,894	63,737	66,713	69,828	73,088
05	Naxaithong	52,240	61,876	73,290	86,809	102,822
06	Xaythany	119,740	145,682	175,547	209,504	248,825
07	Hadxaifong	74,089	84,687	96,801	110,648	126,476
08	Sangthong	21,829	26,559	32,158	38,378	45,802
09	Mayparkngum	40,927	49,345	59,494	71,002	84,737
	Total	599,000	687,084	788,165	902,716	1,034,521

Figure 42-5   Future District Population
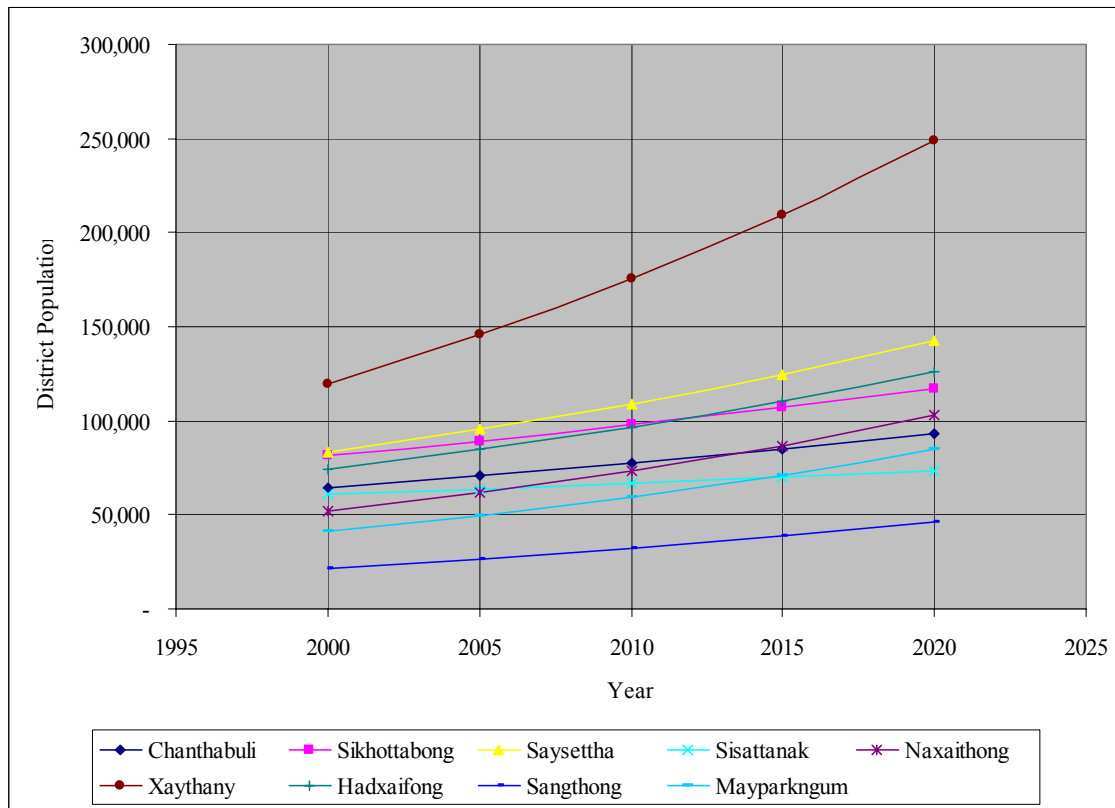
4.2.3   Village Population in Vientiane Capital City

Population growth trends from 1995 to 2000 were examined for respective villages based on the data provided from the NSC. It was found that villages in the central part of the capital city along the Mekong River show a rather low increase ratio, and peripheral villages around the central part show a higher population increasing ratio. The population growth rate by respective villages is shown on Figure 24-4 in the previous Chapter 2.

Based on the results of the examination of the population growth rate at the village level,the population growth rate for the respective villages is estimated and the future population of each village was calculated based on that rate. Results of the village population forecast are shown in Annex 13.

4.3   Future Service Area

Expansion of the service area is planned in three stages, based on the priority of water needs as shown below.

1st Stage :   2004 to 2007

The areas where pipeline installation work commenced in 2003, and will be completed in 2004, financed by the AFD.

2nd Stage :   2008 to 2012

The areas nearby existing service areas, areas where industrial development has been planned, and areas in Thangone and Thadeua.

3rd Stage: Year 2012

Remote and rural areas.

Implementation of the "Expansion of Distribution Network" commenced in the beginning of 2003, financed by the AFD. Areas which are included in the service area and a part of the pipeline installation by the AFD project, should be given the highest priority to supply water, since increasing water production to supply water in the expanded service area by the AFD project has not been planned.

The Thangone area will be covered under the 2nd Stage of the service area expansion. Thangone area is one of the Satellite Town Zones defined by the VUDMP for 2nd priority development, therefore, the study team considered, after consultation with the NPVC, that the area expanded by the AFD pipeline installation should have a higher priority than plans for the Thangone area.

Figure 43-1 shows the service area expansion in each stage together with the pipeline alignment of the AFD Project.