5.2 Construction and Implementation Plan

5.2.1 Project Cost

The construction cost is estimated based on the design criteria and results of preliminary design. The costs include procurement cost for materials and cost of construction works. Procedures of the estimation are explained below.

Civil and architecture:

The cost for civil and architectural components was calculated using the volume of works for each facility and unit cost. Unit costs for each case normally expressed per m^3 and per m^2.

Pipeline

The total length of the pipeline was estimated based on the general arrangement in drawings of the preliminary design. The unit cost of pipe was determined considering the past experience of ODA project.

Pump and motor

The cost of pumps and motors was adopted considering the lowest price in estimates carried out by the Japanese companies.

Treatment plant

This cost includes mechanical, electrical and civil works of the treatment plant in the past record of ODA project. The civil cost is estimated based on tank volume and unit cost. The cost of mechanical and electrical components is calculated by reducing cost of civil works from total cost.

Table 5.2.1 Project Cost Summary

Currency :US$

System	(A) Construction Cost	(B) Engineering Cost	(C) Cost to be borne by Vietnam	(D) Base Cost	(E) Contingency	(F) VAT	(G) Project Cost
FPS2	1,398,000	139,800	153,800	1,691,600	169,200	153,800	2,014,600
FPS3	874,800	87,500	96,300	1,058,600	105,900	96,200	1,260,700
FPG4	3,119,700	312,000	343,100	3,774,800	377,500	343,200	4,495,500
FPS5	670,200	67,000	73,700	810,900	81,100	73,700	965,700
Sub total	6,062,700	606,300	666,900	7,335,900	733,700	666,900	8,736,500
FKS6	799,000	79,900	87,800	966,700	96,700	87,900	1,151,300
FKS8	1,380,600	138,100	151,900	1,670,600	167,000	151,900	1,989,500
Sub total	2,179,600	218,000	239,700	2,637,300	263,700	239,800	3,140,800
FNG10	7,449,100	744,900	819,400	9,013,400	901,300	819,400	10,734,100
Sub total	7,449,100	744,900	819,400	9,013,400	901,300	819,400	10,734,100
FBS11	1,363,500	136,400	150,000	1,649,900	165,000	150,000	1,964,900
FBG13	8,854,800	885,500	974,100	10,714,400	1,071,400	974,000	12,759,800
Sub total	10,218,300	1,021,900	1,124,100	12,364,300	1,236,400	1,124,000	14,724,700
Total (US$)	25,909,700	2,591,100	2,850,100	31,350,900	3,135,100	2,850,100	37,336,100
Total (VND)	436,630	43,665	48,030	528,325	52,833	48,030	629,188

(Exchange rate: 1US$:VND16, 852: JY 106.17 (July 2008)

5.2.2 O&M Cost

O&M cost by water supply system is estimated, which includes costs of personnel, chemical, electrical, repair and others. As a result, O&M cost per unit water consumption is estimated to be 2,307 VND/m^3 in average. The calculation result is presented in Table 5.2.2.

Table 5.2.2 Tentative Cost Estimation of O&M for Water Supply System

	[A] Annual Production (m3/year)	[B] Annual Consumption (m3/year)	Operation and Maintenance Cost (x1000 VND/year) [C] Staff	[D] Chemical	[E] Electrical	[F] Repair	[G] Others	[H] Total	[I] O&M cost per unit water consumption (VND/m3)
FPS-2	183,000	165,000	129,600 37.4%	54,168 15.6%	65,880 19.0%	65,109 18.8%	31,476 9.1%	346,233 100.0%	2,098
FPS-3	364,000	328,000	108,000 45.3%	2,184 0.9%	66,976 28.1%	39,657 16.6%	21,682 9.1%	238,499 100.0%	727
FPG-4	332,000	299,000	129,600 13.2%	97,940 10.0%	517,256 52.6%	149,940 15.2%	89,474 9.1%	984,210 100.0%	3,292
FPS-5	238,000	214,000	108,000 50.5%	1,428 0.7%	60,452 28.3%	24,501 11.5%	19,438 9.1%	213,819 100.0%	999
FKS-6	173,000	156,000	129,600 46.5%	1,038 0.4%	67,470 24.2%	55,275 19.8%	25,338 9.1%	278,721 100.0%	1,787
FKS-8	192,000	173,000	129,600 32.1%	40,896 10.1%	128,640 31.9%	67,566 16.8%	36,670 9.1%	403,372 100.0%	2,332
FNG-10	784,000	706,000	302,400 12.8%	230,496 9.7%	1,278,704 53.9%	343,194 14.5%	215,479 9.1%	2,370,273 100.0%	3,357
FBS-11	203,000	183,000	129,600 34.1%	60,088 15.8%	98,049 25.8%	57,756 15.2%	34,549 9.1%	380,042 100.0%	2,077
FBG-13	1,361,000	1,225,000	561,600 20.5%	400,134 14.6%	1,109,215 40.5%	420,765 15.4%	249,171 9.1%	2,740,885 100.0%	2,237
Total	3,830,000	3,449,000	1,728,000 21.7%	888,372 11.2%	3,392,642 42.6%	1,223,763 15.4%	723,277 9.1%	7,956,054 100.0%	2,307

Remarks:
[A]= [Maximum Daily Production] / 1.2(Maximum daily factor) x 365 days
[B]= [A] x 90% (Loss: 10%)
[C]= [Personnel expense]
[D]= [A] x [Chemical cost]
[E]= [A] x [Electric power cost]
[F]= [Construction cost] x 0.3%
[G]= ([C]+[D]+[E]+[F]) x 10%
[H]= [C]+[D]+[E]+[F]+[G]
[I]= [H] / [B]

5.2.3 Implementation Plan

(1) Priority Order for the Construction Schedule

In order to arrange the progress of construction work in the project schedule, the priority of 9 systems is set based on the results of selection of Priority project described in Chapter 3.5 of Master Plan. The priority order is separated by every province in order to have uniformity in development of project effectiveness. The priority order is shown in Table 5.2.3.

Table 5.2.3 Priority Order

Province	System	Score	Ranking	Main water source
Phu yen	FPS-5	42	1	Groundwater
	FPS-3	41	2	Groundwater
	FPG-4	48	3	Surface water
	FPS-2	47	4	Surface water
Khan Hoa	FKS-6	32	1	Groundwater
	FKS-8	45	2	Groundwater
Ninh Thuan	FNG-10	40	1	Surface water
Binh Thuan	FBG-13	47	1	Surface water
	FBS-11	46	2	Surface water

3 systems, FPS-3, -5 and FKS-6, using groundwater sources are scored top ranking in addition to the system using surface water sources. System FKS-8 has also been places as top priority.

(2) Project Implementation Schedule

The implementation schedule is split up into 3 stages extending through 6 years and these stages are named as financial preparation, detailed design and construction stage. Under each stage, following works are included.

1) Stage A: Financial Preparation

This stage includes activities of justification of the project, approval of the project by the Government, the technical supplementary surveys, financial arrangement and preparation of the project site such as land acquisition, approval of water source.

2) Stage B: Detailed Design

The stage shall include preparation of tender documents,

3) Stage C: Construction

The following main activities shall be undertaken in this Stage of Project.

- Tendering and tenderer negotiation.
- Finalize contract
- Temporary works
- Construction and supervision
- Capacity development
- Test run and hand over

The implementation schedule of the project is shown in Figure 5.2.1.

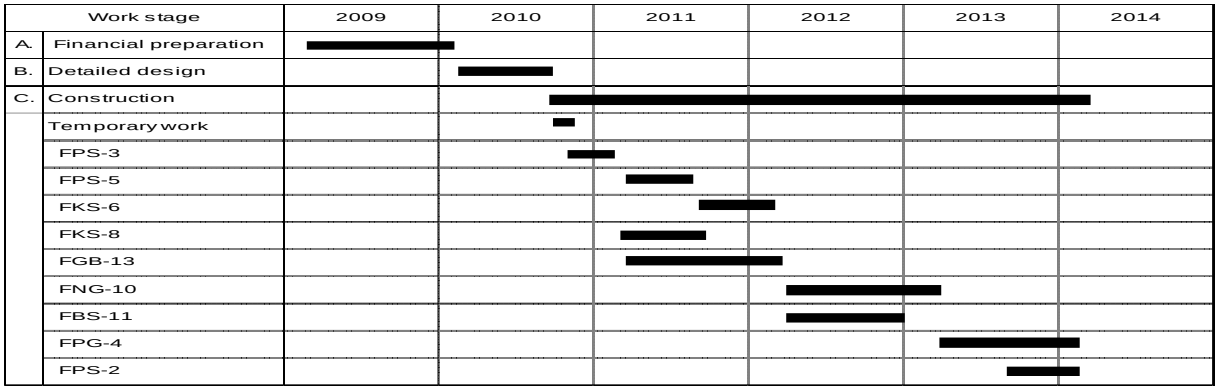

Figure 5.2.1 Project Schedule

(3) Disbursement Schedule

Based on the project schedule, the cost excluding price escalation will be disbursed in the manner presented in Table 5.2.4.

Table 5.2.4 Disbursement Schedule

Unit: x$1000

Stage		2009	2010	2011	2012	2013	2014	Total
A.	Financial preparation	2,850						2,850
B.	Detailed design		330					330
C.	Construction							
	Supervisor (engineering fee)		61	600	600	600	400	2,261
	Temporary works		1595					1,595
	System FPS-3		1,023					1,023
	System FPS-5			784				784
	System FKS-6			594	340			934
	System FKS-8			1,615				1,615
	System FBG-13			10,355				10,355
	System FNG-10				8,711			8,711
	System FBS-11				1,595			1,595
	System FPG-4					3,388	260	3,648
	System FPS-2					1,501	134	1,635
Total cost in 1000US$		2,850	3,009	13,948	11,246	5,489	794	37,336
(Million Vietnam Dong)		48,029	50,708	235,052	189,515	92,500	13,384	629,188

(Exchange rate: 1US$:VND16, 852: JY 106.17 (July 2008)

5.3 Evaluation of Priority Project

5.3.1 Financial and Economic Analysis

(1) Financial Analysis

The financial analysis of the project was in the targeted nine systems carried out by means of the financial internal rate of return (FIRR) and net present value (NPV) methods under the designated assumption.

(2) FIRR

The FIRR of total project is -11.4%, and other results of the calculation for the nine project sites are as follows;

Table 5.3.1 Result of FIRR

	FIRR
Total	**-11.4%**
(By P-CERWASS)	
FPS-2	**-8.6%**
FPS-3	**1.8%**
FPG-4	**-15.0%**
FPS-5	**-0.1%**
FKS-6	**-8.7%**
FKS-8	**-15.1%**
FNG-10	**-14.5%**
FBS-11	**-14.5%**
FBG-13	**-18.3%**

Furthermore, sensitivity analysis was also conducted to check the two cases (double and treble of the proposed water charge) of water charges

Table 5.3.2 Sensitivity Analysis

Uni Price (US$/M^3)		FIRR
0.153 to 0.225	(Proposed Tariff)	-11.40%
0.306 to 0.450	(Proposed Tariff) x 2	-3.2
0.459 to 0.675	(Proposed Trriff) x 3	0.6%

(3) NPV

The NPV is US$ -34 million at the discount rate of 2.5%, which is taken as the interest rate of the standard IDA terms.

(4) Study on water charges

According to the above financial analysis of the Project, the increase in water charges is imperative in order to improve financial condition of the Project. The following Table 5.3.3 explains the comparison of the proposed water charges, Willingness to Pay (WTP), Affordability to Pay (ATP) and water charges including depreciation cost by P-CERWASSs. For reference, the aforementioned

proposed water charges are calculated in accordance with the tentative cost estimation of O&M in each water supply facility, by adding 15% mark-up of the cost, and is also taken into consideration of the price level of the WTP and existing water charges.

Table 5.3.3 Comparison of the Proposed Water Charges and the Indicies

(Unit : US$/m³)

	Phu Yen		Khan Hoa		Ninh Thuan		Binh Thuan	
Proposed Water Charges	**0.225**	**(100%)**	**0.159**	**(100%)**	**0.229**	**(100%)**	**0.153**	**(100%)**
1) Willingness to Pay*	0.179	80%	0.197	124%	0.214	93%	0.184	120%
2) Affordable to Pay**	0.546	242%	0.684	430%	0.571	249%	0.908	593%
3) W.Charges inc. depreciation***	0.528	235%	0.468	294%	0.742	324%	0.487	319%

(Remarks: For the detailed information, refer to the "Supporting Report".)

The WTP is observed by socio-economic survey and is proximate to the proposed water charges in each P-CERWASS. Meanwhile, in case when ATP is calculated by 5% of monthly expenditure, the ATP shows much affordability and possibility to increase water charges in the near future (eg. 242% to 593% of the proposed water charges). Finally, for the further reference, water charges including the estimated depreciation on facilities are calculated on the basis of designated condition in the Supporting Report. As the comparison table concludes that the water charges including the depreciation cost in the four P-CERWASSs except Ninh Thuan could be covered by the price level of the ATP.

(5) Economic Analysis

The economic benefits shall be measured qualitatively. The proposed project is expected to create those benefits;

(a) Resource cost saving and improving by the project
- A shift away from use of alternative water resources, which are thought to be expensive, such as water from private venders, private boreholes, and other commercial water products
- Fairness of water access
- Cost saving by eliminating or reducing the need for private water supply facilities and including installation of storage tanks, pipes and pumping system, and electricity expenses
- Cost saving through lowering of health care or medical expenses for water borne diseases which are caused by low water quality
- Enhancement of social status of women who are supposed to take on fetching water
- Decrease of the child mortality and morbidity rate which are stemmed from low water quality

(b) New demand generated by the project
- Increase of water tariff collection rates
- Increase of money collected as water tariffs
- Increase of new connections to the water supply

Other indirect benefits, such as poverty reduction and environmental improvement, can also be expected from the project.

(6) Conclusion

In conclusion of the financial and economic analysis in the Study, although financial analysis indicates that the Project would be financially infeasible, O&M costs can be coved by the expecting net income from water charges if initial investment (construction) cost are raised from any fund sources. Moreover, according to the result of socio-economic survey conducted by the Study Team, the ATP in the targeted four Provinces is much higher than the proposed water charges which mainly refer to the WTP.

In addition to the financial analysis, economic analysis ascertains that the Project can contribute to the social and economic development for the entire society in the targeted four Provinces, and the significance of the Project can fit to the concept of Basic Human Needs (BHN) and poverty reduction.

5.3.2 Organizations and O&M

To deal with the organizational issues, establishment of the proposed structure in Figure 3.4.3, and well-organized CD as the Study Team recommended in the section 3.4.6 should be smoothly carried out. Especially in Phu Yen and Khan Hoa Provinces, there is no modern water supply facility in the projected areas, and the two P-CERWASSs, naturally, lack of sufficient experience and know-how of the management of modern water facilities. Thus, O & M department shall be established in the organization at the beginning, and then technical capacity of employees shall also be upgraded within the framework of the CD. In this regard, technical assistance, such as the dispatch of engineer and acceptance of trainees, for Phu Yen and Khan Hoa P-CERWASS is provided by Binh Thuan and Ninh Thuan respectively, both of who have already owned the modern water supply facilities and have had broad experience of management of the facilities. Also, IEC activities toward water users shall concurrently be carried out in order to increase water charge collection ratio. In addition, N-CERWASS being in a position to instruct P-CERWASSs also needs more experienced staffs that can monitor all rural water supply services throughout the country.

With regard to the financial issue, uniform management of a number of facilities could be one of the effective measures to redress the profitable balance between the red-ridden and the surplus facilities. Needless to say, it is also important for the facilities in the red to reconsider the water charges. According to the Socio-economic survey conducted by the Study Team, the current water tariffs can be cheap in consideration of income level of water users. As shown in the previous clause, if the water tariffs are raised up to the ATP level, O&M of the facilities, including depreciation, can be feasible.

5.3.3 Environmental and Social Considerations

From the results of the Initial Environmental Examination, some adverse impacts in the following environmental and social items are expected. However, these adverse impacts are minor. If mitigation

measures including proposed measures in this IEE are undertaken properly, these adverse impacts will be minimized and mitigated.

Table 5.3.4 Adverse Impacts and Mitigation Measures

Environmental and Social Items	Possible Adverse Impacts	Mitigation Measures
Local economy (Water vender)	The adverse impact to commercial activities of water venders may be expected by establishment of water supply system.	To mitigate adverse impact on these vendors, their employment as seasonal or part-time staff by the water service corporation and turn to full time farming and household practices by agricultural promotion are proposed.
Land acquisition for project sites	Some proposed sites are located in private agricultural lands, and disappearance of productive agricultural land is envisaged.	It is expected that proper and sufficient compensation including grant of alternative agricultural land is carried out based on the Vietnamese Law and Regulation.
Disruption of normal traffic in the construction stage of distribution network	During construction stage of distribution line, occupancy of roads by construction activities shall affect traffic situation. The occurrence of traffic accident is also expected.	These adverse impacts are short-term impacts, and these can be reduced by appropriate construction site management including announcement and appropriate traffic control.
Noise and vibration in the construction stage of water treatment plants and other facilities	During construction works in the project, some noise and vibration will be generated by heavy equipments for construction.	The following measures are proposed. • Announcement and public notification • Construction activities should be strictly prohibited at night. • Use of low-noise construction machinery • If required, a sound isolation wall is installed. • Arrangement of information desk and a person responsible
Influence of groundwater	From the results of the test borehole drilling survey, selected water supply projects were selected in consideration of groundwater quality and productivity of groundwater. Therefore, adverse impacts such as draw down, seawater intrusion, land subsidence and so on, seem to be negligible.	From a viewpoint of groundwater preservation, monitoring of groundwater quality and groundwater level is recommended.
Accidents (due to war residual substance and water contamination by accident)	During construction and operation stage of the water supply project, some accidents by the war residual substance and hazardous substance outflow are expected.	As countermeasures, a clearance of war residual substances is required to avoid any accidents due to war residual substances. For the water contamination accident, water quality monitoring, establishment of an urgent communication network and preparation of the operations manual for emergency situation are proposed.

CHAPTER 6 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The purpose of this Study is in harmony with the objective of NRWSSS and the Study is expected to generate synergistic effect by keeping pace with NTP project. As a result of FS as a short term program, the water supply system is planned for 15 communes in 4 provinces. It is expected that implementation of this project shall have positive impact on living conditions and poverty reduction of 144,000 persons in the Study area.

In the Study, the ground water potential of many target areas has been confirmed to be lacking through the investigation data of the test well and this is attributed to complicated hydro-geological structure. The water supply system for only 3 communes is considered to use groundwater as prime water source. The source for 1commune is applied to combine groundwater and surface water. The water intake for remaining communes has been planned considering use of alternative sources of water.

The environment impacts caused by water source development and facilities construction are minor due to small size facility and the impact will be minimized and mitigated through proposed countermeasures.

The project should be financed by Grant Aid or through subsidy from the Government to cover initial high investment cost mainly for construction works. If the initial investment cost could be secured, it is expected that net income can cover the O & M cost.

Necessity of further efforts to increase sanitation coverage is identified. Needs of environmental measures are also focused, including prevention of groundwater pollution from septic tank effluent and administration for septic tank sludge disposal. Approaches toward sustainable improvement of environmental sanitation are recommended, such as establishment of provincial taskforce, enhancing IEC, dissemination of new design of septic tank toilet, enhancing financial support and environmental administration.

6.2 Recommendation

As well-known, both aspects: natural and social conditions should be considered to make rural water supply plan. However, groundwater resources potential evaluation as the most important item of the natural conditions has not been studied adequately or unpublicized in Vietnam. It should be leveraged for the planning prior to selection of candidate areas or communes for rural water supply plan.

As a study result of the alternative water source, the wide area water supply system shall be investigated and designed including surrounding communes that lack appropriate water supply system and increased future demand from technical and economical aspect.

As for Phu Yen and Khan Hoa P-CERWASSs, it is recommended to promote drastic restructuring of the organization so as to increase the operational efficiency. In addition, with regard to the financial issue, uniform management of a number of facilities could be one of the effective measures to redress the profitable balance between the red-ridden and the surplus facilities.

Result of the FIRR for overall project is -11.4%, which can be concluded that the project is financially infeasible under the designated condition in the Report. The proposed project should, therefore, be financed by grant funds to cover initial investment cost mainly for construction work. If only the initial investment cost could be secured, net income can cover the O&M costs.

The current water charges are not high enough to cover all the operational expenses including depreciation and future investment. Water charges should be increased in order to allow P-CERWASSs to generate higher fund reserve. In addition to the tariff increase, subsidies from the central and local governments and other fund sources such as international aid organizations are expected to improve the financial condition of each P-CERWASS.

In order to implement the approaches presented in the Study, foreign assistance schemes are recommended since rural sanitation contains cross-sectoral issues and institutional framework is still weak. For example; grass-roots assistance to follow up the Model Sanitation Program under the Study, technical cooperation for capacity development on environmental administration in rural area, and sludge treatment plant project by CDM are recommended.

Further technical examination on septic tank sludge treatment is recommended. As a case study, preliminary design and cost estimation on septic tank sludge treatment is carried out as ANNEX 2, which includes examination on environmental effects through the sludge treatment.