

SOCIALIST REPUBLIC OF VIETNAM
DONG THAP PROVINCE PEOPLE'S COMMITTEE

**CONSTRUCTION OF WATER SUPPLY SYSTEM PROJECT IN
THUONG THOI TIEN TOWN – HONG NGU DISTRICT – DONG
THAP PROVINCE**

FEASIBILITY STUDY REPORT

Dong Thap September 2012

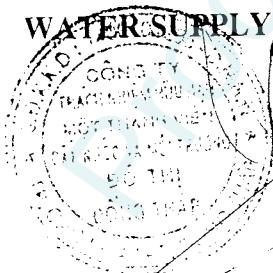
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FEASIBILITY STUDY REPORT

Project owner

**DONG THAP URBAN ENVIRONMENT AND
WATER SUPPLY ONE MEMBER CO.LTD**



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Prepared by

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AND ENVIRONMENT., JSC.**



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I. PROJECT SUMMARY

1. PROJECT DESCRIPTION, PROPOSED AGENCY, PROJECT IMPLEMENTATION AGENCY AND OPERATING AGENCY.

1.1 Project description.

1.1.1 Project objectives.

- ✓ Construct comprehensive water supply system to ensure the water demand for Thuong Thoi Tien Commune, Hong Ngu District.
- ✓ Improve living quality of the residents in the project area
- ✓ Minimize water –born diseases.
- ✓ Enhance the position and role of the project area, Hong Ngu District in particular and Dong Thap Province in general.
- ✓ Promote economic development and attract investment.

1.1.2 Summary on project technical proposals.

Table 1: Summary on technical proposals for water supply system.

Item	Technical solutions (according to selected option)
Location	Thuong Thoi Tien Commune.
Water supply diagram	Tien river surface water → raw water pipeline → treatment plant → Distribution and service pipeline network.
Water supply capacity	3000 m ³ /day
Water intake works – raw water pumping station	Allocate pump float under Tien river.
Raw water pipeline	Allocate iron raw water pipeline - DN250 and HDPE-DN250, 135m length.
Treatment plant	Building water pumping station 3000m ³ /day, with technological line included: Raw water → Mixer → Reaction tank → Lamella sedimentation → Gravity filter → Reservoir → Water Pumping station.
Transmission, distribution and service pipeline network	Use PVC-PN8 as distribution pipeline: DN250-L=2.739m DN200-L=8.149m D160-L=3.417m Pipe HDPE-D110-L=12.360m, PN8 Use HDPE-PN8 as service pipeline: D63-L=47.576m
Household connection	The project will settle for household connection for 2240 households (provision 80% of existing households)

1.2 Project responsible agencies

- 1- Project: Water Supply System in Thuong Thoi Tien Commune, Hong Ngu District, Dong Thap Province.
- 2- Executing agency: Dong Thap Provincial People's Committee.
 - a) Address:
 - b) Telephone: Fax: c) Email:
- 3- Project Owner: Dong Thap One-Member Environment and Water Supply Co.,Ltd.
 - a) Address: No. 1, Ton Duc Thang street, Ward 1, Cao Lanh City, Dong Thap Province
 - b) Telephone: 067 - 3 853 332
 - c) Fax: 067 - 3 852 825
- 4- Project implementation agency: Dong Thap Urban Environment and Water Supply One Member Co.,Ltd.
 - a) Address: No. 1, Ton Duc Thang street, Ward 1, Cao Lanh City, Dong Thap Province
 - b) Telephone: 067 - 3 853 332
 - c) Fax: 067 - 3 852 825
- 5- Operating agency: Dong Thap One Member Environment and Water Supply Co.,Ltd.
 - a) Address: No. 1, Ton Duc Thang street, Ward 1, Cao Lanh City, Dong Thap Province
 - b) Telephone: 067 - 3 853 332
 - c) Fax: 067 - 3 852 825

2. PROJECT IMPLEMENTATION PLAN.

- Prepare the construction investment project and preliminary design: 09/2011
- Drawing design, total cost estimate and construction bidding document: 12/2012.
- Procurement, approval, select building contractor: 04/2013
- Construction duration: from 05/2013 - to 11/2014.

3. PROJECT SITE

The project is implemented at Thuong Thoi Tien Commune, Hong Ngu District, Dong Thap Province.

4. PROJECT FUNDING

4.1 Total investment:

Total investment of the project:

VND 40.071.421.000, equivalent to **EURO 1.541.209** (1EURO = VND26.000)

4.2 Project funding:

The Project is implemented through the Italian commodity aid programme and counterpart fund (of Ministry of Finance – MoF and Dong Thap Provincial People's Committee). In which:

- Italian commodity aid programme: **VND 12,030,179,000**
Equivalent to: **EURO 462,699**
Percentage: **30.02%**
- Counterpart fund: **VND 28,041,244,000**
Equivalent to: **EURO 1,078,509**
Percentage: **69.98%**

4.3 Financial mechanism:

Italian commodity aid programme: Government allocates fund for the Government as the budget fund.

Counterpart fund of MoF and Dong Thap Provincial People's Committee: Project owner is funded under the budget law.

5. PROJECT BENEFIT

5.1 Financial benefit

- ✓ Water tariff for domestic demand: VND4,800/1 m³
- ✓ Water tariff for administration and public demand: VND5,760/1 m³
- ✓ Water tariff for small-scale production and handicraft demand: VND7,200/1 m³
- ✓ Water tariff for business, service and restaurant demand: VND8,640/1 m³
- ✓ Average water tariff: VND5,472 /1 m³
- ✓ The specific analysis result is:

NPV:	19,697	(Million VND)
FIRR:	10.21%	

5.2 Economic benefit

ENPV	12,695
Economic benefit cost ratio (EBCR)	1.16
EIRR:	13.30%

5.3 Social benefit

The proposed project will certainly bring about significant socio-economic benefits for Thuong Thoi Tien Commune, Hong Ngu District as well as Hong Ngu District, Dong Thap Province as a whole. The project contributes to improve living standard of people in the project area and attract investors and tourists to Hong Ngu also.

II. PROJECT CONTEXT AND RATIONALE

1. GENERAL INTRODUCTION

1.1 Overview

Clean water and rural sanitation has been one of the leading national targets in Vietnam. In 1998, the national target program of Vietnam on water and rural sanitation has been established and implemented. So far, the program has brought significant effects. The number of people accessing to clean water and safe sanitation facilities has increased significantly.

Hong Ngu is the Northern border District of Dong Thap Province, total natural area of the District is 209,74 km², (6,2%) of natural area in the Province, the average population growth rate in 2009 is 150.050, population density 695 people/km²; the East borders Tan Hong District, the West borders Tan Chau District – An Giang Province, the South borders Tam Nong District, the North borders Preyveng Province – Cambodia with 18km length.

So far, Thuong Thoi Tien Commune is the commune-level town, to be the administrative, socio-economic and cultural center of Hong Ngu District which facilitate the socio-economic development.

In regards to the implementation of Decision No. 47/2002/NQ.HĐND of Dong Thap Provincial People's Council in the phase 2002-2010 and until 2020.

Accordingly, Hong Ngu District will focus on the construction and development of Thuong Thoi Tien Commune as Urban grade V until 2020, it is necessary to build the technical infrastructure for improving living condition of people and facilitate the socio-economic development in local gradually. One of the key technical infrastructures is to build a water treatment plant which satisfy the demand on water of the Commune in the development phases.

Based on Decision No. 2376/ TTg - QHQT of Prime Minister on approved items of projects funded by Italian, at which Dong Thap Provincial People's Committee has assigned consultant to prepare project: Water supply system in Thuong Thoi Tien Commune – Hong Ngu District – Dong Thap Province, with working capacity 3.000 m³/day until 2015.

1.2 Project introduction

Project: Water supply system in Thuong Thoi Tien Commune – Hong Ngu District – Dong Thap Province.

Project owner: Dong Thap Urban Environment and Water Supply One Member Co.,Ltd.

Consultant: Branch of Vietnam Construction and Environment., JSC (Vicen).

Project location: Thuong Thoi Tien Commune, Hong Ngu District. Dong Thap Province.

Proposed date of commencement and completion: Commencement date : 09/2012. Completion date : 11/2014.

2. PROJECT RATIONALE.

2.1 Macro-environment and development policy of local country.

2.1.1 Macro-environment

Global financial and economic crisis and recession have led to a dramatical turmoil in markets, exchange rate, investment and trade. Climate change is making weather more uncomfortable and unfavorable for agriculture. Natural disasters occur at a higher frequency, more powerful destruction, crop failures, agricultural cultivation cost increased. Diseases (such as influenza A/H1N1) also adversely affected to the economic growth on a global scale (tourism and airway passengers reduced).

Those changes have impacted on the economy of Vietnam, exposed more clearly the weaknesses in quality and the imbalance of the economy which is continuing to integrate into the global economy. Trying to achieve high growth in such unpredictable conditions requires more intense efforts, the relationship of cost-effectiveness was not as expected and risks are greater also.

Summation of the economic situation in 2009, the Government has submitted to the National Assembly the respected achievements: 5.2% GDP growth which is above average level but this is the lowest level since a decade. Inflation is maintained at least than two digits. Hunger elimination and poverty reduction has fallen to 11% which is faster than the commitment to implement the Millennium Development Goals (MDG) due to being calculated following the old poverty line. International community also praises Vietnam's achievements in maintaining equality in income through the GINI index and the impressive poverty reduction in rural areas according to the official report of the Government.

2.1.2 Development policy.

Socio-economic development must be associated with the sustainable development and completion of the infrastructure system and environmental protection. Investment capital is focused on construction of basic infrastructure such as electricity, road, school, etc. especially drainage, water supply and sanitation facilities.

2.2 Conditions and basis of the project

2.2.1 Natural conditions

The project is implemented in Thuong Thoi Tien Commune, Hong Ngu District, Dong Thap Province.

a) Geology condition.

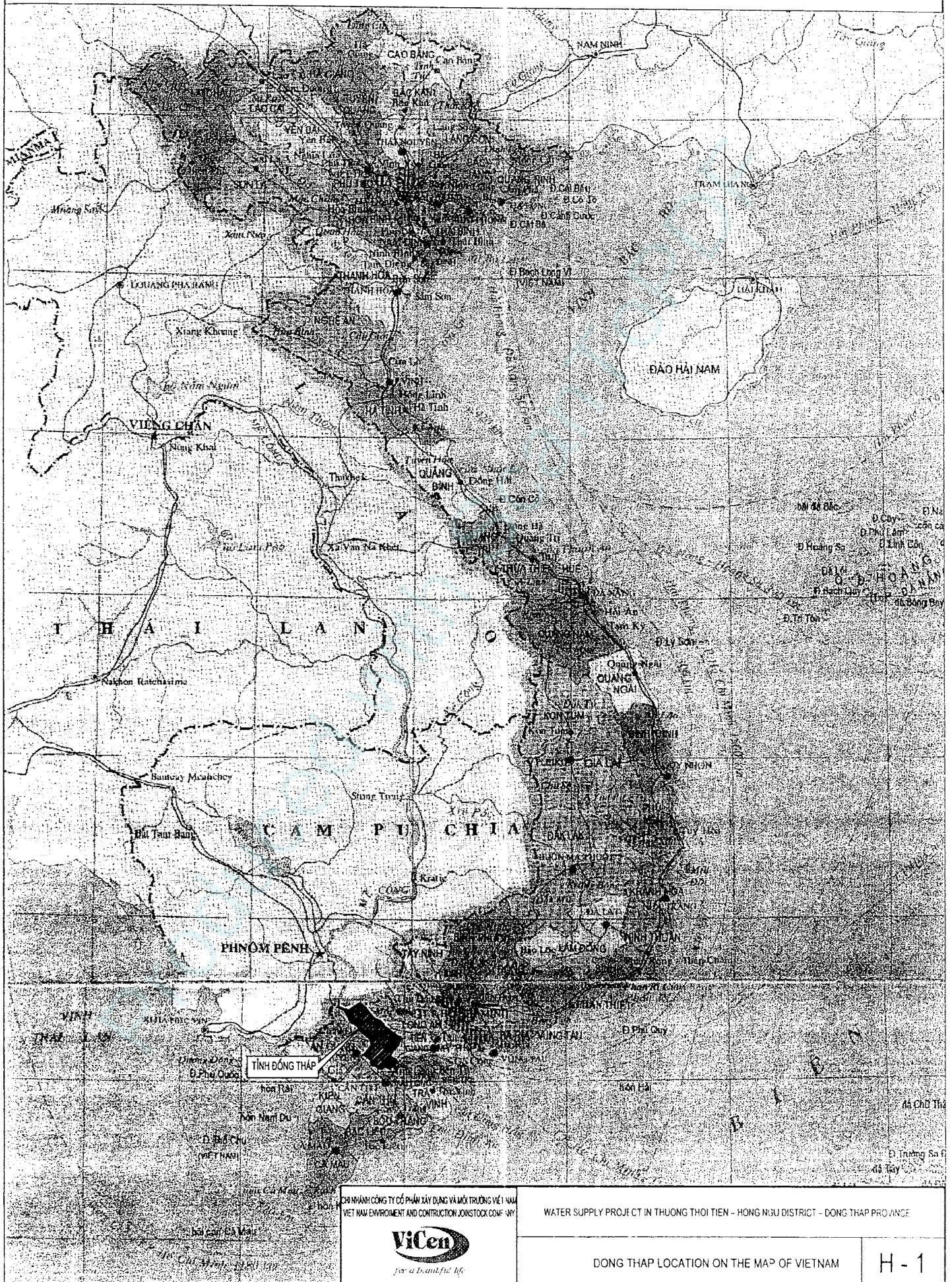
Dong Thap locates in the Mekong Delta Region, one of three provinces of Dong Thap Muoi.

- The North borders Cambodian,
- The South borders Vinh Long and Can Tho,
- The West borders An Giang,
- The East borders Long An and Tien Giang.

Figure-1: Dong Thap location on the map of Vietnam

Hong Ngu District is the border District of Dong Thap Province. The East borders Hong Ngu Commune, the West borders Tan Chau, An Giang Province, the South borders

DONG THAP LOCATION ON THE MAP OF VIETNAM



CHÍNH SÁCH CÔNG TY CỔ PHẦN XÂY DỰNG VÀ MÔI TRƯỜNG VIỆT NAM
VIET NAM ENVIRONMENT AND CONSTRUCTION JOINT STOCK COMPANY



WATER SUPPLY PROJECT IN THUONG THOI TIEN - HONG NINH DISTRICT - DONG THAP PROVINCE

DONG THAP LOCATION ON THE MAP OF VIETNAM

H - 1

Tam Nong Commune, the North border Preyveng Province – Cambodia. There are 01 Town and 15 Communes with 332 km² and 226.607 people (Dong Thap statistical yearbook in 2008).

Figure-2: Hong Ngu location on the map of Vietnam

Thuong Thoi Tien Commune – Hong Ngu District -- Dong Thap Province. The planning area is about 153 ha with the following limits:

- The East and Northeast border Thuong Thoi Hau A Commune, the residential area locates along Provincial route.
- The West and Northwest border Thuong Phuoc I Commune.
- The South borders Tien river
- The North borders land field

b) Topographical condition:

Topographical structure of Thuong Thoi Tien Town in particular and Hong Ngu Commune feature the same characteristic of Dong Thap Province and Mekong Delta Region, such the Pliocene include: alluvium, Haloxen ...

The soil is formed due to the alluvial sedimentation processes of Tien river 2 - 7m depth, majorly sandy soil, sand-heavy soil and low content of soil which will be flushed away and oligotrophic.

The soil is formed by the lake sedimentation, distributed along newly formed alluvium river, occupied almost area of the Town.

c) Climate condition

Locates in the tropical monsoon climate with the same climate characteristics of Mekong Delta Region. Be classified into two distinct seasons annually of which : rainy season is from May to November and dry season is from December to April. The last months of rainy season caused widespread flooding due to high rainfall and upstream flooding.

- Annual average temperature 27.2 °C
- Absolute high temperature 38.6 °C
- Absolute low temperature 16.2 °C
- Annual average humidity 83%
- Annual average rainfall 1,218 mm/year.

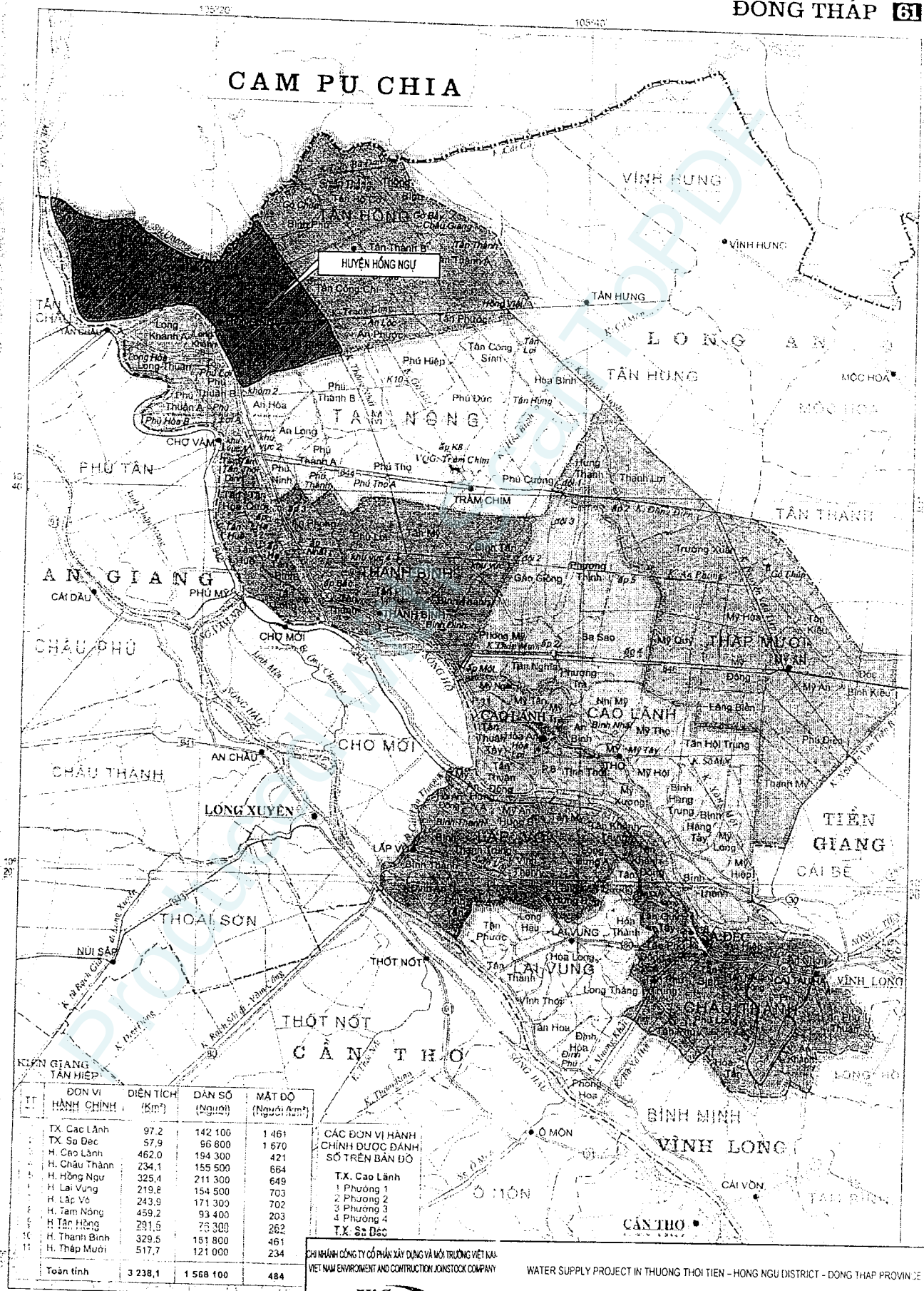
d) Hydrological condition

Hydrology is dominated by three main factors : rainfall regime in place, flow regime of Tien river and sea tidal of South Sea.

Water in the river, canal and ditch is strongly affected by semi-diurnal tides of the South Sea, ranging from 2.5 to 3.5m which possibly facilitated to irrigating in the whole area of the District through the natural canal and ditch system. However, the flooding period is started in October of which the average flooding in canal and ditch is 2.5 - 3.5m higher than rice field level in regards to the flooding in 2000.

e) Hydrogeological condition

Based on the hydrogeological document in the region which major water sources are specified as follows:



- Surface water: Ponds, lakes, rivers, stream, stormwater.
- Underground water : existed in cavity, rock crack Karst holes.
- Dynamics of groundwater has not been adequately studied yet.

2.2.2 Socio-economic condition

a) Existing economic condition

- According to the census, almost people in the region mainly living by farming, aquatic cultivation, handicraft production, business and trading at Thuong Thoi Tien market and some other employees.

- Socio-economic condition of people is low.

- The slow economic development not commensurate with the available potential. due to the infrastructure system has not been properly invested and shortage.

b) Social condition.

○ Population:

- Total population in 2009 is 14223 people.

- Population growth rate:

2001: 1,38%

2002: 1,14%

2003: 1,13%

2004: 1,12%

2005: 1,10%

2006: 1,08%

2007: 1,05%

2008: 1,04%

2009: 1,01%

○ Culture - Society:

Education and training activities: District People's Committee has focused on the implementation of education objectives and assignment, training to raise the quality; renovate the teaching methodologies, assessment and improve the education quality, fostering teachers and education management officers; strengthen the investment in infrastructure and teaching facilities.

The organization of examination: be closely and thoroughly implemented under schedule, safety scheme and strictly assessing the nature of education. The results of the 2008-2009 school year have showed that: 98,84% primary school completion rate, 99,7% middle school completion rate; 96,65% intermediate school, 44,42% high school completion rate compared with 70% plan. The deployment of the new school year 2009-2010 is well prepared.

The work of medical care, population, family and children: continues to implement in accordance with key programs of local and national such as invest in infrastructure, additional manpower, provide with equipments, medicine and other insurance conditions

to facilitate the medical treatment; the National Health-Care Building Thuong Thoi Tien has completed and put into operation, the Health-Care Buildings at Thuong Thoi Tien Commune are being carrying out such as: Thuong Phuoc 1, 2; Thuong Thoi Hau A; Phu Thuan B. The preventive health-care is strengthened and there is no serious epidemic generated; the implementation of contraceptive is effectively, natural population growth rate reduced by 1,02%, exceeded the targeted plan, at which in total of 150.050 people the percentage of children under 5-year old malnourished as 18,5% has met the targeted plan.

Poverty alleviation: take care of family under preferential treatment and social assistance is well performed, create job for 4.546 peoples with 101% of the plan year; percentage of trained employees reach 31,31%, exceeded the targeted plan; completed the construction of 144 houses for the poor under the Decision No. 167/2008/QĐ-TTg of Prime Minister; percentage of households connects with power grid and accessed to water supply has exceeded the targeted plan.

2009 end-year review, there were 3.024 poor people (8,29%) in the commune (526 households increased (1,31%) in compared to the adjusted rate 2%), 4.796 nearly-poor (13,15%). The poor increased due to increase the poverty household in accordance with Decision 167, review the existing condition to suitable with new criteria and development condition of a border commune after separated.

Cultural activity, communication and gymnastics: focus on building cultural family, cultural unit; accelerate movement “people consolidate to build cultural life”; there were 96,62% households registered cultural family, 82,61% of households qualified as cultural family (83%) in 2009; building 02 communes: Long Thuan and Long Khanh B qualified as cultural commune. The State management in the field of culture-information has been strengthened to against foreign cultural products contradicts traditional beautiful habit and custom of Vietnam.

2.3 Market, Supply-Demand Analysis

2.3.1 Market

For the water supply project in general, the market is understood as its actual meaning that the exchange of goods and trading services happens to serve customers. For this project, the market is clean water supply system for users.

- (i) Water supply for domestic use: This is the main market of this project. The domestic water rate is 85% of the total sales of the project, this is a potential market benefiting for the sellers. The consumers using water for domestic use are households which account a high rate and be the main beneficiaries paid attentioned by the project. Water consumed for drinking, washing and other demands. Water supply service has been completely invested, from the source works to the treatment works, the distribution and service pipeline network, and especially the household connection points. Therefore, when the project completed, water is a potential market for water supply companies. The development of this market does not stop at the connection and supply in the early stages, but it continues to be developed and expanded the coverage as well as the serving rate in the following period. Therefore, the local people fully support to build a clean water supply system and they are willing to pay the costs for using clean water services. In financial terms,

this is clearly a market of great demand and fully potential for development so management agencies can upgrade and expand water supply services to serve the benefits of the local people

- (ii) Water supply for public demand: In addition to the main demand of water supply from local people, some other consumers such as administrative agencies, public offices, schools, also need clean water to serve their demand. This market is not large but the price of water is higher than the price of domestic water. So this is a potential market that sellers should exploit.
- (iii) Water supply for commerce and services: Consumers of this market are restaurants, car washing station, and this is also a market with great potential to exploit due to a big amount of served water. On the other hand, the water price for these consumers is greater than that of domestic water so it is really a potential market to exploit and expand services. As well as domestic water consumers, services and commerce have a strong desire to access to clean water supply services to meet their current demand.
- (iv) Water supply for small production and handicraft: The small production units will be the main consumer in this market. This is a rural water supply project, so amount of water supplied to customers is not much. However, in economic-financial aspects, this is also a potential market.

2.3.2 Demand-supply analysis

Once the market has been identified, factors of demand and supply will appear as the market consists of demand and supply.

Supply:

Supply here is the clean water supply system for consumption points in the project area. This project is prepared to ensure a supply for the market of great potential. Supply requirements are identified and guaranteed through the water treatment works, works conveying water to the consumption point in the project area. To identify the supply, it is necessary to determine the demand of the market; this will be presented in detail in following chapters of this report. However, one important thing is that this project serves the demand in the above market, so the demand is understood to be very large and full of potential. After studying the market demand, supply is guaranteed through the construction works such as intake structure, treatment plants, pipeline network, ... Of course, as the supply has been determined, services to bring the Supply to the demand is concerned which is the quality of services, the quality of the works on water supply system, the quality of the services to serve people having supply to sell in the market.

For this project, a clean water supply system will be built to meet the market demand. Clean water is produced to ensure the need of local people in the period from now to year 2020 and expand for Phase 2 to year 2030. A water supply system with capacity of 3000 m³ will be built to serve the local people in the project area. In order to develop the supply after completing the system, a service and distribution water supply pipeline network, especially household connection points will be built to ensure the supply to be brought to the demand. Besides, quality of services in the operation phase is a decisive factor to the development of supply in the clean water supply market.

Demand:

Studying and evaluating the market demand is very important. As analyzed in Section 1.3.1 above, water demand in the project area is very big because at the moment, the project area has no water supply system. There is a desire to a clean water supply service in the project area to improve the quality of life. The demand in this market is diverse, including domestic water demand, public and institution demand, small production and services .. All these subjects have a great demand and are willing to pay for the services provided. Thus it can be said that the market demand for a clean water supply service is huge and has a great potential.

Thus, it can be seen that the demand of water supply in the project area is very big. Most households have desire of a better clean water service, improving lives. Thus, the overall assessment of the demand in the project area is the important basis for the project Owner to build and meet the demand.

Once factors of demand and supply are determined, one of the most important issues of this project is to determine the correlation as well as the calculation of supply to meet demand. One of the most important criteria to determine the Supply is surveying of supply and forecasts as the demand increased. Through studies and surveys in the project area, this project will ensure the accuracy, efficiency and reserves for the future to ensure that the supply is determined accurately.

2.4 Legal basis

- Construction Law No.16/2003/QH11 dated 26/11/2003.
- Tendering Law No.61/2005/QH11 dated 29/11/2005 of the National Assembly of Socialist Republic of Viet Nam on Tendering;
- Law on modification and supplement to some articles relating to basic construction investment No. 38/2009/QH12 dated 19/06/2009 of Viet Nam National Assembly;
- Decree No. 85/2009/NĐ-CP dated 15/10/2009 of the Government on guiding the execution of tendering law and selecting contractors in accordance with Construction Law;
- Decree No. 209/2004/NĐ-CP dated 16/12/2004 of the Government on management of quality of construction works;
- Decree No.49/2008/NĐ-CP dated 18/04/2008 of the Government on modification and supplement to some articles of Decree No. 209/2004/NĐ-CP;
- Circular No.27/2009/TT-BXD dated 31/07/2009 of the Ministry of Construction on guiding the execution of some contents of management of quality of construction works.
- Decree No.12/2009/NĐ-CP dated 10/02/2009 of the Government on management of construction investment project;
- Decree No.83/2009/NĐ-CP dated 15/10/2009 of the Government on modification and supplement to some articles of Decree No.12/2009/NĐ-CP dated 12/02/2009 of the Government on management of construction investment project;
- Decree No.112/2009/NĐ-CP dated 14/12/2009 of the Government on management of construction investment cost;

- Decision No.957/QĐ-BXD dated 29/09/2009 of the Ministry of Construction on announcement of cost norm for project management and construction consultancy;
- Decree No.117/2007/NĐ-CP dated 11/07/2007 of the Government on producing, supplying and consuming clean water
- Joint Circular No.95/2009/TTLT-BTC-BXD-BNN dated 19/05/2009 of the Ministry of Finance, Ministry of Construction and Ministry of Agriculture and Rural Development on guiding principles and determination method, decision authority to the clean water tariff in urban areas, industrial and rural area;
- Viet Nam construction code, volume 1 and volume 3, issued according to Decision No. 682/BXD-CSXD dated 14/12/1996 of the Ministry of Construction;
- VN standard TCXDVN – 33:2006, Water supply, pipeline network and works – design standard.
- Code QCVN 08:2008/BTNMT – National engineering code about surface water quality.
- Code QCVN 01:2009/BYT – National engineering code about drinking water.
- Other documents provided by the Project Owner.

3. PROJECT OBJECTIVES

3.1 Long-term objectives

- Improve quality of life for residents in the project area
- Minimize water-born diseases
- Enhance the position and role of the project area, Hong Ngu District in particular and Dong Thap province in general.
- Promote economic development, attract and call for investment capital.

3.2 Specific objectives:

- Construct a comprehensive water supply system to meet water demand of Vinh Long and Thuong Thoi Tien Commune, Hong Ngu District.
- Ensure a sufficient clean water supply for residents in Thuong Thoi Tien Commune as well as other small industrial zones in the area.

4. SUITABILITY WITH MASTER PLANNING IN THE COUNTRY AND EACH REGION.

4.1 Suitability with master planning in the country.

In 1998, the national target program of Viet Nam about clean water has been established and carried out showing a clear efficiency. Number of people can access to clean water and safe sanitation condition has been increased significantly.

In 2000, Millenium development goals (MDG) was signed by members of the United Nations including Viet nam in which the target No.7 states that until year 2015, a half of population will be accessed to the safe water source.

To implement commitments with the international community, Viet Nam is actively carrying out and putting forward Viet Nam Development Goals to specify the

overall targets on hunger elimination and poverty reduction, improve clean water supply and sanitation, specifically:

- + In year 2010, reduce 40% of the poverty rate under international poverty line.
- + In year 2005, rate of population in the urban area accessing to clean water is 60% and this will increase to 85% until year 2010.
- + In year 2010, wastewater in most towns, small towns and urban areas will be treated.
- + Water and air pollution level must meet national standard of year 2005.

It can be said that, this project is completely in line with policies as well as national orientations on clean water and rural sanitation.

4.2 Suitability with the regional planning.

At the moment, Thuong Thoi Tien is the newly established Town which the planning of water supply and drainage industry has not performed yet. However, the master planning of Thuong Thoi Tien Town specified that, a water supply system used of surface water from Tien river (from 2000 to 4000 m³/day) is going to be constructed.

The proposed project is completely suitable with features and scale of water supply system in accordance with the construction planning of the Town.

5. OTHER RELATED PROJECTS.

Up to now, there is no other related project be constructed at Thuong Thoi Tien Town. It will be regarded as the largest and unique water supply project in the Town if approved.

6. NEED FOR INVESTMENT

6.1 Existing condition of the project area.

6.1.1 Overview

Surveying, collecting data and assessing the current status of technical infrastructure system in general, the status of water supply system in particular to understand the actual situation as well as the burning issues of water demand in the project area and in the whole Hong Ngu District. Effectiveness and feasibility of the project is guaranteed by the status of the project area.

Consultant has carefully surveyed the current status of water supply system in Thuong Thoi Tien Commune in the project area, learnt and gathered useful information from residents living in project areas, from local government and from the agencies involved. The results presented below provide an overview and a basis for proposing, designing water supply system for Thuong Thoi Tien Commune, Hong Ngu District, Dong Thap Province.

6.1.2 Existing condition of water supply

There is no water supply system be constructed in Thuong Thoi Tien Town. People in the Town are majorly used of river water, well water, raining water for drinking

and domestic water demand. The survey shown that the use of unhygienic and untreated water caused variety of water-born diseases such as: diarrhea, sore eyes, etc

Water supply has long been a concern of local government. However, due to the local is poor with limited capital funded for construction which the water supply has not been constructed yet.

For such reason, the construction of a water supply system to facilitate water demand and raising the health of people is an urgent and needed issue.

6.1.3 Drainage and sanitation

Drainage system of Thuong Thoi Tien Commune in the project area has not been completed yet. The drainage is quite natural, not proper, not planned. Rainwater and wastewater self-flow along alleys, lanes then into ponds, lakes or canals. So this has caused a serious environmental pollution.

6.1.4 Existing condition of transport

The inter-transport regional network just have one inter-regional road.

There are several large canals apart from Tien river such as: central canal, Dong Hua canal, Ut Goc canal, etc. Which facilitate the transport of boats. Furthermore, other canals are also be water transportation routes.

The irrigation network with variety of canals and ditches spreading in the whole commune which facilitate irrigation in agricultural production.

There is the provincial highway 841 in Thuong Thoi Tien Commune, 13855m length, the road is stone structure with two bridges (canal bridge Ut Goc and Dong Hua, Central canal bridge).

It is going to expand the provincial highway 841 (direct to the administration site) link with functional areas in the region together with adjacent external roads to facilitate the transportation among functional areas in the region favourably and safety.

Develope and construct new roads in the planning site.

6.1.5 Existing condition of power supply

The power is supplied from the national grid, transmitted from the substation near Hong Ngu Town to Thuong Thoi Tien, along provincial highway 841.

6.1.6 Existing condition of communication

The communication network is gradually developed, positive contributed to the operation of communication, advocate policies, strategies and guidances of the Government.

6.2 Need for investment

At the moment, Thuong Thoi Tien is the new Town, poor infrastructure of which water is one of urgent and needed demand of resident in the Town. The use of untreated water caused a lot of water-born diseases affected to living condition of resident. Water

supply system is not only the expectation of local government but also resident in the Town. Otherwise, one of the top priorities in technical infrastructure construction is to invest in water supply system construction. It is the depth investment, meaningful in social aspect, directly promote the economic development of Thuong Thoi Tien Town. However, it is due to the economic potential is limited and budget is unable to satisfy with the construction investment of water supply system.

The construction of water supply will contribute to the development of socio-economic, gradually improved and increased the life of resident, create favourable condition for the development in Hong Ngu Commune (Thuong Thoi Tien Town) to become urban grade V.

For all reasons mentioned above, an investment for construction of water supply system for Thuong Thoi Tien Commune, Hong Ngu District, Dong Thap Province in regards to non-refundable budget of Italian Government is very necessary.

III. TECHNICAL PROPOSAL

I. WATER SOURCE.

1.1 Overview

The water supply system of Thuong Thoi Tien Town, Hong Ngu District, Dong Thap province is going to be built to ensure regulated hygiene standards. To which, water sources study is one of required issue and be regarded as the top priority of the project. Different water sources is studied and compared by consultant as follows.

1.2 Underground water

Underground water consisted of iron and impurities.

In accordance to the information provided by local, underground water is unstable and bad quality. To use as raw water supply for the project, it should survey water volume and underground water quality in the project area.

1.3 Surface water

Hong Ngu is the place where Mekong river started to flow into Vietnam and divide into two river branches such are Tien and Hau river and Thuong Thoi Tien Town locates close to headwater of Tien river.

Water volume in Tien river is large and good quality. It is the headwater which will not be contaminated and saline intrusion.

The Hydrological regime of Tien river in the project area is as follows:

- Max water flow $Q_{Max} = 41.504 \text{ m}^3/\text{s}$
- Min water flow $Q_{Min} = 2.000 \text{ m}^3/\text{s}$
- Max water level $H_{Max} = 6,03\text{m}$
- Min water level $H_{Min} = -1,19\text{m}$

There is a natural ditch system used to supply water and drainage for rice field such as Ut Goc canal, Hoa Dong canal, Trung Tam canal and other canals. However, such are small ditches and canals and used for agriculture only.

Analysis of Tien river quality

No.	Norms		Unit	Output	QCVN 08:2008/BTNMT
1	pH			6,51	6,5 - 8,5
2	Temperature		°C	-	
3	Conduction		mS	-	
4	Salinity		mg/l	-	
5	Colour		Pt/Co	5	
6	Suspended sediment content	C_{max}	mg/l		
		C_{tb}	mg/l	98	30
		C_{min}	mg/l		
7	Oxidation KMnO_4		mg/l - O_2	1,2	

8	Turbidity	NTU	32	
9	Total hardness	mgdl/l	94	
10	Full alkalinity	mgdl/l	89,2	
11	Ca ²⁺	mg/l	-	
12	Mg ²⁺	mg/l	-	
13	Total Fe	mg/l	0,44	1
14	Total Mn	mg/l	0,02	
15	NH ₄ ⁺	mg/l	0,23	0,2
16	SiO ₃ ²⁻	mg/l	-	
17	HCO ₃ ⁻	mg/l	-	
18	Cl ⁻	mg/l	9,25	400
19	SO ₄ ²⁻	mg/l	-	
20	NO ₂ ⁻	mg/l	0,004	0,02
21	NO ₃ ⁻	mg/l	0,7	5
22	F ⁻	mg/l	0,021	1,5
23	Total coliform	MPN/100ml	8	5000

Through information on above mentioned water sources, water supplied for the project by two sources: raw water of Tien river and underground water.

Content	Option 1 (ground water)	Option 2 (surface water)
Description	Deploy underground water	Deploy surface water from Tien river
Option description	- Building drilled well, well pumping station and raw water pipeline to intake water to treatment plant.	- Building the water intake system and raw water pumping station at Tien river, and raw water pipeline to intake to treatment plant.
Advantages		- Water source is stable and abundant even in dry season to ensure raw water supply for the project. - Sustainability and constant development. - Power cost-effectiveness.
Disadvantages	- Ground water should be evaluated exactly at the preparation of the project. Information about volume and quality can not be regarded as the full basis to supply water for Thuong Thoi Tien Town. - Ground water volume and quality is not good.	- Water quality is seasonal changeable, especially in flooding season, with high content of sediment. - The management of water source is complicated and difficult.

Conclusion: the information about surface water is sufficient. Volume is abundant and good quality, potentially used for the project suitable with the sustainable development of the project area, not influence to geology of the area.

Consultant suggested to use surface water of Tien river as water supply for the project.

Potential of surface water is high. The use of surface water as raw water for the plant exposed many advantages compared with ground water. Quality of surface water is good, exploitable and suitable with the development orientation on water supply of the Government.

2. CAPACITY

2.1 Scope of study

The scope of study for the design phase to 2020 (phase 1: 2010-2020, Phase 2: 2020-2030) based on field survey, the natural borders, the planned border, development plans and planning, population characteristics and references from related agencies.

Accordingly, the study boundary of the project is entire Thuong Thoi Tien Town, Hong Ngu District with 153ha, 14.233 people (2009).

2.2 Coverage area

In principle, the covered area will be determined based on: (i) the scope of study, (ii) service level, (iii) the population distribution characteristics (iv) the current status of water supply (v) the financial status of the project.

Accordingly, the water supply service in the first phase will include some residential areas which are too far from the centre and the households were scattered away from the project area. Accordingly, the water supply rate in 2015 was defined to be 70%. Phase 2 (2025) when the system went into operation stably, it will continue to be expanded to supply water for the entire population of the project area with a rate of 90%.

2.3 Population projection

Table 2: Population projection in the project area

No	Area	Population in 2010 (people)	Population growth rate (%)	Population projection in 2015 (people)	Population growth rate (%)	Population projection in 2025 (people)
1	Thuong Thoi Tien Town	14.223	1,05%	14.986	1,0%	16.553
2	Thuong Phuoc border gate economic zone	11.300	1,03%	11.894	1,0%	13.138
3	Total	25.523		26.880		29.692

It is estimated that 70% of population are accessible to water from water supply system. Percentage of people access to water is presented in the following table:

Table 3: Population is expected to be supplied with water

No	Area	2015	2025
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		Percentage of people be supplied with water (%)	No. of people be supplied with water (people)	Percentage of people be supplied with water (%)	No. of people be supplied with water (people)
1	Thuong Thoi Tien Town	70%	10.490	90%	14.898
2	Thuong Phuoc border gate economic zone	70%	8.326	90%	11.825
6	Total		18.816		26.723

2.4 Water demand projection.

2.4.1 Domestic Water Qsh

Standard for water supply for the project area applies TCXDVN 33-2006: Water-supply for outside and works and construction Vietnam regulations Volume 1- water supply planning. Accordingly, the domestic water use standard was determined through 02 the following bases:

- (i) According TCXDVN 33-2006, Standard for Urban Water Supply class V, IV rural residential area per capita is 60-100 l/ day. Experience showed that, in the first years of installation, water demand is low, thus water standards will be different for different stages.
- (ii) According to Vietnam construction standards-water supply planning, the minimum standards of domestic water supply for the rural residential area is 80 l /person/day.

Based on 2 standards above, consultant suggested to choose water consumption standard in the project area in different phase as follows:

+ Phase 1:

2012-2015: 80 litre/per capita/day

+ Phase 2:

2015-2025: 110 litre/per capita/day

2.4.2 Water for other services

According TCXDVN 33-2206, for the water supply system for urban class V, IV and rural residential area, water demand for other services except domestic demand is the 10% -15%.

From the two factors above, to fit the specialized rules and regulations as well as the nature of a rural water supply projects, simultaneously in accordance with the conditions and actual water demand except domestic ones in the project area, the water demand for other services is as follows: (the rate of other services compared with demands for domestic water mets standard TCXDVN 33-2006, has been determined by experience of similar projects).

2.4.2.1 Water for services, commerce

Water for services, commerce is the water for business-service-trading units in project areas and is determined according to %Qsh:

According TCXDVN 33-2006, water supply for this demand is

+ Phase 1:

2012 - 2015: 15%Qsh

+ Phase 2:

2015 - 2025: 15%Qsh

2.4.2.2 Unaccounted for Water (UFW)

According TCXDVN 33-2006, UFW is defined according to the percentage % of daily capacity on average of the WTP (average daily capacity is the capacity of domestic water supply and water supply for other services).

According to the practical data, due to the bad management of the new construction (lack of experience) caused non-revenue water (NRW). When it old, NRW high but good management. Consultant has suggested to remain NRW during the project operation as 20%.

Accordingly, UFW of water supply systems is proposed as follows:

+ Phase 1:

2012 - 2015: 20%(Qsh+Qdv)

+ Phase 2:

2015 - 2025: 20% (Qsh+Qdv)

2.4.2.3 Water for WTP

The water for WTP is the water for cleaning filter tank and other demand in the WTP is determined by % of daily capacity on average: 5%(Qsh+Qdv+Qthh)

2.4.2.4 Service standards and design criteria

Services – water pressure

- Supply sufficient water for households who has demand on water until 2015
- Supply sufficient water necessary for public services, commercial and small production;
- Service duration: ensure to supply water 24 hours.
- Water pressure at the disadvantage consumption points ensure minimum 10 m.
- Connection points are all fixed with water meter in accordance level B.

2.4.3 Total water demand

Based on the criteria for water use, the total water demand is calculated as the following table:

Table 4: Total water demand

No.	Content	Symbol	Unit	2015	2025
I	Population supplied with water				
1	Percentage of water supply	dscn	%	70	90

No.	Content	Symbol	Unit	2015	2025
2	Population supplied with water	ds	people	18816	26723
II	Water supply standard				
1	Water consumption standard of domestic demand	q_{sh}	l/per capita/ day	80	110
2	Water supply standard of service – commercial	q_{dv}	$\%Q_{sh}$	15%	15%
3	UFW, NRW	q_{tth}	$\%(Q_{sh}+Q_{dv})$	20%	20%
4	Percentage of water used by station itself	q_{bt}	$\%(Q_{sh}+Q_{dv}+Q_{tth})$	5%	5%
5	Daily water consumption rate max	$K_{ng,n\ ax}$		1,3	1,3
III	Volume				
1	Domestic water demand (Q_{sh})		m ³ / day	1510.00	2940.00
2	Total domestic water demand	Q_{sh}	m ³ / day	1510,00	2940,00
3	Volume of water supply for commercial and service	Q_{dv}	m ³ / day	226.50	441.00
4	Total average water consumption demand	ΣQ_{dn}	m ³ / day	1736.50	3381.00
5	UFW rate	Q_{tth}	m ³ / day	347.30	676.20
6	Percentage of water used by station itself	Q_{bt}	m ³ / day	104.19	202.86
7	Daily total average water	ΣQ_{tb} ngày	m ³ / day	2187.99	4260.06
8	Daily water consumption rate max	$K_{ng,m\ ax}$	m ³ / day	1,3	1,3
9	Daily capacity max	Q_{max}	m ³ / day	2844	5538
10	Daily capacity max	Q_{max} làm tròn	m ³ / day	3000	6000

2.5 Division of design phase

Phasing of investment will be effective and avoid wasteful investment; The project is divided into two investment stages as follows:

Phase 1: from 2012 to 2015: water supply capacity of the system is 3.000 m³/day.

Phase 2: from 2015 to 2025: water supply capacity of the system is 6.000 m³/day.

Technical and financial options are going to be presented in this report for carrying out works for water supply system of Thuong Thoi Tien Town phase 1 - 3.000 m³/day.

3. TECHNICAL OPTIONS

3.1 Studied issues

The studies include treatment technology options, water supply network option, pipe material options, operation mechanism of water supply system, etc. The selected water source is surface water of Tien river.

3.2 Design parameters and criteria

3.2.1 Classification of construction phase and technical requirements

Table 5: design parameters.

No	Items	Design phase		Technical Requirements
		Year 2015	To 2025	
1	Raw water pumping station – the cover		x	Reinforced concrete
	Raw water pumping station – electric motor	x		Submersible pump placed in the water collection system.
2	Raw water pipeline		x	Steel pipe DN250 and HDPE DN250
3	Treatment plant – the cover	x		The main works are built by reinforced concrete, reserve land for the construction in phase 2
	Treatment plant - electric motor	x		Work 24 hours/day.
4	Water pumping station - the cover		x	One-storey building, brick wall, reinforced concrete frame
	Water pumping station - electric motor	x		Work 24 hours/ day. Valves are operated manually
5	Inside reservoir Treatment plant	x		Precast steel sheet – install
6	transmission and distribution Pipeline	x		Plastic pipe uPVC (D250-D200-DN160 – PN8) and HDPE – D110-PN8
7	Service Pipe. network.	x		Plastic pipe HDPE (D63), PN8
8	Household Connection, including small meters and pipes.	x		The service pipeline and small pipe in front of the meter Water meter level B.

3.3 Technical Options

3.3.1 Construction of raw water intakes and pumping station.

Through the field survey, surface water will be intook from Tien River, 1,500 m far from the administration center of Hong Ngu Commune to the West. This location will facilitate the construction as well as management and operation of construction.

- Locates at the upstream of administration center, without industrial zone upwards which do not suffer from domestic wastewater and industrial wastewater
 - The river is straight, the bank does not collapse and water flow is abundant. Little influenced by waterway means of transport, as well as do not influence to the transportation in this river.
- Advantages on transportation:
 - Waterway: Tien River is the large and important transport route in the region. This location will facilitate the transport of machines, equipments and materials during the construction and operation management.
 - Roadway: small truck can accessed to the location planned to intake water, facilitate the construction and operation management when the work comes into operation.
- Near the power station: there is a medium voltage cable 22KV in this area, facilitate power supply during the construction and operation management.
- Land: there are many gardens, wide, flat and fewer trees. If there is land demand, it will save compensation cost as well as site clearance duration.

3.3.2 Location of treatment plant construction

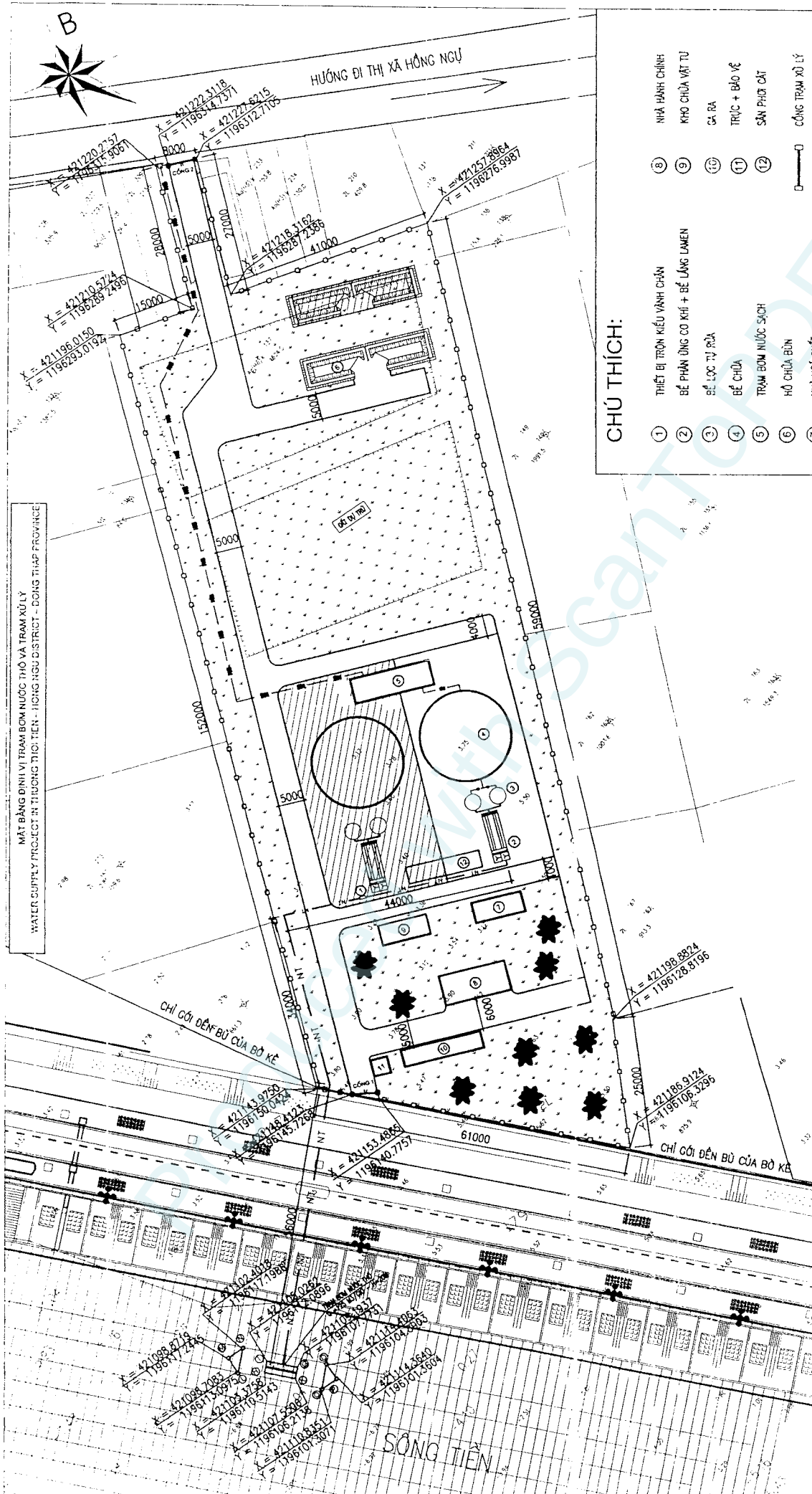
Familiar to the selection of surface water intake location, the construction site of treatment plant is also specified at Tien river side, locates at Thuong Thoi Tien Town, Hong Ngu Commune, Dong Thap Province, 1,500m far from the administration center of Hong Ngu Commune to the West. This location is adjacent to water intake location. Apart from the above mentioned advantages, the construction of treatment plant at this location has proved the following advantages:

- Near raw water source: it will save the construction investment as well as operation management.
- The construction location is located at the agricultural land which saved the compensation and site clearance cost. The construction area is wide and facilitates the construction and capacity boosting for the plant in the future.
- Near the new construction site in accordance to the plan of Communal administration center which need to be supplied with water during the construction phase.

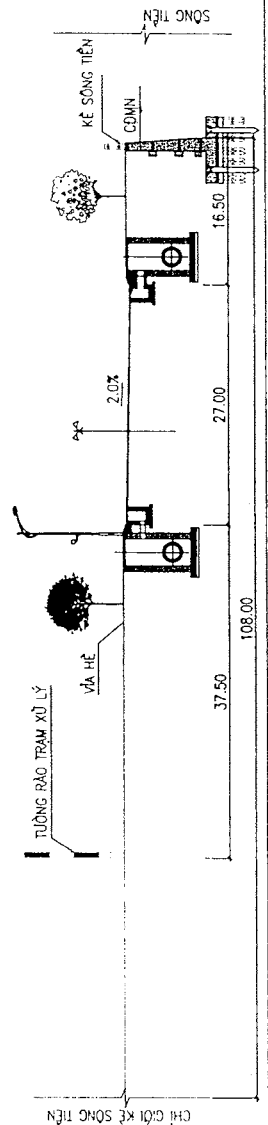
Figure-3: Plan of raw water pumping station and treatment plant location.

3.3.3 Plan on production line.

To carry out water treatment met Vietnamese standard for water consumers in the project area based on raw water quality (Tien river) and capacity as well as the operation



MẶT CẮT NGANG ĐIỂN HÌNH BỜ KÊ SÔNG TIỀN
TYPICAL SECTION



CÔNG TY CỔ PHẦN MỸ DƯƠNG VIỆT NAM
MỸ DƯƠNG VIỆT NAM
WATER SUPPLY PROJECT IN THUONG THOI TIEN - HONG NGU DISTRICT - DONG THAP PROVINCE

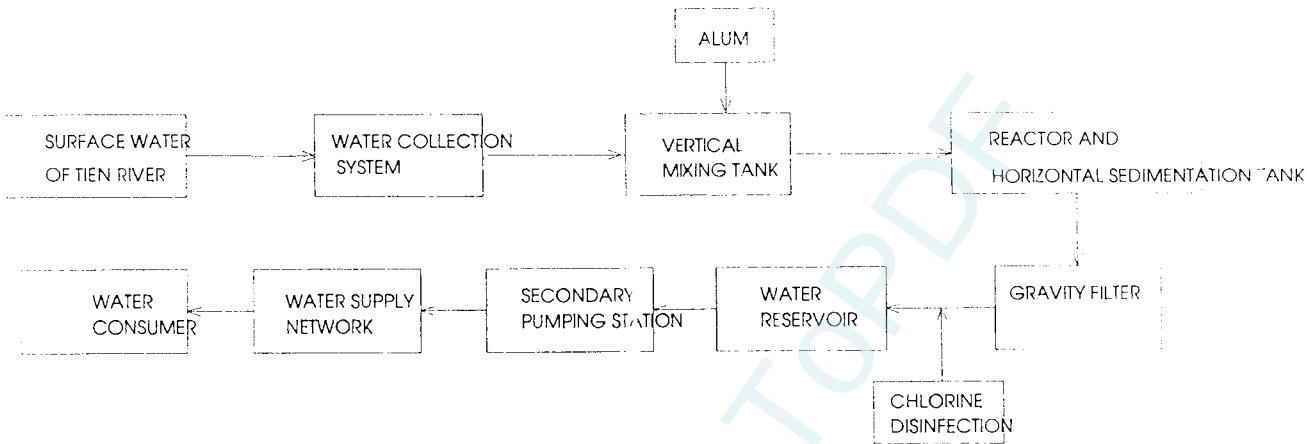


MẶT BẰNG ĐỊNH VỊ TRẠM BƠM NƯỚC THỎ VÀ TRẠM XỬ LÝ
PLAN OF RAW WATER PUMPING STATION AND TREATMENT PLANT LOCATION

H - 3

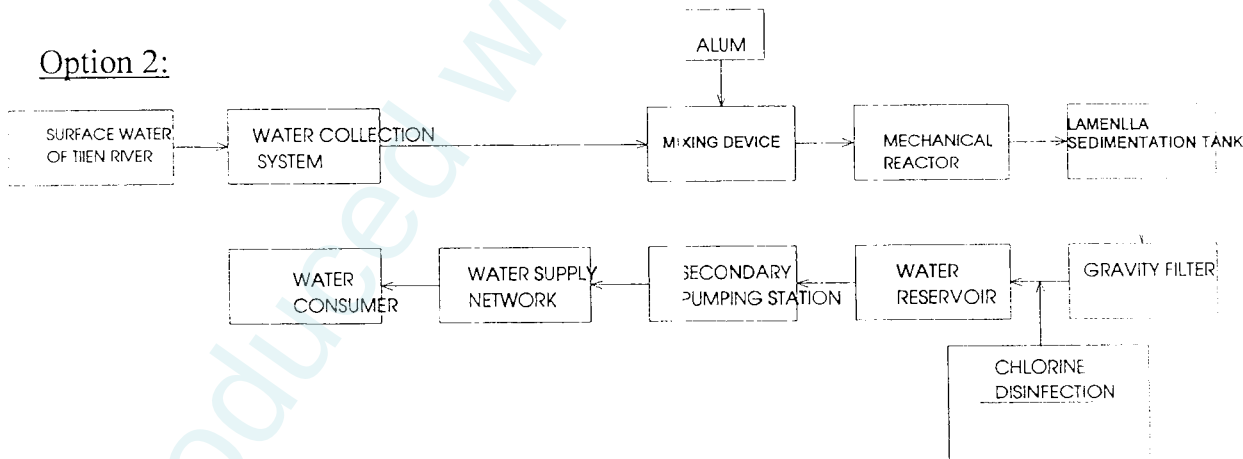
and management skills in local, consultant has proposed some water treatment production line as follows:

Option 1:



Description: surface water of Tien river is pumped into vertical mixing tank in the treatment plant. Before intake raw water to the mixing tank, it will be supplied with alum to create flocculant for water. And it will be intook to the flocculation tank after mixed by machine, of which one part of flocculant is remained and the other is intook through horizontal mixing tank and gravity filter. To which disinfected by Chlorine after intook through water filter. Water in the reservoir will be pumped into the water supply network by secondary pumping station.

Option 2:



Description: surface water of Tien river is pumped into the mechanical reactor through mixing device in the treatment plant. Before intake raw water to the mixing tank, it will be supplied with alum to create flocculant for water. And it will be intook to the reactor after flow through mixing device, of which one part of flocculant is remained and the other is intook through horizontal mixing tank and gravity filter. To which disinfected by Chlorine after intook through water filter. Water in the reservoir will be pumped into the water supply network by secondary pumping station.

The selected option should be suitable treatment technology option, efficient treatment, low operation cost and suitable construction option. The following table presented the production line as well as comparison and selection of consultant:

Table 6: Comparison and selection of water treatment technology

Content	Option (1)	Option (2)
Description	Raw water → Vertical mixing tank → Flocculation tank → Clarifier tank → Gravity filter → Water reservoir → Chlorine disinfection → pumping to the water supply network	Raw water → Mixing device → Mechanical reactor → Lamella sedimentation tank → Gravity filter → Water reservoir → Chlorine disinfection → pumping to the water supply network
Construction items	- Determine the amount of chemical. - Vertical mixing tank. - Flocculation tank. - Clarifier tank. - Gravity filter	- Determine the amount of chemical. - Mixing device. - Mechanical flocculation reactor. - Lamella sedimentation tank - Gravity filter
Advantages	- Simple operation. - Old production line.	- The construction site of sedimentation tank is small. - Performance efficiency. - Lamella technology efficiency - Gravity filters.
Disadvantages	- Large construction site - Initial construction cost is high - Sedimentation efficiency is lower than option 2	- High operation and maintenance cost.

Selected option of water production line: option 2 proved most advantages and being applied in many locals with different water sources and efficiency.

Option 2 is selected: owing to applying production line with mixing device, mechanical reactor, Lamella sedimentation tank and gravity filter.

Figure-4: Diagram of water treatment technology line.

3.3.4 Water pipe material

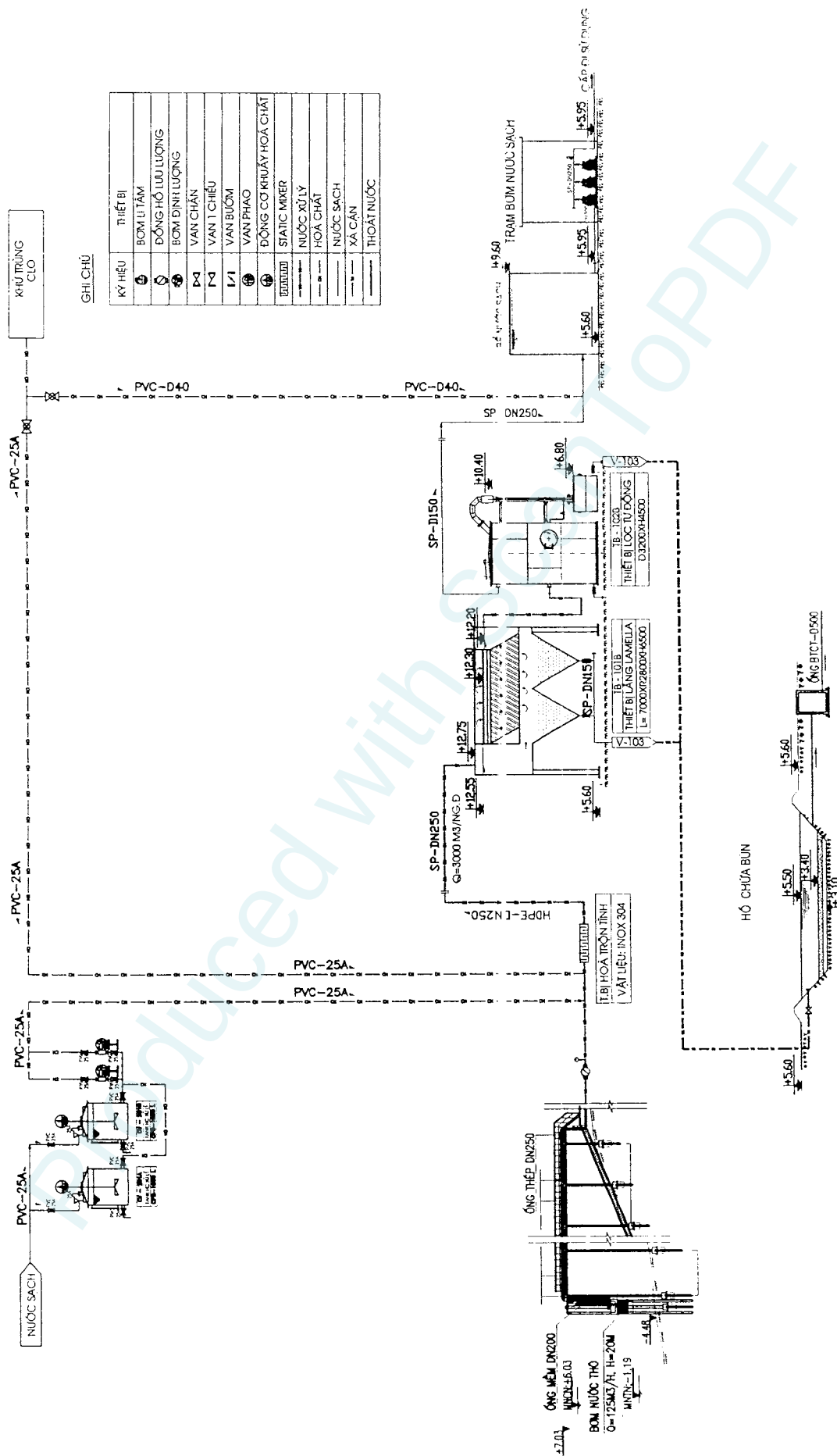
The selection of water pipes for distribution and service network is reviewed based on technical features of each pipe and the economic cost when installing similar works in Dong Thap province.

At present, materials used for water pipes are very various such as uPVC, PE / HDPE, steel pipe, cast iron pipes... The selection of the appropriate pipe for the project is to ensure the highest efficiency, the safest and the most economic.

UPVC Pipes: high strength, long life, low pressure loss, easy to construct, lower construction costs. However, the management is difficult due to it can be digged out easily.

HDPE Pipes: There are other advantages as Vietnamese uPVC pipes. It is also capable of bending, suitable for any terrain, especially very durable, long life. However, a construction cost is generally more expensive than uPVC thus these pipes are often used for the small system.

SƠ ĐỒ DÂY CHUYỂN CÔNG NGHỆ VÀ CAO TRÌNH THỦY LỤC



THE NEW ENGLAND CONSTRUCTION JOINT STOCK COMPANY

QUẢN LÝ XÂY DỰNG CÔNG TRÌNH THƯỜNG CẤP NƯỚC TẠI TRẦN THƯỜNG THỜI TÊN, HƯNG ĐÔNG THẠP
WATER SUPPLY PROJECT IN TRƯỜNG THỜI TÊN, HUNG NGUYEN DISTRICT, HUNG NGUYEN PROVINCE

ИЗДАНИЕ

SCĐ ĐÀM CHUYÊN CÔNG NGHỆ XỬ LÝ NƯỚC
PROGRAM OF WATER TREATMENT TECHNOLOGY LINE

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一
工

Cast iron pipe: high strength, long life, very safe for all terrain and weather conditions. Especially pipe breaking can be reduced. But high construction costs, high technical requirements.

Steel Pipes: There are all advantages like cast iron pipe, additionally, it can lead water better than cast iron one. It's suitable for the complex terrain areas. However, construction costs are expensive; it must be painted for anti-corrosion, anti-erosion.

Through comparison of these materials mentioned above as well as based on the existing water supply works it can be seen that: The combination of several types of pipes depending on the level and functionality as well as cost is the best. Therefore, the consultant proposed to select materials as follows:

- ✓ Pipes in the treatment plant are made of stainless steel pipe.
- ✓ Pipe HDPE will be used for the construction and installation of raw water pipelines DN250 and distribution pipeline D110.
- ✓ Plastic pipe uPVC-PN8 will be used for the distribution pipeline, DN250-D200-D160.
- ✓ HDPE pipes will be used for the installation of service pipe networks, water provision to each consumption point in the project area.
- ✓ The steel pipe will be installed on bridge (from raw water pumping station to treatment plant) and pipelines cross through roads.

3.3.5 Plans of water consumption regulation.

Based on the topography of the project area, two technical options on operation of water supply are compared to each other in regards to investment and operation costs.

- Option (I) inverter pump system.
- Option (ii) direct injection systems and regulation stations.

Table 7: Comparison of water consumption regulation options

Contents	Option (i)	Option (II)
Name of option	using variable frequency pump system	Direct pumping and regulation stations
Description	Inverter system will adjust the secondary pumps operating according to the water consumption of the network	Operation of pumps is simpler with a water regulation stations.
Advantages	- Water supply regime is carried out in accordance with the consumption regime. - Volume and pressure of water supply network is continuously because the pumping station operates round the clock (24/24h), automaticall with the rate if flow and pressure built in the nverter controller. - No need to build water stations to regulate and maintain pressure on	- The regime of water closely follows the consumption regime. - Lower operating costs. - To ensure quality water supply services 24/24, reduce operating costs by limiting the number of hours of water pumping, the pressure can be regulated and maintained - Usually applied with gravity water supply and small-scale

Contents	Option (i)	Option (II)
	the network, reducing initial investment.	
	- Energy efficiency.	
Disadvantages	- The management and operation is complex.	- The initial investment cost is high because of building water station. - Large land occupation area used for building water station. - Suitable with gravity water supply systems, with terrain height changeable.

Selection of the operation mode of water supply systems:

Option (i) – Water supply regime is used by selected inverter pump.

3.3.6 Specific technical solutions for the selected option

a) Technological solutions.

(See calculations in annexes and preliminary design)

Water collection system and raw water pumping station: (the construction is estimated until 2025 and equipment is estimated until 2015)

- Raw water pumping station is integrated and be built out side the channel (30m far from the river edge), the pumping station level I is located on float (built on reinforced concrete pile, cast-in-site concrete pile or pre-cast prestress reinforced concrete to the watercourse) and float moves pump up and down on the surface of tidal, allocate trash screen around.

- Allocate 02 submersible pump (on float) $Q=125(m^3/h)$, $H = 20(m)$ with one on duty and one standby. Install gate valves and accessories.

- Moreover, 7m above inlet structure regarding Tien River upstream piling and covering pile by grid to protect inlet structure.

Raw water pipeline:

- Allocate pipe DN250-L135m (the pipe installed on the bridge is used by steel pipe DN250, 30m, the pipe under the ground is used by HDPE – DN250), intake raw water from pumping station level I to the treatment plant. The plant ensures $3000m^3/day$ until 2015 – 2025 phases.

Water treatment plant: Building treatment plant $3000m^3/day$ for phase 2015

a) Mixer with built-in retaining ring:

- Mixer with built-in retaining ring is used to minimize the section of raw water pipeline and create turbulent flow of mixed water and chemical.

b) Mechanical reactor:

- The mechanical flocculation reactor is made of steel. The retention time in the reactor is 6 minutes. $L \times W \times H$: 3.0 x 1.5 x 3.3 (m).

c) Lamella sedimentation tank:

- The tank is built by steel. It contains flat plates made of Polycarbonate with small gaps (Lamella plate). Dimension of lamella sedimentation tank: 6.9 x 3.0 x 7.1 (m)

d) Gravity filter:

- The filtration process is based on the gravity filter principles.
- The gravity filter is automatically operated based on the vacuum structure.
- The filter is built by precast steel modular, with 02 filters, dimension of each is $D \times H = 3.2 \times 4.8$ (m). Capacity of each tank 1,500m³/day.

e) Sludge sedimentation tank:

- The tank is created naturally, suitable with geology on-site. Total dimension is: $L(m) \times W(m) \times H(m) : 26.8 \times 6.2 \times 3.1$ (m)

f) Water reservoir:

- Building water tank cylinder, semi floating steel $V = 910\text{m}^3$, $D \times H = 18.0 \times 4.0$ (m).

g) Chemical house:

- The chemical house include alum and chlorine house, built together on an area $B \times H = 4.2 \times 9.9$ (m), in which:
 - Dimension of alum house $B \times H = 4.2 \times 3.8$ (m).
 - Dimension of alum and chlorine storage $B \times H = 4.2 \times 2.8$ (m).
 - Dimension of chlorine house $B \times H = 4.2 \times 3.3$ (m)

h) Water pumping station:

- The construction design is determined until 2025, the equipment design is determined until 2015
- Water pumping station $L \times B = 15.5 \times 4.6$ m.
- Install equipments for station including: 1 inverter pump including 03 pumps (02 working and 01 standby) each pump specified technical features $Q = 100 \text{ m}^3/\text{h}$, $H = 36 \text{ m}$, $N = 15 \text{ kw}$, $n = 1450$ circuit/minute.

i) Control house:

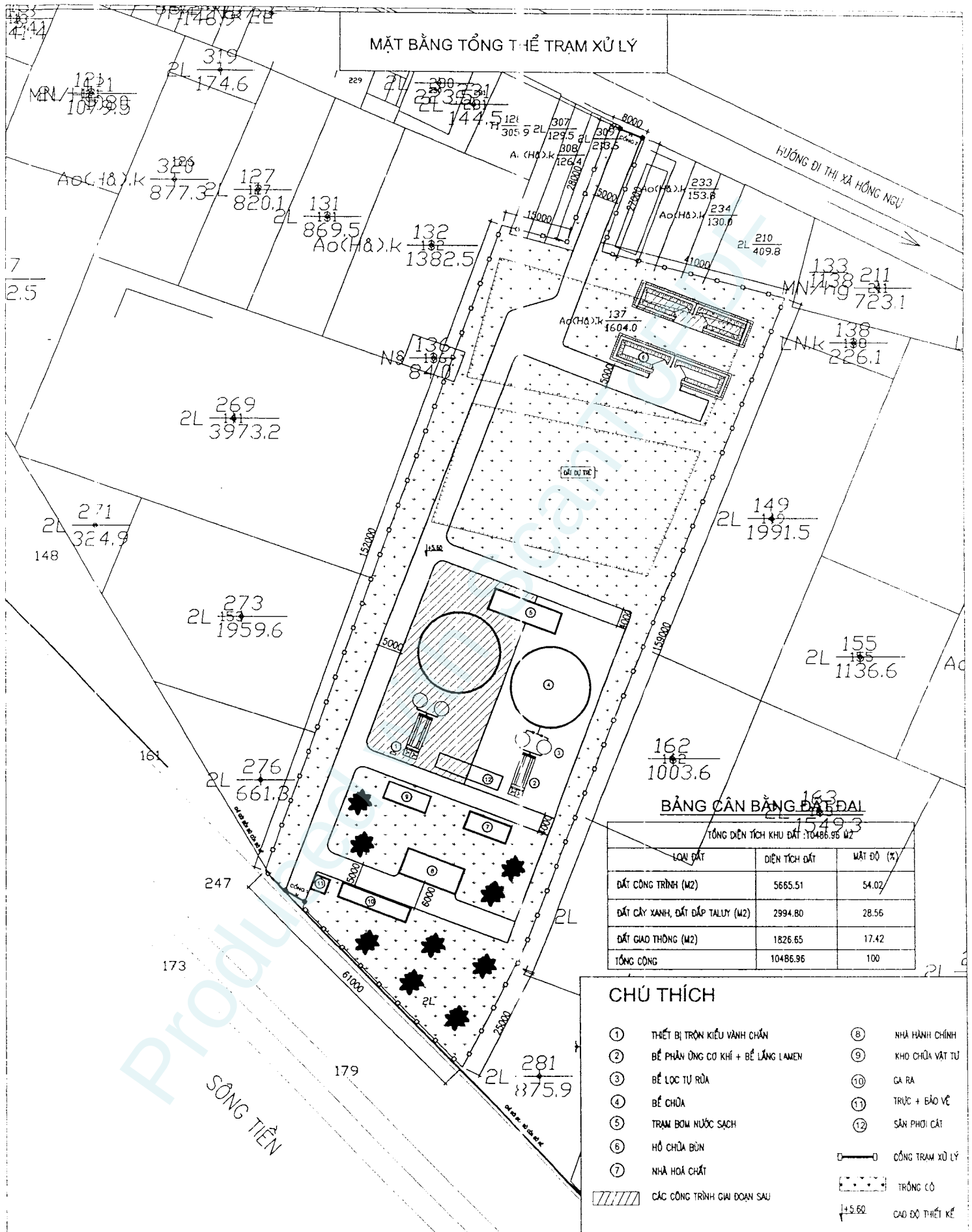
- Building 01 control house $L \times B = 13.2 \times 6.0$ (m).
- Reinforced concrete pile, brick wall, reinforced concrete roof.

j) Other items:

- Inner road: asphalt road, load bearing 2-3 tons.
- Guard house:
 - o Dimension: $L \times B = 3.5 \times 3.5$.
 - o Reinforced concrete structure, brick wall, corrugate plate:
- Gate, fence.
- Sewerage system.

Figure H-5: General plan of water treatment plant.

MẶT BẰNG TỔNG THỂ TRẠM XỬ LÝ



BẢNG CÂN BẰNG ĐẤT ĐAI

TỔNG DIỆN TÍCH KHU ĐẤT: 10486.95 M ²		
LOẠI ĐẤT	DIỆN TÍCH ĐẤT	MẬT ĐỘ (%)
ĐẤT CÔNG TRÌNH (M ²)	5665.51	54.02
ĐẤT CÂY XANH, ĐẤT ĐẬP TẠLY (M ²)	2994.80	28.56
ĐẤT GIAO THÔNG (M ²)	1826.65	17.42
TỔNG CỘNG	10486.95	100

CHÚ THÍCH

- | | |
|--------------------------------------|-------------------|
| ① THIẾT BỊ TRỘN KIỂU VÀNH CHẤN | ⑧ NHÀ HÀNH CHÍNH |
| ② BỂ PHẢN ỨNG CƠ KHÍ + BỂ LẮNG LAMEN | ⑨ KHO CHỨA VẬT TƯ |
| ③ BỂ LỌC TỤ RỪA | ⑩ GA RA |
| ④ BỂ CHỨA | ⑪ TRÚC + BẢO VỆ |
| ⑤ TRẠM BƠM NƯỚC SẠCH | ⑫ SÂN PHOI CÁT |
| ⑥ HỒ CHỨA BÙN | |
| ⑦ NHÀ HOÀ CHẤT | |
- CÁC CÔNG TRÌNH GIAI ĐOẠN SAU
 CÔNG TRẠM XỬ LÝ
 TRỒNG CỎ
 CAO ĐỘ THIẾT KẾ

Distribution pipeline network:

Distribution pipe network is calculated according to max using hours of water. Flow is calculated based on the table of water flow distribution by hour for the period up to 2020.

Hydraulic calculation of network is calculated by Epanet with hydraulic formula WILLIAM HAZEN,

On the main distribution pipelines > DN100, there is discharge valve at the lowest points and gas collection/ discharge at the highest points. Install mount and anchor jack at tee, bend, etc. The average pipe depth to the top of the pipe is 0.7m. The average breadth of the ditch is 0.8 m. The number of distribution/ service pipelines is as follows:

- uPVC D250 : 2,739m
- uPVC D200 : 8,149m
- uPVC D160 : 3,417m
- HDPE D110 : 8,983m

Service Pipeline network

Service pipe networks using HDPE-PN8 with pipes and length as follows:

- D63 : 46,576m.

The service pipes are calculated according to the flow distribution chart, depending on the number of serviced households. Service pipes will mainly on the pavements, 0.5 to 1.5 m from houses in average and average pipe laying depth is 0.5 m.

Figure-6: General Layout of water supply system**Household Connections:**

The number of connection households is temporarily calculated to be 2240 households (80% of existing residents). The project will pay these connection points with the material/point are pipe HDPE PN12.5 with D21-D27, the flow meter, valve, junk.

b) Construction solution.

Based on drilling results of geological surveys, offering a reasonable structural solution for the work is necessary. This section only preliminarily mentions measures on construction of works; detailed solution will be presented in the basic design of the project.

The works in the treatment plant will be built with cast- in-place reinforced concrete structures. On the distribution pipeline, the position with tees, bends, and cones ...must be supported by concrete pillow. Valve pits, brick pits are constructed with bricks, slab covers are constructed by reinforced concrete.

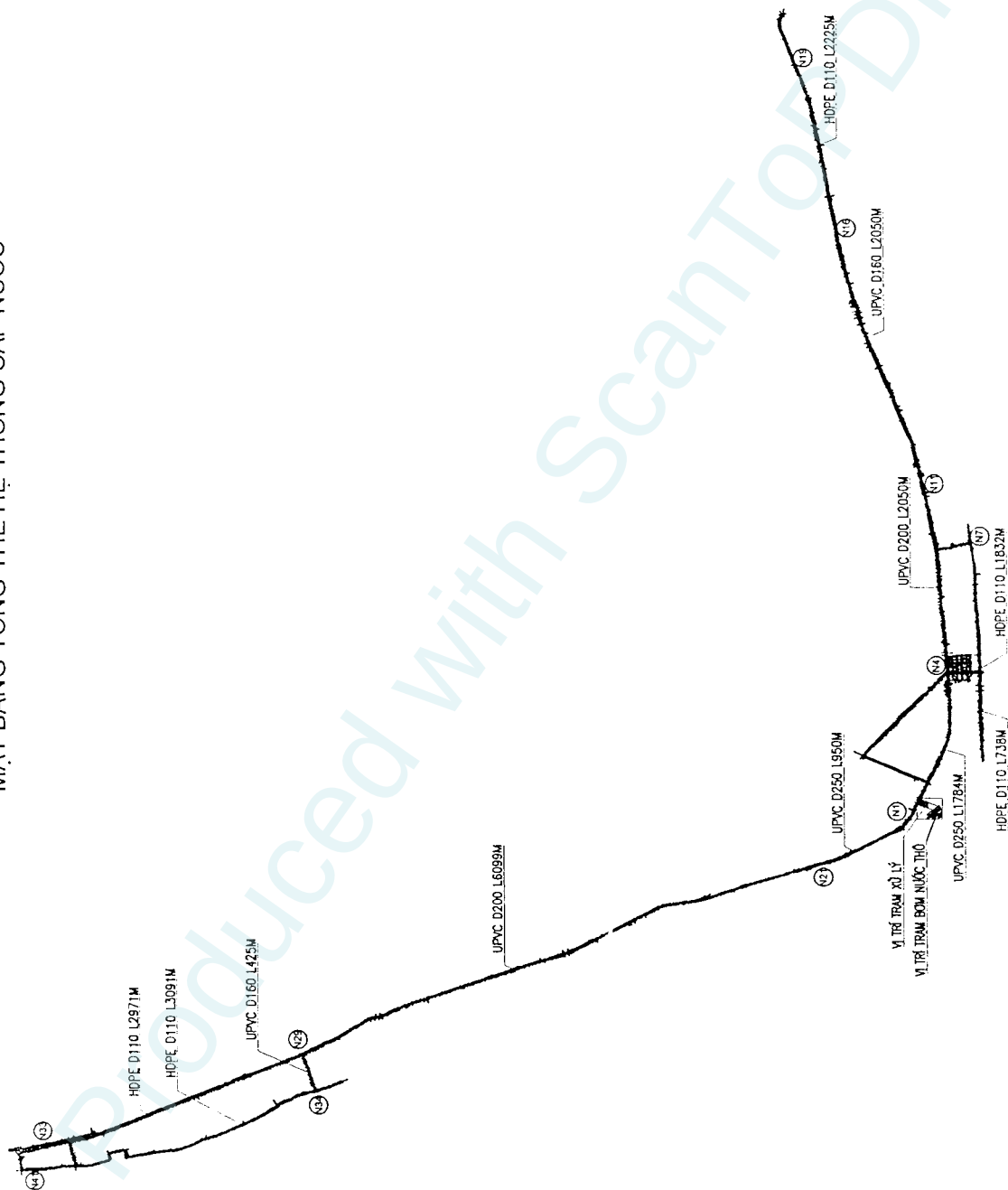
Detailed calculation of construction measures are presented in basic design report.

c) Power supply solution.

Power is supplied from line 22KV, through the area next to raw water pumping station and water treatment plant:

- Install outdoor 01 3-phase substation 180KVA: 35/22KV/0,4KV.

MẶT BẰNG TỔNG THỂ HỆ THỐNG CẤP NƯỚC



CHUYÊN NGHIỆP VÀ ĐAM MÊ
 CHUYÊN NGHIỆP VÀ ĐAM MÊ
 CHUYÊN NGHIỆP VÀ ĐAM MÊ



ĐƠN VỊ THIẾT KẾ VÀ XÂY DỰNG CÔNG TRÌNH HỆ THỐNG CẤP NƯỚC TH. TRẦN THƯỜNG THỌ TIẾN - TH. ĐỒNG THÁP
 WATER SUPPLY PROJECT IN THUNG THOI TEN - HONG NGU DISTRICT - DONG THAP PROVINCE

MẶT BẰNG TỔNG THỂ HỆ THỐNG CẤP NƯỚC
 GENERAL LAYOUT OF WATER SUPPLY SYSTEM

H - 6

- Install power, lighting system, power generation in the plant.
- Install 01 standby power generation station 100 KVA
 - o Dimension: L x B = 3 x 3 m.
 - o Steel structure, corrugate plate, corrugate wall, the ground is paved by slab concrete.

3.3.7 *Materials and equipment standards and technical requirements*

- Plastic pipe uPVC DN25, ISO 4422:1996, PN8
 $e = 13.3^{+1.0}$.
- Plastic pipe uPVC DN200, ISO 4422:1996, PN8
 $e = 13.3^{+1.0}$.
- Plastic pipe uPVC DN160, ISO 4422:1996, PN8
 $e = 11.8^{+1.0}$.
- Pipe HDPE DN110, thermal welded by PN8 $e = 8.1^{+1.3}$ in accordance with ISO 4422:1996 (E).
- Pipe HDPE DN6, ISO 4427:1996 (E). the depth and accessories is in accordance with DIN 8074:1999, PN6
- Accessories:
 - o Check valve:

Check valve is used to separate 1 system or equipment for maintaining and repairing. The proposed pressure is consistent 70°C, minimum met 1.25 times of highest pressure of the system.

The proposed check valve is the flange check valve produced in accordance with BS 5163, its length (the gap of two flange) is in accordance with BS 5163 (ISO 5752 series 3). The flange and drill PN 10/16 is in accordance with ISO 7005-2. Valve stem and valve cap is made of grey iron (BS 1452 grade 220/250) or ductile cast iron (BS 2789 grade 500-7).

Check valve installed on the distribution network is manually operated check valve.

- o Discharge valve

Due to flow circulation in the pipe is high which residues unable to deposited, only small aggregate or raw sand to which check valves should be fixed at the lowest location of the pipe. Wastewater is discharged directly to the combined ditch of the area or river, pond, rice field but not affected to aquaculture, tree and living environment of resident at the discharge point.

- o Gas discharge valve:

Single valve with 1 large hole and semi-automatic operation with flange in accordance to ISO 7005-2 (EN 1092-2:1997, DIN 2501). The valve stem and cover is made of grey iron GG-25 in accordance with DIN 1691 and covered by green epoxy.

Valve is suitably used for domestic water supply only or untreated water (not wastewater) and ensure its operation at the lowest pressure level 0.2 bar, and highest level is 16 bar. its temperature enable to reach 90°C.

All valves must be tested hydraulic at pressure equal to 1,5 time of nominal pressure.

- Flexible couplings:

The flexible coupling must be manufactured according to ISO 9001. All details of coupling including bolt, and nut must be painted to avoid corrode.

All kinds of joints should be available in order that the installation will be quick and efficient without the lubrication and any particular instrument.

4. SITE CLEARANCE AND RESETTLEMENT PLAN.

4.1 The purpose of site clearance

The purpose of the compensation, resettlement plan is to meet the locals' requirements when they lost land. The loss was converted into money, however, it cannot fully calculated because the problem is very sensitive, such as the relocation will change or disorder their living method, leading to many other changes positively and negatively. These losses can be calculated by cash are: Land, houses, crops, ... the damages can not be calculated by cash are: changes of living habits, earning for living, ...

Therefore, all project will also sought to limit to the relocated households, and if the relocation is compulsory, the project owner needs to consider not only the immediate compensation be converted into money, but the way they earn for living after resettlement, avoid economic –social-environmental problems arised during the land acquisition. Simultaneously, the project will create conditions for those affected to improve or at least restore living standards, income cration capacity and production as before the project's existance. Details are as follows:

- Determining the scope of the work items.
- Socio-economic Characteristics of affected areas.
- Cost estimates and budgets for compensation and progress.
- jobs and income for the direct affected households (relocation or loss of agricultural land)

4.2 Study scope of compensation and resettlement plan

Owing to the construction site of raw water pumping station is located at the watercourse of Tien river which do not carry out compensation and site clearance, the area subjected to study compensation and resettlement for the project included: construction site of water treatment plant

However, there was no case of housing removal and displaced person in the water supply system project of Thuong Thoi Tien Town, Hong Ngu District, Dong Thap Province. Otherwise, the distribution pipeline is built along roads, rice field, alleys which the requisition during the construction did not occur and did not affect to the agricultural production area.

There was no affection to the natural reservation area, pagodas, temples or other sensitive areas in the project area.

The area requisited for the project (permanent and temporary requisition) is summarized as follows:

- Permanent requisited area:

Requisitioned area used for treatment plant construction, raw water pumping station and bridge construction: 0,6692 ha

- Total temporary requisited area (provision): 46.576m²

4.3 Legal frame work

- Constitution of the Socialist Republic of Vietnam April 15, 1992.
- Land Law on 26 November 2003.
- Decree 181/2004/ND-CP on October 29, 2004 to implement provisions of land law.
- Decree No. 188/2004/ND-CP of November 16, 2004; method of determining prices and price framework for land categories.
- Circular no. 197/2004/TT-BTC dated 26/11/2004 on guideline to implement Decree No. 188/2004/ND-CP.
- Decree No. 198/2004/ND-CP dated 3/12/2004 on the regulation of land use fees.
- Decree No. 197/2004/ND-CP, dated 05/12/2004 of the Government's regulations on compensation, assistance and resettlement when the State recovers land.
- Circular no. 116/2004/TT-BTC on 12/1/2004 by the Ministry of Finance guiding implementation of Decree No. 197/2004/ND-CP.
- Decree 17/2006/ND-CP dated 02/06/2006 by the Government on amending and supplementing some articles of the decree guiding implementation of land law.
- The Decree 84/2007/ND-CP dated 25/5/2007 by the Government on supplementary provisions on issue of land use right certificates, land acquisition, implementation of land use rights, order and procedures of compensation, support, and resettlement.
- Decree 123/2007/ND-CP on July 27, 2007 by the government on amending and supplementing Decree No. 188/2004/ND-CP.
- Decree No. 69/ND-CP on 13/8/2009 by the Government on additional regulations on land use planning, land prices, land acquisition, compensation and resettlement assistance.
- Circular 14/2009/TT-BTNMT dated 01/10/2009 of MONRE on regulating compensation, support resettlement and procedure of acquiring, transferring, renting land ;
- Decision No. 29/2009/QĐ-UBND dated 23/12/2009 of Dong Thap province on issuing regulation on compensation, support and resettlement as the State acquires land on area of Dong Thap province 2010;
- Decision No. 35/2011/QĐ-UBND dated 17/12/2011 of Dong Thap Province on issuing price of types of land on area of Dong Thap Province 2012.
- And some other related documents.

4.4 Principles and conditions for compensation.

4.4.1 General principles

Plan of Compensation, support and resettlement (if any) will incorporate with the general principles as follows:

- ✓ Resettlement and land acquisition will be minimized, was taken into account to make proposals for the design and construction of items of the water supply systems;
- ✓ All affected households / individual will be compensated;
- ✓ the Government will be compensated with new land with the same using purpose. if there is no land for compensation, the owner shall be compensated by the value of land use rights by the land price at the time of acquisition;
- ✓ compensation, support and restore is equal to the cost of replacement or relocation without depreciation value;
- ✓ All the affected people living, working, trading or cultivating on the land which is in the acquisition until before the expiration of compensation is eligible for recovering measures to help them improve or at least maintain the living conditions, the ability to create income, and production as before the project's existence;
- ✓ Plan for acquisition and compensation plans, must be carried out with community consultation to ensure the democracy and ensure that the impact is minimal;
- ✓ Households affected by the project will be compensated, assisted (if any) 30 days before the expected site clearance date.

4.4.2 Conditions for compensation

Those affected by the project will be eligible for compensation and assistance, including state agencies, individuals and households who meet one of the following conditions:

- Having the certificate of land use right as prescribed by law on land;
- Having allocation decisions by authority state bodies under the provisions of the law on land;
- Households and individuals using stable land confirmed without dispute by the People's Committees of communes, wards and towns and having one of the following certificates: on land use rights before 15/10/1993, certificates of temporary land use; certificate of lawful inheritance, donation ... certificate of transfer, sale, liquidation, the price of land use rights and assets on land;
- Households with land tax receipt. or, having no above certificates, through townships's cadastral documents or the list of affected households before the completion of RAP;
- Households and individuals using land with permanent residence in the locality and direct agricultural production, forestry, aquaculture and salt ...
- Households and individuals using land that was formerly managed by the State in the process of implementing land policy of the State
- Residential communities are using land with works, temples, churches are certified as public land by the commune PC and without dispute;

The influences of compensation mentioned:

- Agricultural land area affected permanently or temporarily;
- Area of land affected during construction;
- Houses, works and crops, trees ... on the affected area;
- The temporary impacts during construction for production, business

4.5 Legal documents to receive compensation.

4.5.1 Legal documents for land

Residents have the legal right based on the land use certificate issued by the local People's Committee; this certificate may be a long-term, temporary or leasing land; residential or public land used illegally for civilian objectives without a certificate by the local People's Committee. Each type of land use is explained as follows:

- The affected households who are eligible for compensation: those who have certificates of land use rights issued by the city authorities.

- Those affected households will be eligible for compensation: is property owners included in the following areas:

- a. Any legal land ownership certificate was issued before 15/10/1993 and without any dispute;
- b. Having the certificate of land use rights by inheritance or issued by the former regime without legalization;
- c. Land tax receipts;
- d. Construction certificate;
- e. Certificate of residential locality;

- The household/personal/collective/unit without legal conditions for compensation: including the households owned land after 15/10/1993 (the time of application of current Land Law); not having an official certificate; not having certificate of land use rights from the inheritance, having no tax receipts or certificates of the locality.

- The affected household will not be compensated if household migrates to the affected areas after completion date of the resettlement plan.

4.5.2 Legal documents for architectures

Families and individuals have the right to build houses and buildings if they are allowed, provided and supported by the government. Construction permits defined legal right of the house, buildings and other assets.

- Lawfully owner: they must have legal possession right for houses, buildings and other properties, those permitted to be constructed by the district or commune authorities, or who have a certificate of ownership.
- Lawful owner of houses, buildings and other assets: those affected by the project but having no construction permit, or certificate of ownership, but can meet the following criteria:
- Property possessed before 1993 and without any dispute, or

- Having the certificate of land use rights or
- The owners can legalize their land use rights because they have permanent residence.
- Illegal ownership of buildings, structures and other assets are these affected assets were built after 1993 without construction permits or those who have no ownership or land use right.

4.5.3 Legal documents for business households

Business including any type of activities which bring income or profit; normally, enterprises have to register with local authorities and pay income tax. The following enterprises are eligible for compensation:

- Companies have a legal right: the affected households have long term business registration and pay taxes fully to local governments;
- Households who do not have business registration and income or household's business foundation affected by the project possibly completed tax payment in full or partially.

4.6 Support and restore the economy

The conditions to have rights to receive the financial aid and be economic restored base on the resident situation of affected people by project. The following groups are supported:

- Legal objects: are affected people having the certificate of permanent residence issued by local authorities.
- Probably legal objects: are affected people without the certificate of permanent residence but having the certificate of temporary residence issued by local authorities, or have the conditions to meet the demands of the certificate of permanent residence.
- Illegal objects: are affected people without the certificate of permanent residence and any kind of certificate and have no conditions to register the certificate of residence.

4.7 Policy on rights and interests

4.7.1 Compensate for land

The affected households of project having the **legal right or probably legal right** to the damaged land area will be compensated 100% of the withdrawn land area according to the general regulation of GoV; these affected households are compensated the same land area and be accepted by these affected ones (concentration resettled zone or in many different zones) with full of the certificates for right of land use and not pay any amount of money.

The affected households that have **no the legal right** to the damaged land will be compensated the amount with the same value as the assets on the withdrawn land, not over 30% of withdrawn land in cash. The affected households are sensitive households, the project can supply to these households a land area in the resettled zone or according to the requirement of these households, the project will compensate the affected area with the 50% and these households will manage the new houses actively.

4.7.2 ***Compensate for houses and architectural buildings***

Affected households are hosts of house, buildings, architectural works and plants

- Affected households, including the legal, probably legal or illegal objects, are received 100% of compensated fee for damages of whole house, works, and architectural buildings that are withdrawn. No apply the compensated price reducing for reducing materials in comparison with the original value or value that can be reused.
- Affected households of group that is not the legal right to receive the compensation will be compensated the supporting amount of 60% for damage of withdrawn buildings in cash.
- Households that are affected by project, be damaged in business or production, will be compensated 100% of replacement value in cash.
- Affected households will be compensated in cash with the same value as 100% value of yearly plants, perennial, profitable fruit trees or commercial value trees, etc. that be affected by land withdrawing.
- Compensation for plants and farm produce of withdrawn land according to the decision of provincial people's committee about the compensated value for plants and fruits; however, the affected households must ensure that the conditions are compensated and supported in detail: (i) for land area using for planting the perennial, this is used continuously during 12 months, (ii) area for planting the perennial, the using time must be continuous in 16 months, (iii) afforested area has the continuous using time of 24 months
- The compensation level is paid for the farmer is on the common price unit of Province in comparison with the market price for fruits or according to the replacement fee for long-day crops, perennial;
- Compensation price is calculated on the actual using area, not on the using area

The affected households are renting houses or architectural works

- The HHs rent houses or works which are affected by project will receive compensation in cash valued 100% of cost for rehabilitation, reparation and upgrade for the legal land area of those works.
- The HHs renting houses that have to relocate will be supported an amount valued as remaining renting contract value, but not over 03 months and will be supported an amount for transportation or arrangement of new accommodation.

The affects on business/lose the jobs

- The affected people in the legal, probably legal and illegal groups will be received the compensation in cash for business damages, according to the turnover of previous year;
- The affected people in the legal, probably legal and illegal groups, people who are affected in temporary time to the business and production companies will be compensated in the affecting period basing on the declared tax level. In case, they do not have the business certificate, they will be received a compensation as 500,000 VND/month for the life fee in the 3 months

Support to make stable for production and life

- The policy for supporting the affected households according to the Decree 69/2009/NĐ-CP. Moreover, basing on the actual situation in local, the President of provincial people's committee will decide the supporting method to ensure the living place, stabilize the life and production for the people who are withdrawn the land; for the special cases that are approved to the Prime Minister.
- The households, people who directly attend in the farming when government takes back the farming land and has no land to compensate, out of being compensated in cash, they are supported to change the job and made the jobs on one of methods, such as in cash or land or house or non-agricultural producing, business lands as follows:
 - To support in cash from 1.5 to 5 times higher than agricultural land value for whole withdrawn agricultural area; the supported area is not over the limit of agricultural land delivery in local;
 - To support one time with a land piece or flat or non-agricultural producing, business land piece.

People who are affected by the project must rebuild their houses on the remaining lands, or people who must move to the others will receive:

- (1) Transport fee 50.000 VND for the people who rebuild their houses there and from 1 million VND to 3 millions VND for people who must move to the another places;
 - (2) The life allowance in cash as 30 kg rice/person/month in 3 months for the resettled people on the spot and in 6 months for the people who move to the another places,
 - (3) The bonus is 10% but not over 5 millions VND for the people who destroy and give themselves the land to the project management on time according to the plan of project;
 - (4) The people who resettle on the spot or must move to another places and they are in the difficult situations, or are receiving the social allowances will be supported specially, not under 1 millions VND;
- The heavy affected people have right to receive the supporting level to restore the life, not under their levels before having project, and the best thing is better than situation before having project. The affected people lose more than 20% of agricultural land or the turnover will be supported to restore amount of 3 millions VND per household as planned. This allowance can be adjusted according to inflation status and actual status on each local.

4.8 The advantages and difficulties for the compensation and resettlement

4.8.1 Advantages

- **No house:** This is the best advantage is point because there is no household is mixed in life causing by project. Therefore, it is not compensated for movement, or for management of resettlement, and jobs and not necessary to consider the public order after settlement. This advantage is not for all projects. However, the

project manager still has the plan to support properly in income for the households who have no agricultural land (it will be shown in detail in the following part).

- **No pagoda, cemetery, historical, cultural, medical buildings, beautiful views, part, schools, hospital, etc.:** the fee and procedures to move or damage one of these above buildings are usually complicated, sometimes can not done.
- Thanks to small area of permanently and temporarily acquired land, the site clearance is more simple and easy.

4.8.2 Disadvantage:

- **Large temporarily acquired land area:** A large land area is acquired for construction of water supply system. Although this occurs only in a short time and doesn't require compensation but the project still has to take care about construction method, traffic safety, drainage safety, landscape and environmental sanitation (These are thoroughly studied in Chapter: Environmental issues)
- Beside the above advantages, the disadvantages remain in compensation, site clearance and resettlement that can not calculate advancedly.

4.9 Expenses for compensation

One point that needs to be remarked for the project of the water supply system of Thuong Thoi Tien town, Hong Ngu district, Dong Thap province is that there is no household must move their houses, it means this project does not consider the resettlement. Therefore, the actual nature of compensation, resettlement is compensation, clearance the layout, it is called as compensation for short.

4.10 Carry out the compensation, clearance the layout and support

This part will show the framework of organization for carrying out the resettlement plan. This project will be controlled by Project management Unit of Dong Thap Water Supply One Member Co. Ltd., (PMU)

Dong Thap provincial people's committee

- ◆ Promulgate the compensation price for land and building;
- ◆ Lead the implementation the compensation and site clearance of the project.

Project management unit (PMU):

- ◆ Has the responsibility for controlling, management the works relating to project in the previous invested period as: make, submit to approve the project, carry out the clearance and compensation, receive the construction layout; make, submit to approve the bidding plan, bidding invitation documentation; carry out the bidding, examine the bidding, and submit the bidding result.

Resettlement department:

- ◆ Support the project area in the working process to the public to determine the problems relating to the affect of the project to the living land, agricultural land and other producing services, etc, ...
- ◆ Make the necessary supporting programs in order to support the stability for lives of households, ensure at least their lives are the same or better than lives before having the project.

District PC:

- ◆ Make the good conditions to implement the project through the making the committee for compensation, encourage each individual to ensure that this brings the effects from the functions of Committee.
- ◆ Ensure that all agreements of Committee for compensation to affected households are saved in text.
- ◆ The people's committee of district will usually follow the compensation plan progress through the following the data about the compensation and resettlement that are supplied by the compensation committee. The people's committee of district will update the reports if they are necessary and fast give these documents to the people's committee of province; and of course the urgent problems are always special concerned.
- ◆ Answer the claims of the affected households.

Other organization

The financial department: has responsibility to

- ◆ Confirm the market price of land and buildings in the project zone and zone that will be compensated, cleared and supported
- ◆ Evaluate the compensation rate and supporting levels and allowances that are suggested of committee for compensation, clearance the layout and supporting the affected households by project; and
- ◆ Supply the capital and cash for programs of compensation, clearance the layout and supporting.

Environmental resource department:

- ◆ The environmental resource department has responsibility to control the land using in the provincial zone and manage all the buildings that are owned by government. The department must have responsibility to combine the plans of compensation, clearance the layout and supporting of Dong Thap province and control these programs in the limit of whole provincial development.
- ◆ The environmental resource department will support the project by supporting the district people's committee to issue the certificate for households who are affected by project, including the certificate of using land right and certificate to build the house.

The investment and planning department:

- ◆ The investment and planning department has the responsibility to control whole the short-term and long-term projects; and the program to develop the economy ...

society of the town. The investment and planning department has the responsibility to confirm the yearly financial plan (including the amounts to compensation, clearance the layout and supporting that are approved by the People's committee).

4.11 Cost estimate

Most of compensation fee is for the architectural buildings on land, including: single architectural works, fence, yard, road, shadow trees, industrial and agricultural crops.

Cost for compensation and site clearance is estimated as **VND 3,094,446,000**.

4.12 Compensation and site clearance schedule

The compensation, site clearance and support committee has responsibility to investigate, make the documentation about all the lands and buildings that are affected by land acquisition and for the data analysis and make the land withdrawn map. The steps will be carried out as follows:

Table 8: Compensation and site clearance schedule

No.	Explanation	Expected date	Note
1	Approve the for compensation and site clearance schedule	12/2012	
2	Information disclosure	01/2013	
3	Detailed measurement survey (DMS)	02/2013	
4	Prepare compensation plan	02/2013	
5	Pay for compensation	03/2013	
6	Site clearance	03/2013	
7	Monitoring and assessment	03/2013-02/2014	

4.13 Monitoring

The PMU and the compensation, site clearance and support committee of district people's committee takes responsibility for internal monitoring activities. The main data need to be monitored are:

- Evaluate the compensation and the accuracy level
- Carry out the compensation according to the government policy
- Public information and must refer to many points
- Complaint progress
- Supply the restored allowances and education allowances
- Make jobs.

5. ENVIRONMENTAL ISSUES

5.1 Overview

5.1.1 Study scope

The environmental issues are studied separately for the water supply system of Thuong Thoi Tien town, Hong Ngu district, Dong Thap province, includes the affects to the environment of this project during the construction and further using the buildings, such as: Treating group, water tower and distribution and service network.

5.1.2 Technology process

The technological process for treating water is suggested to study must be suitable to the quality of chosen water supply resource. The common and popular treating methods in Vietnam are come to the studying in order to give the best technological line with the lowest management and commissioning fee, the most reasonable fee and construction method.

The common affect of the whole project is positive and will be an important step in the improvement, upgrading the water supply conditions to the area of Thuong Thoi Tien town of Hong Ngu district, Dong Thap province.

5.1.3 The legal regulations need to be complied

a) The legal regulations of environment that need to be complied during project implementation

According to the Decree no. 21/2008/NĐ-CP dated 28.02.2008 regarding amendment, addition some articles of the Decree no. 80/2006/NĐ-CP dated 09.8.2006 of Government regarding the detail regulation and implementation guide of some articles of Environmental protection law, the water supply project for Thuong Thoi Tien town, Hong Ngu district, Dong Thap province to extract the surface water with the small scope, design capacity under 50.000 m³/day and the short construction time, no big affect to the environment, so that no need to make the Environmental impact assessment (EIA) of this project, the positive affects, negative affects of this project to the environment and the methods to reduce these bad affects. The environmental affects of the project mainly are the positive ones. The works on construction project as digging land, installing the piping line, ect. will not affect to the quality of environment because of the small project scope and short construction time. Moreover, the project contributes to enhance the public health of local through the supply the fresh water to households.

b) The environmental legal bases

- The environmental protection law, amended in 2005 and be approved on 29.11.2005 by National Assembly and come into force officially from 01.07.2006
- Decree no. 29/2011/NĐ-CP dated 09.8.2006 of Government regarding the detail regulation and implement guide some articles of Environmental protection Law.
- Based on the development orientation on city water drainage of Vietnam to 2020, issued on the Decree no. 85/1999/QĐ-TTg dated 05.3.1999 of Prime Minister.
- Decree no. 91/2002 (11.11.2002) regarding Organizational Responsibility and Function of Ministry of resources and environment;

- Decision no. 45/QĐ-TTg (02.4.2003) regarding the establishing the Departments of resources and environment in provinces;
- Decision no. 22/2006/QĐ-BTN&MT regarding the compulsory application the Vietnamese standards on environment;
- Decree no. 149/2004/ND-CP (27.7.2004) of Government regarding the regulation on the certificate issuing for investigation, excavation, using the water resources, waste water drainage to the water resources.
- Basing on the Vietnamese standards on environmental protection.
- Surrounding air quality standard: TCVN 5937 – 2005.
- Air quality – maximum acceptable concentration of some poisonous substance in the surrounding air: TCVN 5938-2005.
- The noise in public and resident areas - maximum acceptable noise level: TCVN 5949 -1995.

5.1.4 Environmental impact assessment process

The environment assessment instruments are applied for the small projects to ensure to meet the demands of assessment on environmental affect in Vietnam, including:

Table 9: The environment assessment instruments

Project	The environment assessment instruments
- The surface water supply system project with the capacity $\geq 50.000 \text{ m}^3/\text{day}$	Preparing detailed EIA.
- The project of water supply system, surface water resource with the capacity $< 50.000 \text{ m}^3/\text{day}$	Environment protection commitment.
Small project with the household scope.	Not required

According to the above regulation, the water supply project for Thuong Thoi Tien town, Hong Ngu district needs to have the Environmental protection commitment, which will be done as private report before constructing the project.

5.2 Environmental impacts and mitigation measures

This project is to upgrade the life through the supply the fresh water, the project helps the local to enhance the living standard, improve the public health, and contribute to make shorter the distance between the rural and urban areas.

The common affect of whole project is positive and will be an important step in improvement, upgrading the water supply conditions to the project area.

The water supply infrastructure construction will supply fully the fresh water by the water supply system that is designed with proper technical standards. The project will help the local in these rural areas to improve the living standard through the approaching the fresh water and enhance the sanitation conditions.

As the same projects, this project will affect to the environment in the both positive and negative ways in 3 periods: Site clearance, system construction and operation.

However, for each project, there is a separate thing that needs to be concerned. For this project, these points need to be concerned as follows:

- Inlet structure and raw water pumping station
- Water treatment plant
- Distribution and service pipeline

5.2.1 The Environmental impacts in the site clearance phase and Mitigation measures

a) Impact assessment:

In this period, the main thing is land acquisition and compensation. In general, because the project land area is not too large and is developed corresponding to the demands, so the land acquisition and compensation has some advantages. This thing is done according to the Vietnamese regulations that are approved by local authorities and affected by community. The main impacts are to lose the right of land using.

Main piping routes will be set along the existing piping routes, use the land temporarily during the construction process.

During the construction, some areas will be affected as cut off power, relating buildings damaging, and vegetation cover destruction. This clearance will carry out in the short time with the small scope and with the previous inform so that the affect is not too big.

b) Mitigation measures:

During the project planning, the land acquisition is limited at maximum level and it must be suitable to the development plan of Thuong Thoi Tien town. To reduce the affects, this is managed to do after the crop harvest in order to avoid affecting to the land using and farming of local as well as limit the compensation expenses. On the other hand, the exact calculation the compensation quantity and giving the suitable compensation policy for vegetable and fruits to local are necessary.

5.2.2 The Environmental impacts in the construction phase and Mitigation measures

a) Other impacts:

The distribution and service pipeline is quite long, approximated 20 km. However, the affected time is not too long and mainly in the pipeline is along the provincial road no. 841 and some earth roads, with the thinly populated traffic flow so that this problem can be solved completely.

The construction the service pipeline must go through the yards and damage the fences of households. The problems need to be concerned as follows:

- If there is no suitable solution for construction, this will cause an obstruction or air and water pollution, affecting landscape, causing troubles in public order on the whole construction routes.

Also need to pay attention that, the temporary acquired land area to construct the transmission, distribution water system is quite large. This area is quite large so the affects to the environment is noticeable if the clearance and construction are carried out at the same time.

Other impacts:

- Cause noise during the construction.
- Dusty pollution: causing by the sand, soil, stone amount during the digging and installing the pipeline.
- Air, noise, vibration pollution: causing by operation of construction vehicles in the area and along the route transporting the soil, rock and material. Dust, waste air from the construction machines.
- Cause the partial flood during pumping water for construction or digging roads.
- The depression of soil, buildings during the digging the piping tracks.
- Life waste of workers who take part in the works on site.
- Surface water pollution: causing by construction and domestic wastewater during construction.
- Working accidents.

However, these impacts are not too big because:

- The water pipeline is mainly along the roads, brushwood, etc.
- No need to acquire land (only use temporarily the land during the piping construction time).
- The construction is implemented in the short time so the impacts on economic-social environment are in the low level.

b) Mitigation measures:

The temporarily land withdrawing is agreed by all levels of government and local so the compensation will be done quietly advantageously, the necessary condition is to have the agreement in time and procedures for compensation between local and authorities must on the legal regulations.

The methods in detail as follows:

For the compensation and site clearance:

- There is discuss between the levels of local authorities with each resident group, analysis and answering all the questions of local before carrying out the compensation.
- Inform in text or on public news or through the discussion to each household about the compensation and site clearance plans.
- The clearance is needed to do after the crop harvest to avoid the loss for land using and farming of local and limit the compensation expenses.
- Need to calculate exactly the compensation quantity and give the suitable compensation policy for fruits and plants.
- Partially clear way; construction is made gradually as the clearance goes on. This is very important to avoid the loss for local, avoid the traffic jams.

For the construction:

In each period, the construction can be done according to the way that construction is made the completion goes on (the length of each road needs to be constructed depends on the actual geographical situation, the average length is about 2 km for one time).

- Before constructing, it is needed to inform to local in detail and in text or through the discussion, public communication media to receive the agreement and supporting.
- After the constructing each length, it is needed to restore the layout as the original situation.
- During the stone, soil transporting, use the cover to avoid dust dispersion.
- Collect the hard waste and life waste.
- The working safety and the risks during constructing or in the bad weather are limited through the good application the safe regulations on site.
- Apply the working safe, sanitation and environmental protection regulations for officials and workers in the project area.
- Make the guides, instruction tables, warnings in the suitable positions to control the traffic in order to avoid the traffic jam and accidents.
- All the works must follow the technical standards, criterion regulated by Vietnamese government.
- Inform to the local in surrounding area about the construction plan.

5.2.3 The environmental impact during operation phase and mitigation measures.

a) The impacts:

- Water pollution due to endosmosis of the dirty water though out the pipeline.
- Loss of water due to leak that makes the pipeline broken or due to vandalism, theft of water.
- The impact of sludge generated from cleaned and filtered sewage
- Chemical leaks and accidents during the operation

b) The mitigation measures:

- Regular maintenance of treatment equipment, water supply pipelines.
- In cases of violations, it is necessary to endorse the clear-sighted policy on sanction.
- Checking regularly the provided water quality, before distribution.
- Setting up the checking points with the installed equipment.
- Installing the security clock and protective fence around the pumping stations, water plants.
- Applying the rules of work safety.

5.2.4 Breakdown caused by project operation

a) Causes:

- Fire: Because of the treatment technologies with the chemical use, it creates enough condition to cause during its combination.
- Electricity-caused fire: water plant, raw water pumping station that overuse the electrical equipment (pumping machine, mixing machine, etc.) in the aquatic environment with the toxic ingredients that can cause the electrochemical corrosion, chemical corrosion which electrical, fire and explosion.

b) Affected area:

- Fire: If fire occurs in the area of the treatment plant, it will damage to the items of work and cause the working accident.
- Leaks, spills remains untreated: When spills occurs that stagnates the operation of the system, directly negatively impacting on the business activities of enterprises who use the water resource of the plant.

5.2.5 Measures against fire, explosion and environmental problem:

To ensure the safe operation of water plants in the designed drawing and shop drawing, Contractors should pay attention to the issue of fire prevention and environmental problems (shut down equipment, masks ..). Operator must be trained in rescuing the incidents.

5.3 The plan for managing, monitoring and reporting the environmental control.

Pursuant to Vietnamese law on the environmental protection, in various stages of construction and operation of the project management office along with the Contractors that must implement the Environmental Management Program (EMP).

The objective of EMP for this project is to provide guidance for projects to ensure the environmental aspect. EMP includes the management program, monitoring and reporting to minimize the negative impact on the environment, implementation organization structure of EMP and emergency rescue measures for possible incidents.

5.3.1 The plan for managing, monitoring and report the environmental control:

The EMP's goal of program for monitoring and reporting the environmental control - water supply system project in Thuong Thoi Tien town that collect continuously the information on the environmental quality change due to the project operation and detect in time the bad impact on environment at project area propose the reasonable solution to preventing, minimizing the environmental pollution. On the other hand, environmental quality control is to ensure the safe operation of the Project. The parameters proposed to evaluate in the environmental control program and environmental control reports as follows:

- During the construction phase of the project: noise and dust, waste collection, cut and fill earth, soil erosion and safe measures;
- In operation phase of the project: noise, air quality, water quality (raw water and water after treatment), settlement of the works.

5.3.2 Construction Phase

- Construction time in the project area is expected about six months, during this period the environmental control will be conducted as follows:

- The noise parameters, smoke and dust will be monitored at 02 locations considered as the most affected location (the construction area in water plant and along the main road where the loading pipeline run through, this area of high population rate), with frequency 1month/ 1time for 6 months of whole construction period.
- The waste collection and embankments, soil erosion and work safety measures controlled by 1month/1time for 6 months of whole construction period. The waste material in daily activities of construction workers should be monitored to collect and process it under hygiene standard.

Report on environmental monitor at the construction phase is quarterly prepared and submitted to the local environment management agency by the relevant agency in charge of construction or as required in each particular moment.

5.3.3 Operation management phase

- Monitoring the quality of raw water and fresh water after treatment in the operation phase: analyzing the samples once a month with regular targets, basic water supply quality in accordance with standard- Vietnamese Standard (VS) 01:2009 /Circular-Health Ministry issued June 17, 2009 of Health Ministry. Location for taking the raw water samples the construction (works), location for taking the water sample after treatment at the storage tanks of the treatment station and at tap of households.
- Monitoring the settlement in and around the water plant, water stations every year to ensure the work structure quality.
- Monitoring the noise criteria will be made at the pumping station with the frequency of 3months/1time.
- Monitoring the targets of waste during the operation include: the sludge collection, filtered washed discharge water of the water plant will be monitored 6 months/1time.
- Air quality is monthly checked at the sector of the chemical house to take the urgent remedial measures in cases of chemical leakages. Pipeline network is also frequently checked to minimize the water leakage or loss.

Report on the environmental control at the operation phase is prepared and submitted to the local environment management agencies by the relevant agency in charge of construction or when required in each particular moment.

5.3.4 Implementation organization

Responsibilities of involved organizations and relevant agencies in the process of controlling and assessing the environment are showed in the following table:

Table 10: Role and function of environment of units involve in the project.

Role	Function
<i>The implementation units</i>	
Dong Thap urban environment	Coordination and management of project operation in line with guiding and supervising the project.
One	

Role	Function
Member Co. Ltd. – Project owner	
PMU - Dong Thap urban environment One Member Co. Ltd. – Representative of Project owner.	Bear the full responsibility for comprehensively implementing and managing the Environment Management Plan
Environmental Officer of the project	Responsibility for training and supporting the Contractors on environmental issues as well as inspection and monitoring the project implementation process to ensure the full and appropriate compliance with the regulated procedures.
Environmental Consultant	Preparing the Environmental Management Plan
Contractor	The constructional measures - Application of mitigation measures during construction - Ensure the safety measures for workers and local people during construction - Comply with Vietnamese safety policies.
Project Operation Department	Operating the project and take the measures for managing and monitoring the environment and periodically report the results to the management department
Supervision Agency	
Environment Management Department – DONRE of Dong Thap	Bearing the responsibility for ensuring the compliance with the environment management and protection under the Environmental Protection Law, Decree 80/2006/Decree-Government, Decree 21/2008/Decree-Government and Circular 08/TT-BTN. For water supply project in Vinh Long, Vinh Ha commune is the project group II, the monitoring report and EMP's implementation will be evaluated and approved by Environment Management Department in accordance with the institutional framework for Environmental management and protection.
Internal Supervision	Supervising the contractors during construction, including the implementation of the environmental management activities in the environmental action plan.
Independent Supervision	Independently supervising the implementation of the environmental management plan.

5.4 Conclusion

Since the process of assessing the environmental impacts of water supply system project in Thuong Thoi Tien town, the conclusion is:

- Water supply system project in Thuong Thoi Tien town is a project to positively improve the environment, bringing the fresh water to every household, contributing to gradually narrowing the gap between rural and urban.
- General environmental impact of the whole project is positive and will be an important step in improving the conditions of water supply, environmental sanitation, improving the health of communities in the region, helping to prevent and eliminate disease, reducing the rate of diseases due to non-sanitation water quality. This is the most important factor that the project gives to the local people;
- The social economy, the project creates the favor condition for people in life and production, promoting the conditions for development activities in the project area.
- The negative impacts of projects in place or at the local scale will be mitigated by the method of technology, management and supervision.

6. FIRE PREVENTION AND SAFETY

Fire prevention and environmental protection is one of the mandatory requirements for all projects, it must not have any trouble in any construction process, as well as during system operation process. When research to map out the project for construction investment that should take the necessary measures for fire prevention, environmental protection. The analysis of the possible causes, finding the solutions to prevent, minimize the bad impact on the environment and people is essential. From the evaluations above, need to have the specific requirements for each phase of the projects as follows:

- In step of setting up the constructional investment projects and technical design that need to follow the proper procedures, standards and norms of the constructional industry.
- During construction, the contractor should take the adequate measures and construction schedule as well as strictly complying with the regulations on labor safety and environmental protection which are required. The management process construction, monitoring and coordinating between the parties from the Investor, Supervision Consultant, Company in charge of construction and local authority that must be very tight and uniformed. The work arising out of construction methods in the bids that must be passed by the responsible parties for consideration and approval.
- The comissioning of the project must take the adequate safety measures and have the guidance document for the necessary operation. This process must be strictly monitored by the concerned parties and especially the relevant agency for management and system operation in the coming time.
- When hand over the project to the management and use relevant agency. Contractor must hand over all the operation-guided documentation in line with the technology transfer programs and instructions for Operator. The process of

technology transfer and operation guidelines for workers as well as the materials used for the operation must be designed through consultancy.

- When accept the work, the relevant agency for managing and using the work must operate it in accordance with the guidance documentation. During the warranty period of the Contractor if any problems arise not in the guidance document that should be immediately reported to the Contractor for solving.

1.3 Total investment cost

Total investment cost for project is presented in annexes of this report, this section only shows the brief information in the following table:

Table 11: Total investment cost

No.	Work Items	Amount (1000 VND)
1	Raw water pumping station	2,830,000
2	Raw water pipeline	155,264
3	Water treatment plant, capacity 3000m ³ /day	15,101,833
4	Distribution pipeline	12,155,442
5	Indirect investment cost	2,874,339
6	VAT	3,311,688
7	Contingency (10%)	3,642,856
8	TOTAL – ROUNDED (1000VND)	40,071,421
9	IN EURO	1,541,209

2. FUNDING SOURCE

Capital structure of the project shall be determined on the basis of the current regulations of the Government of Vietnam, the financial principles of the project and the general principles of the sponsor as follows:

- Fund of Italia Government for the main materials such as: Raw water pump, distribution/transmission pipeline, volume meter...
- Counterpart fund of MOF and Dong Thap PPC for the remaining works (including investment preparation, site clearance and taxes).

From the estimate of investment cost, fund structure of project is identified and presented according to items. The cost distribution tables provide detailed information for items.

Table 12: Fund structure for project

No.	Work item	Italy fund (VND1000)		
		Italy fund	Counterpart	Total
1	Source work	1,750,000	1,080,000	2,830,000
2	Raw water pipeline to treatment plant	105,179	50,085	155,264
3	Water treatment plant, capacity 3000 m ³ /day	10,175,000	4,926,833	15,101,833
4	Distribution/service/household pipeline network	-	12,155,442	12,155,442
5	Indirect investment cost	-	2,874,339	2,874,339
6	VAT (10%)	-	3,311,688	3,311,688
7	Contingency (10%)	-	3,642,856	3,642,856
8	TOTAL (1000VND)	12,030,179	28,041,244	40,071,421
9	EURO	462,699	1,078,509	1,541,209
	Rate %	30.02%	69.98%	

3. FINANCIAL MECHANISM

Project is to be implemented through two 02 capital sources :

- Aids in goods from Italy Government : the Project Owner shall use this capital as the capital allocated from the state budget.
- Counterpart funds from the Ministry of Finance and DongThap Provincial People's Committee : for the counterpart funds, it shall be used as per the budget law.

So, the financial mechanism can be deemed as the allocating mechanism from the state budget

IV. TOTAL INVESTMENT, CAPITAL STRUCTURE, FINANCIAL PLAN

1. TOTAL INVESTMENT COST

1.1 Overview

Determining the total investment cost, financial mechanism of the project is one of the important steps. Based on the volume of work proposed in the technical chapter to calculate the total investment. Besides, determining the financial mechanism for the project is one of issues that has the significance to decide the efficiency of the project in the view of the finance and economics.

1.2 Basis for preparing the total investment cost

Currency and exchange rate : items in total investment shall be calculated in Vietnam currency, then shall be converted into EURO at the exchange rate promulgated by the State Bank of Vietnam at the quarter IV period of 2012 which shall be 1 EURO = VND 26,000.

Price change level: Total investment shall be calculated to the earlier periods of 2014 when completing the works to be put to use, with the annual price escalation of 5 % with Vietnam currency.

Investment and building period: The investment and building period shall be calculated from May 2013 to the end of 2014. The due borrowed funds shall be determined on the basis of the construction schedule and using the corresponding capital

Tax and financial obligations: the project shall be invested by the aids in goods from Italy Government (ODA) and domestic counterpart capital; hence, the project must comply with the regulations and policies on tax, the current state financial obligations which stipulate for the ODA funds using projects.

Contingencies: including the contingencies for the arising works during the project executing process, the deviations due to the calculation and price escalation. The contingencies shall be calculated to be 10 % for all cost items.

Other laws and regulations:

- Unit price for works construction- the construction of Dong Tha province issued according to Decision No. 1728/2006/QĐ-UBND dated 27/6/2006 by Dong Thap PPC.
- Based on construction survey unit price of Dong Thap PPC issued according to Decision No. 45/2006/QĐ-UBND dated 24/08/2006 of Dong Thap PPC.
- Based on the Decree No 112/2009/ND-CP dated December 14th, 2009 of the Government on the management of the works investment cost.
- Based on Circular No.04/2010/TT-BXD dated 26/05/2010 of MOC guiding on preparing and managing work total investment cost.
- Decision No. 957/QĐ-BXD dated 29/09/2009 of MOC on announcement about rate of work management cost and cost for consultancy on work construction investment;

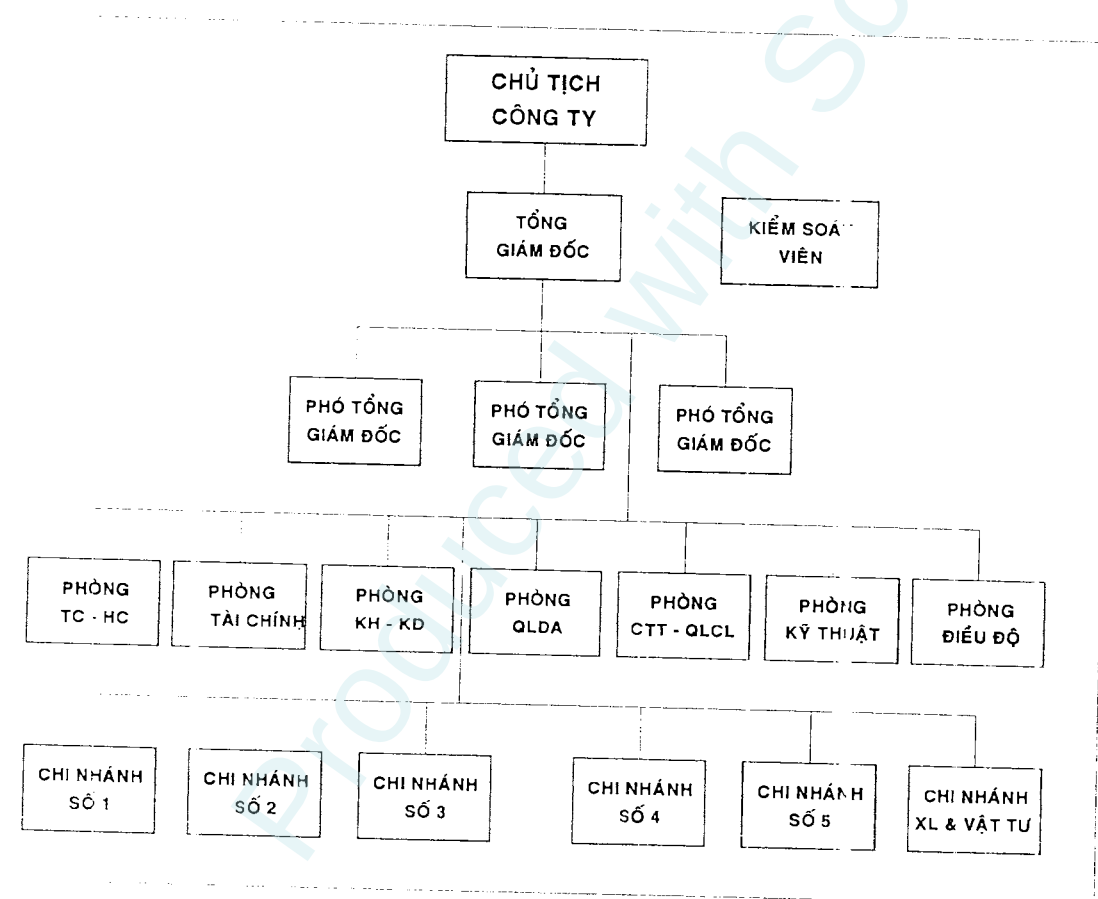
PROJECT MANAGEMENT, IMPLEMENTATION, AND OPERATION

DATA ON PROJECT EXECUTING AGENCY

stitution

implementation method will follow the Decree No 12/2009/ND-CP dated 2009 of Government on management of the works construction investment. Regarding the investment needs and works construction into consideration, the project shall delegate the authority to the Provincial People's Committee, which shall delegate the power to the project owner to manage and use the capital for construction investment.

Project Owner is Dong Thap Water supply and Urban environment One Co., Ltd. At present, Dong Thap Water supply and Urban environment One Co., Ltd. consists leaders and 07 divisions and 06 branches. The organization structure is as follows:



sional and financial aspects

Project executing agency (Dong Thap Water Supply and Urban Environment Co., Ltd.) is the state business engaged in the clean water manufacturing field to

be supplied to local people. The business product is the clean water, which is supplied for local consumption in Dong Thap province.

- According to the latest report by the company, the monthly revenue that it can obtain from the clean water trading activities is about VND7 billions per month.
- The clean water tariff at present is applied according to Decision No. 16/2011/QĐ-UBND dated July 7, 2011 on announcement of clean water tariff for living, production and business on area of Dong Thap province, including:
 - Domestic clean water tariff for the poor (has certificate) is VND4,500/1m³ applicable for 12m³, from the 13th m³, applying water tariff VND6,000/1m³.
 - To other users such as student, pupils, state officers or employees: apply price VND6000/1m³.
 - Clean water tariff for business and production: VND7000/1m³
- The main equipments and tools mostly are car, motorbikes, equipments in water sector such as pump, valve, pipe, etc.

2. PROJECT IMPLEMENTATION MANAGEMENT

2.1 Project implementation management

Organization of the management of the project implementation is divided into 03 stages:

- Preparatory stage for investment
- Stage of implementation of investment
- Operation stage.

2.1.1 Investment preparation stage

The project owner (Dong Thap Water Supply and Urban Environment One Member Co., LTD) has assigned the Representative to the project owner, being PMU of Dong Thap One Member Water Supply and Urban Environment Co., LTD to carry out the works regarding the investment preparation such as organization of the project preparation, submission, and project approval; preparation and approval of the bidding documents, assessment of the bids; organization of land acquisition, compensation and resettlement etc.

2.1.2 Construction investment stage

PMU is Dong Thap Water Supply and Urban Environment One Member Co., Ltd shall continue to perform the works including: organizing the negotiations, contract signing with the bid gaining Units; organizing the implementation of the civil building contract for completing the works; organizing the bidding or appointing the unit to perform the supervision of the construction, payment of the works items, hand over of the works to the Project Owner for management and operation of the exploitation and use of works etc.

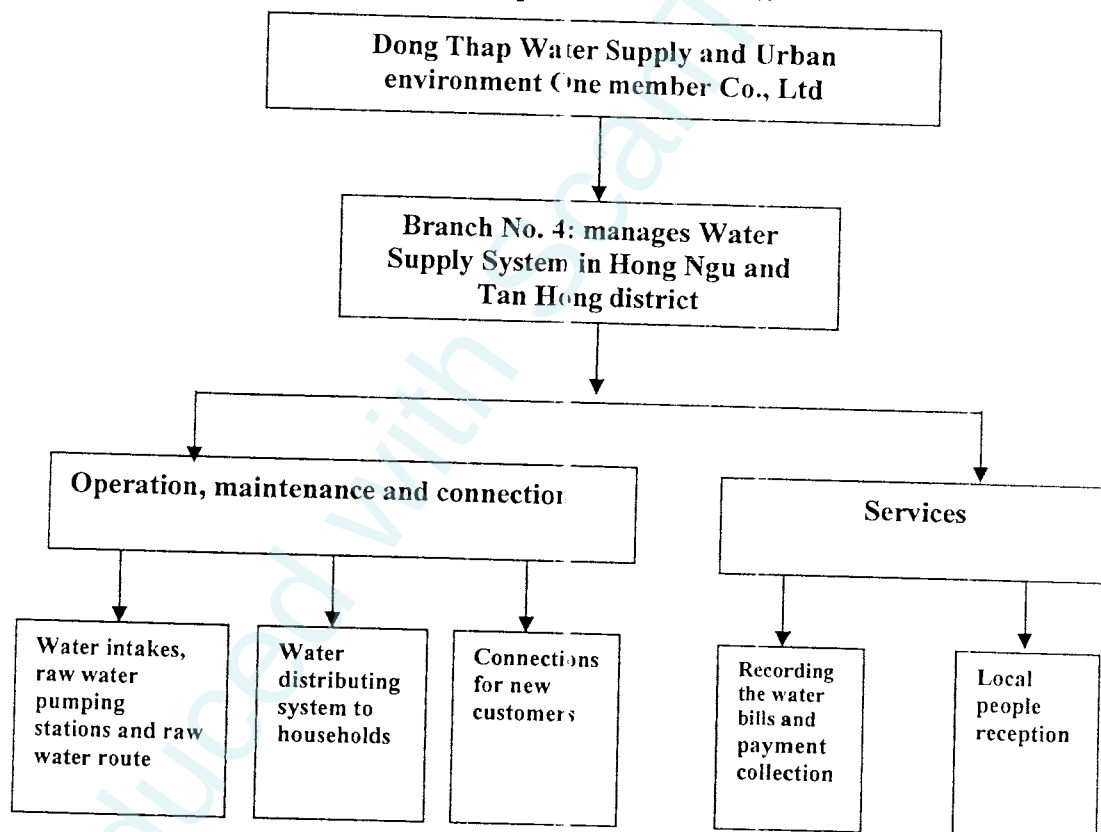
Upon completion of works, PMU shall hand over the owner the water supply system and the owner shall organize the operation and exploitation.

2.1.3 Operation management stage

Operation is a very important stage to the life circle of a project. Hence, selecting the method and method of management of the system operation is very necessary and has great significance.

At present, Dong Thap Water Supply and Urban environment One member Co., Ltd. has assigned Branch No. 4 to manage Water Supply System in Hong Ngu and Tan Hong district. With the existing capability and experience, we recommend that the management of Thuong Thoi Tien town water supply system after being completed be undertaken by Branch No. 4. The main activities of water supply enterprises shall be management of the operation, maintenance of the water supply system, the raw water station, the treatment stations, water connections to households, recording the monthly water bills, etc.

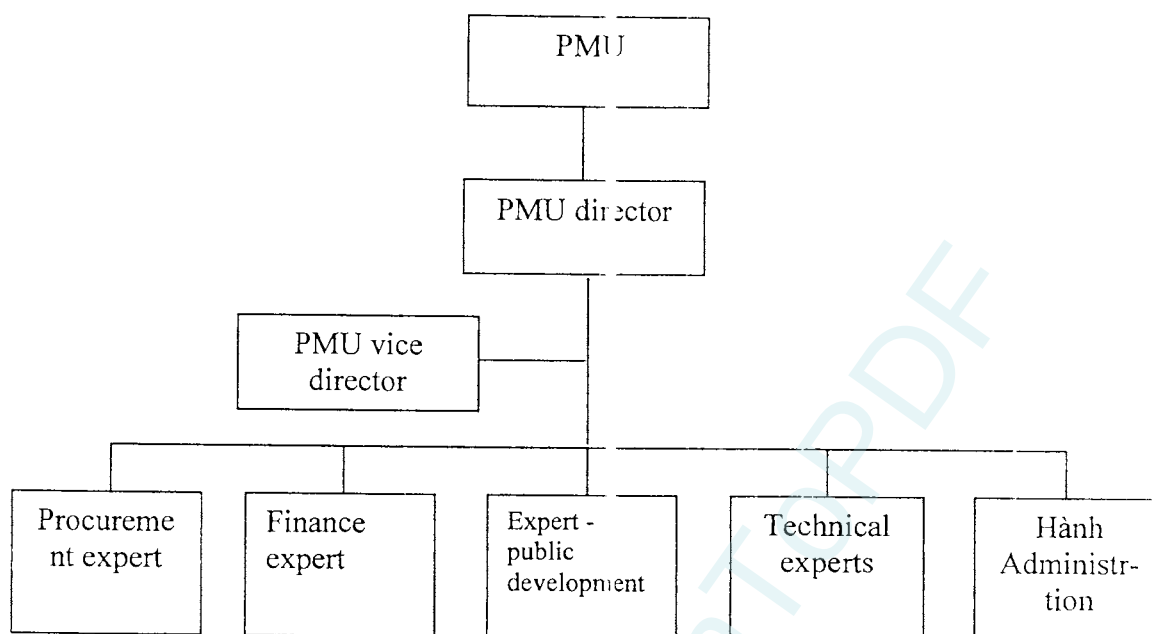
Organizational structure of the enterprise is as follows:



2.2 Human management

As above mentioned, in order to perform this project, Dong Thap Water Supply and Urban environment One member Co., Ltd. (project owner) had assigned PMU under Dong Thap Water Supply and Urban environment One member Co., Ltd. to perform project management, arrange staff and preparation for investment. Main functions of PMU at investment preparation phase are such as Prepare project, submit for project approval, prepare Invitation for bids, approval of bidding result etc.,

Staff arrangement for PMU to carry out the project is highly important, decisive for effectiveness and project progress. For project performance, staffs are arranged as follows:



Role of contractors

In order to perform work scopes of Project, besides role of PMU, other managing authorities and departments, contractors shall carry out project work scopes which play important role and significant in project quality and progress. Based on each phase, contractors and their roles are presented as follows:

Consulting contractor of investment preparation: To provide services in terms of engineering, human resources to perform survey, basic design, prepare invitation for bids, basic design for project; submit competent agencies, authorities for approval. This is a key important phase during project performance. Role and characteristics of this Contractor has decisive roles to quality of the works, project progress, having influence on effectiveness of economic- technical, and financial-social aspects affected by project.

Contractor of design - construction of the works: This contractor is selected through widely bidding; This Contractor is ensured to execute 02 main tasks (i) To provide engineering services and staffs to carry out investigation, detailed design of work items according to the ratified basic design; (ii) To provide, install, construct work items in accordance with the detailed design approved by PMU. Role of this Contractor is also very important, having directly influence on construction quality of the work, life service, stability, artistic designing and engineering of the work.

Construction supervision contractor: To provide staffs to execute construction supervision of erection, construction contractor. This is a important task, objective in controlling quality of erection construction contractor. This contractor represents PMU to perform checking, construction supervision at site. Such contractor ensures that the works shall be constructed in accordance with design, working safety, complying with legal regulations as well as regulations, codes about construction.

2.3 Consultant's role

So as to perform investment preparation, PMU themselves can execute their work scopes or hire experienced and capable consultants to assist PMU in performing work scopes before investment. Consulting contractor assist the investor in work scopes: Assist

PMU in supervise activities of contractor in charge of investment preparation; control quality, progress of products by consultants of investment preparation; assisting PMU during bidding consideration, evaluating tender dossiers for erection, construction; helping PMU with legal procedures to perform this project.

This technical assistant (TA) are those has important roles in assisting PMU to assess and execute work scopes of the project.

2.4 Roles of organizations related to project

Work scopes of the project are classified from the Central to local level.

- 1) The Government: Consider frame agreement between the Government of Vietnam and the Government of Italy. Operate macro operation in terms of management and using ODA capital.
- 2) Ministry of Planning & Investment: Liase, in charge of work scopes about project performance funded by ODA capital: Instruct authority in charge to set up list of porgrame, project requiring ODA funds of each authority so as to summarize into List of requirements of ODA fund, submit the Prime Minister for approval.
- 3) Ministry of Finance: Officially representing “borrower” i.e The State or the Government of Socialist Republic of Vietnam in international conventions about ODA borrowed funds. Previde over financial work scopes: issue regulations of regrant a loan, allocate, financial conditions and mechanisms, etc.
- 4) Relevant ministries, departments: Collaborate with Ministry of Planning and Investment to give ideas and perform work scopes related to the State policies for projects funded by ODA. Execute the State administration functions for programes, project in compliance with legal regulations. When needed, to be responsible for considering and giving ideas in writing about matters related to programe, project within required time.
- 5) Dong Thap PPC : coordinate with MONRE ain submitting to Goverment to sign international agreement regarding ODA for related program, projects ; Ensure quality and outcomes of ODA fund managed directly by local authority ; Responsible for land acquisition, site clearance and implementation of compensation and resettlement policies in accordance with laws.
- 6) Dong Thap Water supply and Urban Environment One member Co., Ltd. – Project Owner :
 - ✓ Prepare, submit and approve project ; manage site clearance and compensation, hand over works ; prepare and submit procurement plan, bidding documents ; procure, evaluate procurement and aprove procurement results for approval of PPC.
 - ✓ Sign and implement contract with selected Contractor in accordance current laws.
 - ✓ Prepare document to assign or lease land for construction of works.
 - ✓ Coordinate with local authority to implement land and crops compensation, site clearance and site hand over in accordance with schedule.
 - ✓ Coordinate with related agencies to in-time solve related works in implementation process.

2.5 Role of sponsor

This project uses aid given gratis by Italian Government and counterpart capital, so role of Italia foundation is also important. Italian Government will consider and approve the project after approval by Dong Thap People Committee. Check, evaluation and supervision of the project will be carried out by the Foundation during project performance.

3. PROJECT IMPLEMENTATION PLAN

To perform well the work scopes of project, all relevant departments, agencies must participate and take their responsibility of the project.

According to regulations of Vietnamese Law, project management and execution shall comply with Decree No 12/2009/NĐ-CP dated 12/02/2009 by the Government on managing pre-feasibility study projects.

For execution, the project can be divided into three phases: Phase of investment preparation, investment phase and phase of operation, management. Corresponding to each phase, responsibility of relevant parties, other departments, agencies and authorities may have different responsibilities but they must agree with the work scopes to be done.

Table 13: Project schedule

No.	Content	Completion date
1	Prepare feasibility study project, basic design	09/2012
2	Detailed design, prepare total cost estimation, prepare bid document for construction	12/2012
3	Bidding consideration, approval on bidding result, contract negotiation	04/2013
4	Construction, erection of the works	05/2013-11/2014
5	Training, instructions on operation, test run, hand over the works	12/2014

4. PROCUREMENT PLAN

4.1 Overview

Bidding shall be done in compliance with Law on bidding No 61/2005/QH11 dated 29th November 2005 by the National Assembly of The Socialist Republic of Vietnam on Bidding and Decree No 85/2009/NĐ-CP dated 15th October 2009 by the Government on instructions on implementing Law on bidding and selecting construction contractor according to Law on construction.

4.2 Requirements

Priority: No priority form dedicated for contractors.

Procurement advertisement: Notice on bid invitation must be publicized in bidding newspaper for three consecutive periods and publicized in electronic communicative page about bidding and may be publicized on public communicative means for more convenient for approaching by concerned individuals and organizations.

Bid opening and evaluation: Bid document will be opened in public and instructions shall be noticed in advance. Bidding evaluation must comply with criteria declared in bid document and contract shall be awarded for contractor with the lowest cost. Contractors

- ✓ Settlement, submit settlement.
- 7) PMU, Dong Thap Water supply and Urban Environment One member Co., Ltd. – Representative of Project owner:
 - ✓ On behalf of Project owner implement all works such as : Prepare, submit project, survey, site clearance compensation, resettlement, prepare and submit bidding document, bidding evaluation, etc.
- 8) Responsibility of consultant :
 - ✓ Carry out the pre-investment works (survey, socio-economic survey, prepare FS, basic design, etc.).
 - ✓ Support, implement related works of bidding doc, bidding evaluation
 - ✓ Support Project owner in contract selection, negotiation and signing process. Consultant helps Project owner by reporting frequently.
 - ✓ Supply the necessary information, take responsibility in work construction process.
 - ✓ Consider, review options, plan submitted by contractor. Propose to Project owner the good
 - ✓ Support Project owner in review, identification of quantity and quality of construction items. Inform on time to project owner in urgent cases.
 - ✓ Prepare technical, financial document, etc. to form legal basis for construction, handing over and operation of work
- 9) Relevant authorities:
 - ✓ In order to implement project in accordance with schedule, Project owner needs close coordination with agencies, units and departments such as People Committee, Department of Planning and Investment, Department of Construction, Department of Natural Resources and Environment, Department of Finance, relevant Commune's People Committee etc., to solve timely work scopes such as finance capitalizing, asking for construction permission, compensation, treatment of underground works, payment, liquidation etc.

who participate will not be stood out the evaluation process because of minor differences and non-consierable details.

Apprail contractor's capability: In order to get re-appraisal result of capability, contractor must satisfy stipulated requirements as set forth.

Standard documentation: Standard documentation about prequalification of capability. ability/ appraise of contractor's capability will be applied.

4.3 Form, method and division of bidding packages

4.3.1 Procurement method

Procurement bidding for work items, equipment, facilities and services for the project shall comply with general instructions about procurement bidding of the Foundation and the GoV. Subject to value of packages, possible to refer the following forms:

- (a) International competitive bidding (ICB): For construction erection contract with its value more than 2 million of USA or value of equipment exceeding over 500,000 USA, bidding procedure will be done for Vietnamese and international contractors.
- (b) Local Competitive bidding (LCB): For construction erection contract with its value from 100,000 to 2 million USA. bidding procedure will only be done for Vietnamese contractor.
- (c) International shopping (IS): With equipment contract with its value from 100,000 to 500,000 USA, bidding procedure will be done by take pricing by local and foreign capable contractors.
- (d) Direct Procurement (DP): For work items, equipment and service with their values estimated less than 100,000 USA, bidding procedure will be done by take pricing by take pricing by competent companies.

4.3.2 Procurement method

Bidding compries of 01 dossier.

4.3.3 Package division

Based on features of the works and regulations of relevant parties, especially to ensure project progress, soon put the works into operation, and project will be divided into the following sub packages:

- (i) Package of procurement belongs to Italian capital: Including main facilities, equipment, materials belonging to Italian capital.
- (ii) Package of procurement belongs to local capital: Including domestic equipment, materials (the remaining materials, equipment do not belong to Italian capital).
- (iii) Package of work items construction inside the plant: Including work items such as treatment complex, storage tank of fresh water, water tower etc.,
- (iv) Installation, assembly package of technological pipelines inside water plant and water supply network: Including water supply pipeline inside water plant, water tank and network of distributed water pipe, serviced water supply, connecting to building within the project scope.

4.4 Good procurement plan

Based on bidding forms, package divisions and value of each package, we schedule to propose the following table of bidding plan for procurement:

Table 14: Procurement plan

No. contract	Package	Type of contract	Contract value (EURO) ^(*)	Contract value (VNĐ) ^(*)	Milestone		
					Bidding invitation	Bidding assignment	Completion
QT/01	Package procurement	of NCB	852.784	22.172.376	01/2013	04/2013	11/2013
QT/03	Package of work items for construction of raw water pumping station and wastewater treatment plant	NCB	215.651	5.606.918	01/2013	04/2013	11/2014
QT/04	Installation and construction package for pipeline system	NCB	94.740	2.463.244	01/2013	04/2013	11/2014

(*): Exclude contingency fee and VAT

5. PROJECT OPERATION

5.1 Operation agency

As presented in part 2 of this chapter, authority, agency who perform the project is Dong Thap Water Supply and Urban environment One Member Co., Ltd. to project operation phase, Dong Thap Water Supply and Urban environment One Member Co., Ltd. will assign Branch No. 4 (manage water supply in Hong Ngu and Tan Hong district) to receive management, operation and maintenance of the project.

5.2 Institutional development

5.2.1 Principle

Components to develop the system will enhance capability for Branch No. 4 so that they can manage water supply system effectively.

To assist enhancing capability for such authority, help them to manage effectively the existing water supply system and new construction owing to this project, system development component will assist to develop system, skills and face of authorities more developed.

Mode of setting up collection resource from fees for fresh water supply. Managers and staffs must be capable and enthusiastic. Operate infrastructures and equipment effectively and stably. Improvement level of service, separate other benefit public services. Improvement of management capability is aimed to meet principles of the market economy independently and strength in finance.

5.2.2 Enhancement capability for PMU

Training program of enhancing and developing capability for PMU: This is a project related to many agencies, authorities, so it is required to develop capability for the PMU to operate and manage project in effective way.

Equip managing facilities for office work such as office, computer, for department of investment project preparation. In order to achieve the previously mentioned aims, the activities will be performed at the following areas:

Management, equipment and systems

Computer and office equipment are suitable for managing communication to control activities and operations, accounting, issue invoice, store, operate and maintain other daily activities.

Accounting system in computer is aimed to support the application of method "concentrate fees" in financial management.

System of information management in computer and set up control plan of activities

Macro management,

Management and maintenance of drainage system,

Management and maintenance of waste water collection system,

Observation and control system.

Training

Training is one of the key strategy to develop knowledge and professional skills for managers and staffs in water supply.

Training program will be executed in the following areas:

- + Coaching senior staffs
- + Enterprise aims, monitor activities and prepare development plan
- + Management and prepare financial plan
- + Management and customer service
- + Management and human resource development
- + Supervision and manner of execution
- + Communication system about water supply works.
- + Site survey for water supply.
- + Management of water and environment quality.
- + English, computer and other business skills.

Special activities

Together with providing systems, equipment and training sources, component of system development also assists some other activities through workshops, group discussion and or direct consulting, including:

- + Planning human resources
- + Build up financial plans for long term business development.
- + Build up price table proposal about drainage fee to achieve financial self control.

- + Survey households about attitudes, aspiration and opinions from customers
- + Compose documents related to public relations to support direct exchange with the public
- + Plan visits to exchange and study and ask for ideas, opinions as well as observe effective operation models.

5.3 Operation and maintenance

After project has been completed and handed over the works to the owner, one document (or hand book) instructing management and operation will be handed over by the Contractor to the Owner to instruct ways as well as management measures, operation of works in the project.

Operation and maintenance need to be done well to protect value of technical infrastructure system, to ensure operation capability of the works, environment conservation as well as maintain adequate service level.

For water supply network, one of the main activities is to check drain level on pipeline to maintain hydraulic capacity as well as water supply ability.

Raw water pumping station, water plant need being checked daily. It is scheduled that operation and maintenance of pumping station, treatment station will be operated by trained senior staffs of Hong Ngu Water Supply Enterprise.

By existing capability and experiences, operation and maintenance of water supply at Thuong Thoi Tien town will be performed well and effectively by Hong Ngu Water Supply Enterprise.

VI. PROJECT OUTCOMES AND IMPACTS

1. INVESTMENT OUTCOMES

1.1 Financial analysis

1.1.1 Water price determination

a) Water price plan

The plan for collecting water cost will be calculated according to the price structure for water supply services. Accordingly, the determination of prices towards cost recovery, enough to pay for management and operation of water supply system and has a part devoted to the construction, repaired major works on the system.

b) Depreciate fixed assets on water supply project.

According to the Decision No. 206/2003/QĐ-BTC, all fixed assets including fixed asset investment of state has also to calculate the depreciation on business costs. Depreciation is computed for the upgrading, repair major projects throughout the project life cycle.

In accordance with this decision, the depreciation period for different fixed assets and the variation is quite long, whereby:

- + Machines and equipments: 5-12 years,
- + Storage tank, courtyard and road: 5-20 years
- + Solid houses : 25-50 years
- + Pipe, drainage canal : 6-30 years
- + Thus, if the shorter depreciation, the higher price is but must depend on the actual quality of the work to calculate the depreciation period properly. So for this project we divided into 03 categories of fixed assets and depreciation period as follows:

Construction works (housing, the housing cover works, 25 works 25 năm related to construction, etc.)

Items related to pipelines, canals 20 years

The machineries, equipments, etc. 10 years

Thus, the calculation of the depreciation of the building is required and must be calculated into the cost of clean water.

c) Management , operation and maintenance expenses

The determination of cost management , operation and maintenance is important because it relates to the determination of water prices.

Table 15: Management and operation expenses

STT	Work items	Unit	Amount
1	Electrical energy expense within 1 year		591,300,000

	Electrical energy expense for raw water pumping station	Kw	236,520,000
	Electrical energy expense for treatment plant	Kw	354,780,000
2	Chemical expense		
	Disinfecting clo, rate 1,6 g/m ³	kg	14,892,000
	Alum expense 50g/1m ³ doses with alum content of commercial purity 50%)	kg	517,387,500
3	Cost of minor repairs in one year (5% depreciation value)	Item	118,923,353
4	Labour Salary within 1 year	Manday	273,750,000
	Total (1+2+3+4):		1,516,252,853
	General administration expense within 1 year	Item	75,812,643
	Total (rounded):		1,592,065,000
	Management and operation expense for 1m ³ clean water (VND)		1,454

The cost to produce 1m³ of water (calculated for living activities) is VND 1,454. this is the important bases for determining the cost of clean water.

d) Caculating for clean water price

Elements for water price include:

- Operating cost
- Depreciation expense

Genral principle for determining water price

- Caculate accurately and sufficiently to guarantee the return of loan and operating cost & maintenance, including interest norms.
- It must be based on the affordability of consumers. Affordability is usually assessed on household income. Fee for the water use accounts for 3-5% of income is reasonable and this ratio is applied by the international lending institutions.
- Water price will be adjusted to ensure financial effectiveness and ensure that project owner can balance revenues and expenses and feasible project. In theory, the production and operation cost will be different anually (usually increases), inflation may be different. So in this project, the water price was proposed to increase every 5 years. Of course, the actual price of water must be determined by the Provincial People's Council and PPC to ensure the project is beneficial and financially feasible, we expected to set up the plan every 5 year.
- Approved by the Provincial People's Committee inccordance with the price framework issued by the Ministry of Finance.
- The price water as below:

Table 16: Elements for water price

Giá thành nước sản xuất	(1) Direct investment	1.1 Chi phí điện 1.2 Chi phí hoá chất 1.3 Chi phí Nhân công 1.4 Chi phí sửa chữa nhỏ 1.5 Chi phí quản lý chung
	(2) Depreciation	Fixed asset depreciation
	(3) Taxes and fees	3.1 VAT 3.2 business income tax
	(4) Assess benefit	Assess benefit over 1m ³ water sale

From the elements above, clean water cost is calculated in the following table below (calculated separately for living activities)

Table 17: Clean water price caculation

No	Expenses	Unit	Amount
I	Direct expense		
1	Electricity expense	VND/m ³	540,00
2	Chemical expense	VND/m ³	486,10
3	Labor cost	VND/m ³	250,00
4	Upkeep, secondary repair	VND/m ³	108,61
5	General administration cost	VND/m ³	69,24
III	Fixed assest depreciation		
1	Depreciation	VND/m ³	2,172,12
IV	Total		3,626,06
V	Assess profit and business income tax		
1	Assess profit 3% (IV)	VND/m ³	109
2	Business income tax (25% Assess profit)	VND/m ³	27
VI	Pretax price VAT (IV+V)	VND/m³	3,762
	VAT (5%)	VND/m ³	188
	Clean water price for living activities	VND/m³	4,000

So, the cost of clean water is calculated VND4.000/1m³ (at the time of 2014-the work come into use)

Water price is calculated to satisfy the criteria for accurate to ensure full cost operation management, adequate depreciation costs, sufficient to pay interest and refund

original loan and ensure Project owner gets benefit to pay tax for the State. The price of clean water also must be compatible with the affordability customers, accepted by customers. But in reality the price of clean water increase and the water price plan is decide by Provincial People's Committee consistent with the price bracket issued by the Ministry of Finance.

To ensure the operation effective project financially throughout the life cycle of project, we propose price and water rate as follows:

- Water price for living activities is VND 4,800 /1m3
- Increase water price is every 5 years.
- VND1,500 for each time.

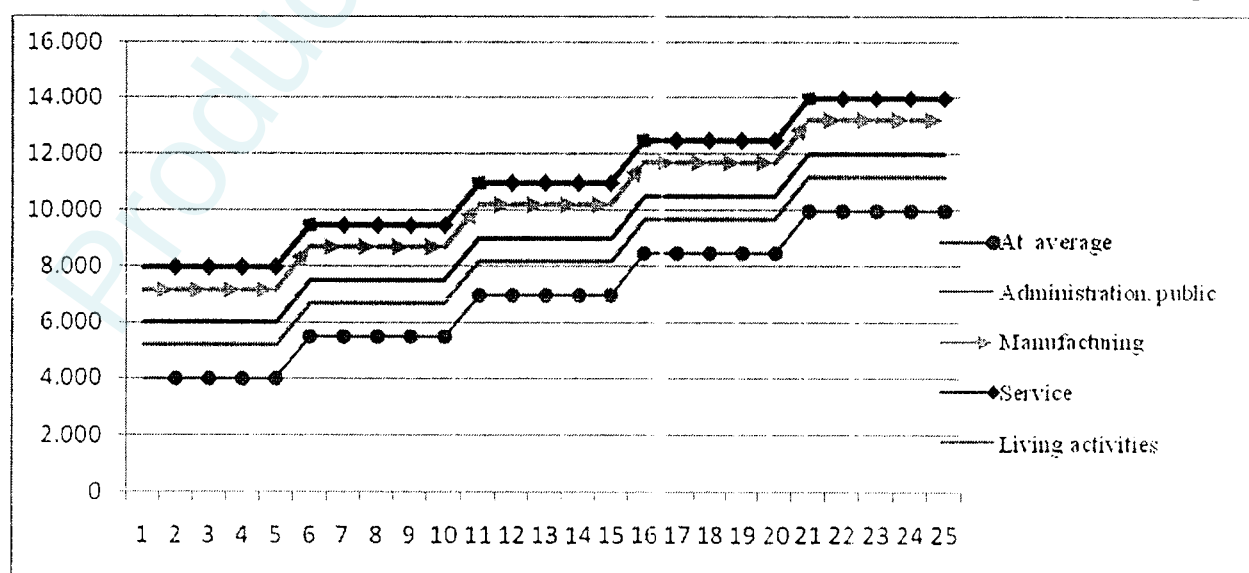
In fact, there are many different objects using water and water price for these subjects are also different. Therefore, based on actual use of objects as well as the proportion of the water system in Dong Thap, we have made reference table for determining the selling price of each object.

Table 18: Clean water price for diffirenet objects

No.	Object	Rate %	Clean water price
1	Living activities	65.0%	4,000
2	Administration, public, school, hospital etc.	5.0%	6,000
3	Manufacturing, building basically, enterprises etc.	15.0%	7,200
4	Business, service, restaurant and other services	15.0%	8,000
	At average		5,180

Increase water plan is expected every 05 years as discribed above, the price and price increase plan are decided by Provincial People's Committee.

Figure H-7: Water increase plan



1.1.2 Financial analysis

a) Overview

Financial analysis project is to estimate the level price of the financial recovery of the research project that needs to save and follow profit aspect of the project owner. Input of project is evaluated in terms of market price. This input is called “financial expense”. In this case, it is said financial benefits like significant revenue from the operation of the project in terms of collecting money from selling water.

Costs and financial benefits through the project life are compared in terms of current prices. If the current total value of project costs balanced with the financial benefits (when the rate on the cost benefits - $B/C = 1$), the depreciation rate is used to calculate the current value, which is called the financial internal return rate (in short FIRR).

The financial costs include: direct funding for direct construction, taxes, compensation for site clearance, risk costs, management costs and technical costs. However, price inflation is beyond the financial cost.

FIRR is calculated and used as an indicator mainly about the feasibility of project with the financial net present value (FNPV) and the ratio of B/C. FIRR is determined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_{ft}}{(1+R_f)^t} = \sum_{t=1}^{t=T} \frac{B_{ft}}{(1+R_f)^t}$$

Of which:

T: The ending year of project

C_{ft}: Annual financial cost of the project researching in year T

B_{ft}: Benefit of the project in year T

R_f: The rate of payback

In this case, life circle of water supply project is 40 years as in the economic evaluation of improvement projects.

Then, the capacity of project owners in the operation and maintenance should be determined in proportion to B/C using capital flows from operate and maintenance costs, repair costs, and revenues from fees above the operation of projects, and maintenance is often done by the project owner. Ratio B/C is determined by the following formula:

$$B/C = \frac{\sum_{t=1}^{t=T} \frac{B_{ft}}{(1+R_d)^t}}{\sum_{t=1}^{t=T} \frac{C_{omr}}{(1+R_d)^t}}$$

Of which:

T : The ending year of project

C_{omr}: operate and maintenance costs in year T

B_{ft} : annual profit in year T

R_d : reduction rate

b) Financial analysis results

Financial analysis work done through job:

- Determine the fixed assets depreciation.
- Determine the manufacturing cost and operating management.
- Determine the water price
- Determine the revenue from water
- Caculate the monetary flow
- Caculate flow of money

The life cycle of project estimated 25 years based on fixed assets depreciation according to prevailing Law of Vietnam.

Financial analysis results:

FIRR:	10.21%	Greater than the inflation rate, which is assumed to be 5%
FNPV:	16,697	(1000 VNĐ)

Thus, the water supply system project in Thuong Thoi Tien town is financially feasible.

1.2 Economic Analysis

1.2.1 Overview

This project brings economic benefits are tremendous social sector projects, the beneficiaries from the project perspective of economic analysis is not only objects but also the owner using water project and Government. In this section we will present the evaluation of the economic benefits brought by the project.

1.2.2 Economic Cost

Project cost is determined through technical research, including capital costs, maintenance costs and annual operation increase. These costs are calculated on the end of 2009.

The financial costs are converted into economic costs, using prices and implicit conversion factors. Conversion factor for skilled labor is not assumed to be 0.7 and for goods and services purchased abroad is 1.31. The economic opportunity costs for capital are set at 12% similar to other projects in Vietnam.

1.2.3 Economic Capital

Capital investment plans are adjusted conversion value of them through economic factors impact the following:

- Ratio of value added tax applied to 10%, according to Value Added Tax Law (Amendment) No. 07/2003/QH11 17/06/2003, for the expenses for the import and purchase in the country.
- Score domestic price adjustment costs 1:00 for investment from domestic spending in domestic currency, the assumption of socio-economic system is the inflation rate at 5% a year.

- For individual projects have to calculate VAT in calculating the economic model. VAT purchase goods, construction and installation are eliminated.

1.2.4 Production cost

The production costs are calculated similar to the model of financial analysis. Production costs have not read any accounts in foreign currencies. Value added tax does not apply to the production costs of domestic raw materials, including energy costs, chemicals and technical maintenance costs annually. Cost allocation includes an annual depreciation of investments and loans payable.

See details in the annexes (Planning and depreciation costs of annual economic output).

1.2.5 Economic benefits

Economic benefits of the project are divided into the quantifiable benefits and are unquantifiable benefits. This depends on the availability and quality of data and information. The quantifiable benefits can include:

- The use of direct benefits, as measured by the social benefits from increased output but low water price.
- The benefits of consumer surplus is more interest in social welfare arising from higher consumption (per capita as well as the number of consumers) at a lower price and selling when prices are not expected project.
- The public health benefits arising for medical expenses, medical, etc., and when production increased by reducing the number of sick leave.

These benefits are estimated from the period 2014 - 2038. Here are the calculation results when there are projects of economic benefit.

The average water consumption levels

In calculating the economic analysis of clean water consumption was the same as applied in calculating the financial analysis of projects.

Rates of application

Similar models of financial analysis, business value of 5,472 đ/m³ average in the first years of operation (2014), the expected price will increase in accordance with a fifth year and once last year to operate (2038) the average price of about 11,472 VNĐ/m³. Corporate income tax to the tax rate is 25% for water products, according to Enterprise Income Tax Law No. 09/2003/QH11 17/06/2003.

Consumer surplus

Surplus of annual consumption is estimated with the assumption:

- The increase in annual water demand in the absence of the project is approximately 2%.
- Score increased cost of water per year when no project is 1.05.

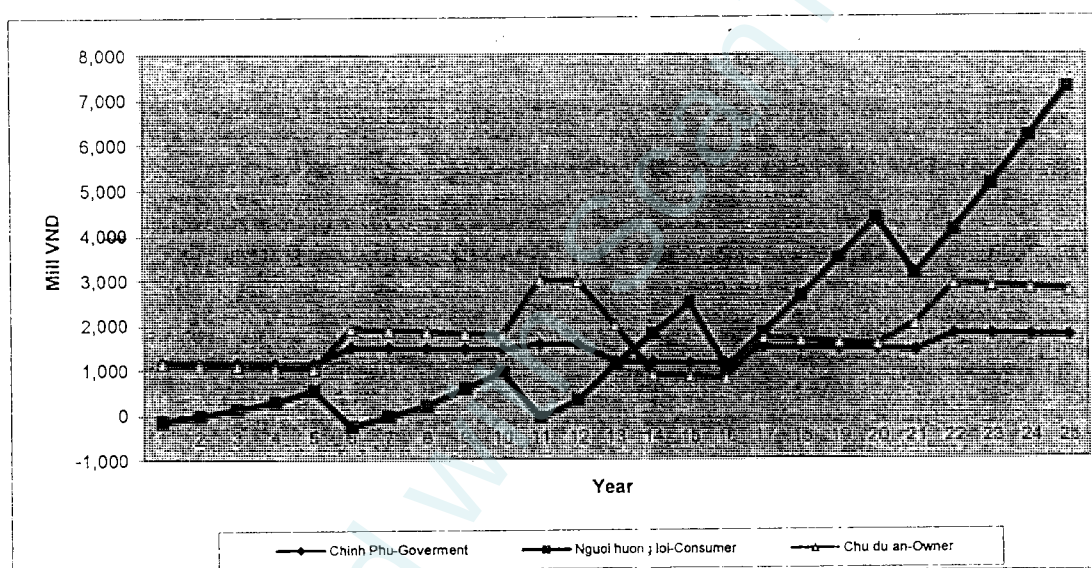
Results of calculation of consumer surplus in 25 years of operation (2014- 2038) as follows:

1.2.6 Economic Analysis Results

Feasible in economic terms is measured by net present value (ENPV), internal rate of economic return (EIRR) and the rate of profit - Expenses (EBCR). Criteria for feasibility of the project as follows: NPV > 0, EIRR higher than the economic opportunity cost of capital is 12% and greater than 1 EBCR. The discount rate applied is 12% and the data calculated based on fixed prices beginning in 2010. Results of economic analysis of water supply project in Thuong Thoi Tien town, as follows:

Economic Net Present Value (ENPV)	12,695
Economic benefit-cost ratio (EBCR)	1.16
Economic internal return rate (EIRR)	13.30%

Figure H-8: Benefit flow



2. SOCIAL IMPACT ASSESSMENT

2.1 Clean water supply source improvement

The project has some very important impact for poverty reduction. Currently, poor households in towns, especially in Thuong Thoi Tien town have few chance of using clean water than other strata. The water supply to households with poor water pipes will enhance social justice to them commensurate with the economic conditions; households with more-affluent who are not only water supply continuity and stability upon benefits but also pay less money than the poor. The poor households to use alternative water sources require take very much effort and time.

Supplying water by pipe also means significantly contributing to reduce time and effort for collecting water and increase your valuable time for work and increase income, education and health. Poor households have to walk or bike to far (400m-1000m) every day to get drinking water if they do not have safe water and ensuring the health of nearby wells or they are shallow and saline water in dry or contaminated by flood water during the rainy season. The piped water supply will contribute to reducing uncertainty for the poor to get water they need to know where in this important time.

The construction of water supply system also means that poor countries will be granted a reasonable price. Currently, the poor pay 5-20 times higher than the money for a very little amount of water. Piped water supply will contribute to increased purchasing power with the same amount of budget. When using more water (including washing, bathing) will contribute to improved health and reduced risk of disease arising from wells or water sources are polluted.

2.2 Health improvement

Health improvement also contributes to reducing medical costs and medication for families, special the project has enormous impact to the poorest of society.

The diseases caused by water also have strong influence to the poor. Because no job means no income. Losing an employee has a strong influence to the poor and makes them more falling into poverty. This influence also entails the loss of income of the sick, the medical expenses, the loans with high interest rates, increased debt, children having to leave their school for earning living, and selling the property for money.

Similarly, when children are ill, adults must stop production to care for them. These kids are very vulnerable to diarrhea, malnutrition, affecting the development of strength and memory and thus also affects the economic development at community level.

2.3 Impact on role of gender

In Vietnam society, women are the main users of water in traditional function for cooking and taking care of their families. Housework relating to water includes food preparation, cooking, washing and cooking water appliances, washing clothes, bathing children, care for the elderly, sick cattle and house cleaning.

At the same time, when women spend more time at home, they are responsible for the sale of water from the tap other people's families.

However, women play a leading role in the sanitation services coincided with their traditional functions in the family and in society. For example, more women work as the street cleaners, garbage collector using vehicles and public toilets cleaners than men.

When water is not available, the females usually have more important role in the taking of water from other sources. This work can often be shared with men, especially in taking water in remote areas or water several times a day which requires more labor.

In some places, the taking water is the responsibility of the whole family, so all of the idle labor is mobilized for this work every day. But in some areas, water taking is a heavy and difficult work thus parents do not want water to be wasted if their children are assigned with this work. When children participate in the taking water, the girls have to make this work more than boys.

The project is considered to have great influence on the function of gender, because women have a greater role in activities related to water and sanitation.

2.4 Impact on decision regarding gender

Vietnam has a very large number of families with female owners (about 1/3 of the families having women over 45 years old as owner). 2/3 of women's families have no

men, the 1/3 have one man but the women are household heads. This can happen when men go far from home for work.

Whether the rate of women family having female owners is quite high but they are not decision makers, but mostly men or their sons. Women have only limited rights such as making decisions to spend on meals and raising children in which men decide on important issues like expenses and family issues.

As a result, the project has enormous impact on decision making relating gender. Men involve in water management and distribution while women are eventual users at the family level (including issues of water selling). Men control these assets as well as issues of water supply.

2.5 Impact on living condition

Because women are the main users of water, having function of cooking and care for the family, and spend more time at home than men, they are the main benefit carriers from the project. The water used for drinking, cooking, washing, washing clothes, washing the dishes requires much work and effort of women.

Thanks to this project that women will have to spend less time in collecting water, availability of water will reduce the strength get water and take less time to care for family members, who being sick not guaranteed by the use of unreliable water and thus also improve the health of women.

Financial position of women in the family is also improved, and it causes more time for productive work and less time to buy water from unreliable.

3. ENVIRONMENTAL IMPACT ASSESSMENT

Environmental issues have been presented in detail in section III.6 of this report.

4. PROJECT SUSTAINABILITY

4.1 Technology maintenance ability

With selected treatment technology, this is a popular technology in Vietnam and other countries in the world today. Actually, works have similar scale applied with this technology show that, the sustainability of technology is high; the stability in operation is also great

Treatment technology is sustained partly through management and operation capability of work in system of workers later. The selected Line of processing technology, itself, has nature of long-term sustainability, if combined with good operating efficiency; sustainability and longevity of the works have been significantly improved.

During the operation time when the work has been completed, with the careful calculation of input parameters, the selected processing technology can completely ensure the correct water treatment complying with design requirements. This ensures the project to have long sustainability because treatment technology is one of the most important factors determining the efficiency and lifespan of the project.

4.2 Finance remaining capacity

For the project, after completion of construction, in order to stand and operate for a long time, one of the most decisive factors is the financial elements. The costs to ensure operation of include management, operating, maintenance and repair costs ... All these costs have been calculated in water price, so the sale of water and money from this activity decide the financial capability for the project.

The investigation report shows that people in the project area have high consensus and commitment on connection to the water supply system. They are willing to pay water price rates as calculated by the project to provide water supply services. So it can be assessed that the ability to financially sustain the project is feasible. With the ability to maintain a financial guarantee, it means that the sustainability of the project has been confirmed along with sustainable technologies

4.3 Management and operation capacity

As noted, when the work is put into operation, Hong Ngu water supply factory under Dong Thap water supply and urban environment One member Co.,Ltd is a unit directly managing the operation of work. With the available ability and experience in operating Hong Ngu Water factory, water supply system Thuong Thoi Tien town will be surely operated and managed at highest manner.

VII. CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSION

Clean water is now an essential demand for life of people all over the country. Using unreliable will lead to large consequences for people's life, health and even economy.

Because economic conditions remain difficult, people and local government in project area have a strong desire to have a water supply system to improve life quality and family health, etc.

For people in the region benefited from the project, life has become easier since fresh water came. Improved health is result of minimization of environmental risk. Cleaner landscape is fruited from water supply system constructed by the project.

The other economic benefits are also considered, including an increase in property values, health improvement and sickness reduction affecting to poverty reduction. The socio-economic problems are more advanced, the presence communes increasingly changes, partly thanks to the clean water project.

2. RECOMMENDATION

The project of water supply system in Thuong Thoi Tien town carry important socio-economic implications, not for the town mentioned above in particular, but also beneficial for the whole Hong Ngu district as well as for the province of Dong Thap.

Because the demand for large capital project, it is respectfully requested that supports and facilitates the project investor to conduct the necessary procedures to use the aid funded by the Government of Italy. For the reciprocal capital of Vietnam, respectfully request Provincial People's Committee to balance allocation of the annual budget for project implementation.

To meet the timely progress of the project proposals, respectfully request Dong Thap Province People's Committee to instruct relevant departments to closely coordinate with the investor in the process of project preparation and early put forward approval for the investor to make the next step./.

VIII. ANNEX

- **Annex A: The calculation spread tables of population, capacity, hydraulic water supply network and calculation of the treatment work size.**
- **Annex B: The summary of total investment cost.**
- **Annex C: The financial analysis tables.**
- **Annex D: The economic analysis tables.**

Annex A: the calculation spread tables of population, capacity, hydraulic water supply network and calculation of the treatment work size.

Produced with ScanTOPDF

PREDICT POPULATION AND DETERMINE SERVED POPULATION

1. Coverage scope

Thuong Thoi Tien town

S = 153 ha

14.93415

2. Predict population

No.	Area	In 2010(people)	Population growth rate (%)	In 2015(people)	Population growth rate (%)	In 2025 (people)
1	Thuong Thoi Tien town	14,223	1.05%	14,986	1.02%	16,553
2	Thuong Phuong Bordergate ec	11,300	1.03%	11,894	1.01%	13,138
2	Total	25,523		26,880		29,691

3. Determine served population

No.	Area	In 2015		In 2025	
		Rate of served population (%)	Number of served population (people)	Rate of served population (%)	Number of served population (people)
1	Thuong Thoi Tien town	70%	10,490	90%	14,898
2	Thuong Phuong Bordergate ec	70%	8,326	90%	11,825
3	Total		18,816		26,722

SUMMARY OF DEMAND ON WATER FROM 2015 TO NĂM 2025
WATER SUPPLY PROJECT IN THUONG THOI TIEN TOWN - HONG NGU DISTRICT - DONG THAP PROVINCE

No.	Content	Symbol	Unit	2015	2025
I	Served population				
1	Rate of served population	dscn	%	70	90
	Number of served population	ds	People	18,816	26,722
II	Water supply standard				
1	For domestic demand	qsh	l/ng.day	80	110
2	Public demand	qcc	%	0%	0%
3	Fire fighting	qpccc	%	0%	0%
4	For trade-service	qdv	%Qsh	15%	15%
5	Pouring tree - cleaning road	qrd+tc	%	0%	0%
6	For industrial production	qcn	%	0%	0%
7	Loss rate	qth	%(Qsh+Qdv)	20%	20%
8	For treatment plant itself	qbt	%(Qsh+Qdv +Qth)	5%	5%
9	Daily water demand (max)	Kng.max		1,3	1,2
III	Volume				
	Domestic demand (Qsh)		m3/day	1,505,259	2,939,450
1	Total volume for domestic demand	Qsh	m3/day	1,510.00	2,940
	For public demand	Qcc	m3/day	-	-
	Fire fighting	Qpccc	m3/day	-	-
2	For trade-service	Qdv	m3/day	226.50	441.00
3	Pouring tree - cleaning road	Qrd+tc	m3/day	-	-
4	For industrial production	Qcn	m3/day	-	-
5	Total average water demand (Qtt)	Qtb	m3/day	1,736.50	3,381.00
6	Loss rate	Qth	m3/day	347.30	676.20
7	For treatment plant itself	Qbt	m3/day	104.19	202.86
8	Total average daily water demand (Qtb)	ΣQtb.ngay	m3/day	2,187.99	4,260.06
9	Daily water usage coefficient max	Kng.max	m3/day	1,3	1,2
10	Daily capacity - max - Qmax	Qmax	m3/day	2,844.39	5,112.07
11	Daily max capacity - Qmax - rounded	Qmaxlàm tròn	m3/day	3,000.00	5,000

SUMMARY OF WATER CONSUMPTION IN PERIOD I - 2015

Time in day	Water for domestic			Water for trade-service demand		Lost water - water treatment		Total water volume for the whole area		
	K _{gld} = 1,7			Q(m ³)	Pattern	Q(m ³)	Pattern	Q(m ³)	%Q _{ngd}	Pattern
	%Q _{sh}	Pattern	Q(m ³)							
0-1	1.0	0.24	15.1			18.81	1.0	33.91	1.55	0.37
1-2	1.0	0.24	15.1			18.81	1.0	33.91	1.55	0.37
2-3	1.0	0.24	15.1			18.81	1.0	33.91	1.55	0.37
3-4	1.0	0.24	15.1			18.81	1.0	33.91	1.55	0.37
4-5	2.0	0.48	30.2			18.81	1.0	49.01	2.24	0.54
5-6	3.0	0.72	45.3			18.81	1.0	64.11	2.93	0.70
6-7	5.0	1.20	75.5	14.16	1.5	18.81	1.0	108.47	4.96	1.19
7-8	6.5	1.56	98.2	14.16	1.5	18.81	1.0	131.12	5.99	1.44
8-9	4.5	1.08	68.0	14.16	1.5	18.81	1.0	100.92	4.61	1.11
9-10	4.5	1.08	68.0	14.16	1.5	18.81	1.0	100.92	4.61	1.11
10-11	5.5	1.32	83.1	14.16	1.5	18.81	1.0	116.02	5.30	1.27
11-12	6.5	1.56	98.2	14.16	1.5	18.81	1.0	131.12	5.99	1.44
12-13	6.5	1.56	98.2	14.16	1.5	18.81	1.0	131.12	5.99	1.44
13-14	5.0	1.20	75.5	14.16	1.5	18.81	1.0	108.47	4.96	1.19
14-15	5.0	1.20	75.5	14.16	1.5	18.81	1.0	108.47	4.96	1.19
15-16	4.5	1.08	68.0	14.16	1.5	18.81	1.0	100.92	4.61	1.11
16-17	5.5	1.32	83.1	14.16	1.5	18.81	1.0	116.02	5.30	1.27
17-18	7.0	1.68	105.7	14.16	1.5	18.81	1.0	138.67	6.34	1.52
18-19	7.0	1.68	105.7	14.16	1.5	18.81	1.0	138.67	6.34	1.52
19-20	6.5	1.56	98.2	14.16	1.5	18.81	1.0	131.12	5.99	1.44
20-21	5.5	1.32	83.1	14.16	1.5	18.81	1.0	116.02	5.30	1.27
21-22	3.0	0.72	45.3	14.16	1.5	18.81	1.0	78.27	3.58	0.86
22-23	2.0	0.48	30.2			18.81	1.0	49.01	2.24	0.54
23-24	1.0	0.24	15.1			18.81	1.0	33.91	1.55	0.37
Total	100	24	1510	227	24	451	24	2187.99	100.0	24

SUMMARY OF WATER CONSUMPTION IN PERIOD 2-2025

Time in day	Water for domestic			Water for trade-service demand		Lost water - water treatment		Total water volume for the whole area		
	K _{giđ} = 1,7			Q(m ³)	Pattern	Q(m ³)	Pattern	Q(m ³)	%Q _{ngđ}	Pattern
	%Q _{sh}	Pattern	Q(m ³)							
0-1	1.0	0.24	29.4			36.63	1.0	66.03	1.55	0.37
1-2	1.0	0.24	29.4			36.63	1.0	66.03	1.55	0.37
2-3	1.0	0.24	29.4			36.63	1.0	66.03	1.55	0.37
3-4	1.0	0.24	29.4			36.63	1.0	66.03	1.55	0.37
4-5	2.0	0.48	58.8			36.63	1.0	95.43	2.24	0.54
5-6	3.0	0.72	88.2			36.63	1.0	124.83	2.93	0.70
6-7	5.0	1.20	147.0	27.56	1.5	36.63	1.0	211.19	4.96	1.19
7-8	6.5	1.56	191.1	27.56	1.5	36.63	1.0	255.29	5.99	1.44
8-9	4.5	1.08	132.3	27.56	1.5	36.63	1.0	196.49	4.61	1.11
9-10	4.5	1.08	132.3	27.56	1.5	36.63	1.0	196.49	4.61	1.11
10-11	5.5	1.32	161.7	27.56	1.5	36.63	1.0	225.89	5.30	1.27
11-12	6.5	1.56	191.1	27.56	1.5	36.63	1.0	255.29	5.99	1.44
12-13	6.5	1.56	191.1	27.56	1.5	36.63	1.0	255.29	5.99	1.44
13-14	5.0	1.20	147.0	27.56	1.5	36.63	1.0	211.19	4.96	1.19
14-15	5.0	1.20	147.0	27.56	1.5	36.63	1.0	211.19	4.96	1.19
15-16	4.5	1.08	132.3	27.56	1.5	36.63	1.0	196.49	4.61	1.11
16-17	5.5	1.32	161.7	27.56	1.5	36.63	1.0	225.89	5.30	1.27
17-18	7.0	1.68	205.8	27.56	1.5	36.63	1.0	269.99	6.34	1.52
18-19	7.0	1.68	205.8	27.56	1.5	36.63	1.0	269.99	6.34	1.52
19-20	6.5	1.56	191.1	27.56	1.5	36.63	1.0	255.29	5.99	1.44
20-21	5.5	1.32	161.7	27.56	1.5	36.63	1.0	225.89	5.30	1.27
21-22	3.0	0.72	88.2	27.56	1.5	36.63	1.0	152.39	3.58	0.86
22-23	2.0	0.48	58.8			36.63	1.0	95.43	2.24	0.54
23-24	1.0	0.24	29.4			36.63	1.0	66.03	1.55	0.37
Tổng	100	24	2940.0	441	24	879.06	24	4260.06	100.0	24

TABLE DETERMINING REGULATION VOLUME OF RESERVOIR

Time in day	Volume of primary pump (%Qngđ)	Volume of secondary pump (%Qngđ)	Water volume into reservoir (%Qngđ)	Water volume out of reservoir (%Qngđ)	Remaining water volume (%Qngđ)
1	2	3	4	5	6
0-1	4.17	1.55	2.62		7.75
1-2	4.17	1.55	2.62		10.37
2-3	4.17	1.55	2.62		12.98
3-4	4.17	1.55	2.62		15.60
4-5	4.17	2.24	1.93		17.53
5-6	4.17	2.93	1.24		18.76
6-7	4.17	4.96		0.79	17.97
7-8	4.17	5.99		1.83	16.15
8-9	4.17	4.61		0.45	15.70
9-10	4.17	4.61		0.45	15.25
10-11	4.17	5.30		1.14	14.12
11-12	4.17	5.99		1.83	12.29
12-13	4.17	5.99		1.83	10.47
13-14	4.17	4.96		0.79	9.68
14-15	4.17	4.96		0.79	8.89
15-16	4.17	4.61		0.45	8.44
16-17	4.17	5.30		1.14	7.30
17-18	4.17	6.34		2.17	5.13
18-19	4.17	6.34		2.17	2.96
19-20	4.17	5.99		1.83	1.14
20-21	4.17	5.30		1.14	0.00
21-22	4.17	3.58	0.59		0.59
22-23	4.17	2.24	1.93		2.52
23-24	4.17	1.55	2.62		5.13
Cộng	100	100			

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tien - Dong Ngu district- Dong Thap province

Water treatment plant

I Design capacity

Design capacity:	Q_{ngd}	=	3000 m^3/ngd
Operating time:	T	=	24 h
Calculation capacity of hour:	$Q_h = Q_{ngd}/T$	=	125.000 m^3/h
Calculation capacity of second:	$Q_s = Q_h/3600$	=	0.035 m^3/s
	$Q_l = Q_h/3.6$	=	34.722 l/s

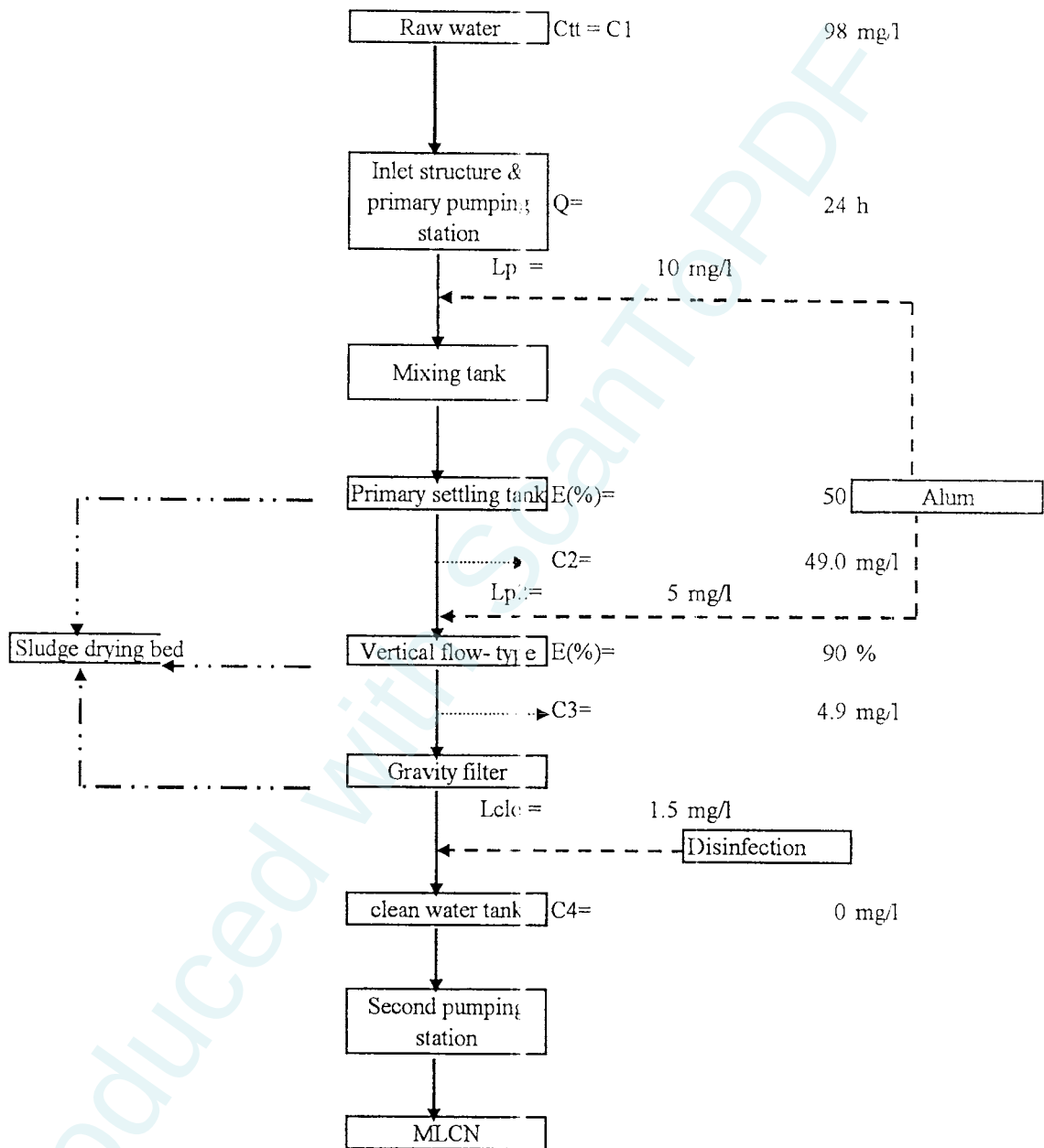
II Water resources:

- 1 Water resources: Water surface
- 2 Quality of raw water:

No	Criteria		Unit	Result	Standard
1	pH			6,5	6,5 - 8,5
6	Volume of suspended systance	C_{max}	mg/l		
		C_{tb}	mg/l	98	30
		C_{min}	mg/l		
7	KMnO ₄ Oxidation		mg/l - O ₂	1,2	
8	Turbidness		NTU	32	
9	Total hardness		mgdl/l	94	
10	Total alkalinity		mgdl/l	89,2	
11	Ca ²⁺		mg/l	-	
12	Mg ²⁺		mg/l	-	
13	Fe ²⁺		mg/l	0,44	1
14	Mn ²⁺		mg/l	0,02	
15	NH ₄ ⁺		mg/l	0,23	0,2
18	Cl ⁻		mg/l	9,25	400
20	NO ₂ ⁻		mg/l	0,004	0,02
21	NO ₃ ⁻		mg/l	0,7	5

III Selection of process line

From the result of raw water quality analysis, selecting the diagram of following process line to treat raw water according to QD 1329/2003/BYT domestic water quality



CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tien - Dong Ngu district- Dong Thap province

A INLET STRUCTURE - PRIMARY PUMPING STATION

Design capacity:	Q_{ngd}	=	3,000	m^3/ngd
Operating time:	T	=	24	h
Hourly calculation capacity	$Q_h = Q_{ngd}/T$	=	125.00	m^3/h
Secondly calculation capacity	$Q_s = Q_h/3600$	=	0.035	m^3/s
	$Q_l = Q_h/3.6$	=	34.72	l/s

I Trash rack

Area of trash rack (m^2):				
$w = Q \cdot K_1 \cdot K_2 \cdot K_3 / V_s \cdot n$		=	0.430	
In which:				
Q-Capacity in TP	Q	=	0.035	m^3/s
K1- Contraction ratio by steel bar, $K_1 = (a+d)/d$	K_1	=	5.4	
	K_2	=	1.25	
	K_3	=	1.1	
Vs- water speed across trash rack	V_s	=	0.3	m/s
Number of water inlet	n	=	2	
Size of trash rack	$A = \sqrt{4 \cdot w / \pi}$	=	0.7	m
Selected trash rack	$A \times B \times H$	=	0,7x0,7x0.7	m

II Raw water pump

Number of operating pump	n_1	=	1	bom
Number of stand-by pump	n_2	=	1	bom
Total pump	$N = n_1 + n_2$	=	2	bom
Simultaneous operation ratio	η	=	1	
Flow per pump	Q_1	=	34.72	l/s
Pump head: $H = H_{hh} + h_1 + h_2$	H	=	16.36	m
In which:				
High level of existing water level on ri Z1		=	-1.19	m
High level of existing water level in ri Z2		=	11.95	m
Difference between high leveling and l Hhh		=	13.1	m
Total loss on common discharge pipe $h_l = h_{d1} + h_{d2} + h_{dd} + h_{cb}$		=	0.22	m
Stand-by pressure	h_2	=	3	m

1 Selected pump:

Flow:	Q	=	125	m^3/h
Head pressure	H	=	17	m

2 Calculation of discharge tube pè pump:

Flow:	Q_1	=	0.035	m^3/s
Diameter:	D	=	250	mm
Speed:	V	=	0.71	m/s
Cedi factor:	C	=	140	
Unit loss	$1000i$	=	1.92	m/km
Length of discharge tube:	L	=	10	m

Loss: $h_{d1} = 0.02 \text{ m}$

3 Calculation of general discharge tube:

Flow: $Q_c = 0.035 \text{ m}^3/\text{s}$

Diameter: $D = 250 \text{ mm}$

Speed: $V = 0.71 \text{ m/s}$

Cedi factor: $C = 140$

Unit loss $1000i = 1.92 \text{ m/km}$

Length of discharge tube: $L = 5 \text{ m}$

Loss: $h_{d2} = 0.01 \text{ m}$

IV Calculation of raw water transmission pipeline::

Flow: $Q_c = 0.035 \text{ m}^3/\text{s}$

Diameter: $D = 250 \text{ mm}$

Speed: $V = 0.71 \text{ m/s}$

Cedi factor: $C = 140$

Unit loss $1000i = 1.92 \text{ m/km}$

Length of discharge tube: $L = 75 \text{ m}$

Loss: dọc đường $h_{dd} = 0.14 \text{ m}$

Loss: cục bộ $h_{cb} = 0.3 * h_{dd} = 0.04 \text{ m}$

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tien - Dong Ngu district- Dong Thap province

DESIGN SPECIFICATION

I. Inlet specification

	Symbol	Gía trị đơn vị	Unit
1 Capacity	Q	3000	m ³ /ngđ
2 Operating time	h	24	h
3 Stand-by factor	k	1.05	
4 Water resources		Nước mặt	
5 Dust content in dry season	C _{min}		mg/l
6 Average dust content	C _{tb}	98	mg/l
7 Dust content in drought season	C _{max}	198	mg/l

II. Hydraulic design specification

1 Detention time in reaction tank	t	10	ph
2 Mixing strength in tank no.1	G1	70	s-l
3 Mixing strength in tank no.2	G2	40	s-l
4 Sedimentation rate	U _o	0.12	mm/s
5 Speed			
- Water speed into mixing tank	V _{in}	1.11	m/s
- Water speed in distribution pipeline to settling tank	V _{settling}	0.25	m/s
- Water speed across distribution hole to settling tank	V _{hole}	0.14	m/s
-Water speed in settling pipe	V _{nước}	0.002	m/s
-Water speed in jagged inlet tray	V _{răng cưa}	0.08	m/s
-Water speed in inlet tray in settling tank	V _{thu nước}	0.13	m/s
-Water speed to filtering tank	V _{ra}	0.71	m/s
6 Pipe diameter			
- Pipe diameter to mechanic mixer	D1	0.2	m
- Pipe diameter to settling tank	D2	0.25	m
- Distribution pipe diameter to settling tank	D3	0.3	m
- Waste pipe diameter to settling tank	D4	0.15	m

III. Specification of mechanical reactor

1 Length per tank	L	1.5	m
2 Width per tank	B	1.5	m
3 Máy khuấy bể 1			
- Capacity	P	510	W
- Number of rolling radius	n	66	vòng
- Length of stirring arm	L	0.6	m
4 Stirrer in tank no.2			
- Capacity	P	170	W
- Number of rolling radius	n	46	vòng
- Length of stirring arm	L	0.6	m
5 Height of reaction tank			
-Working height of reaction tank 1	H _{ct1}	3.3	m
- Protection height of reaction tank 1	H _{bv1}	0.1	m
-Working height of reaction tank 2	H _{ct2}	3.25	m
- Protection height of reaction tank 2	H _{bv2}	0.15	m

6 Altitude of reaction tank		
- Bottom altitude of reaction tank	H bottom	3.7 m
- Center altitude of raw water pipeline	H pipe	6.9 m
- Top altitude of reaction tank	H top	7.1 m
7 Distribution section		
- Width	B	0.8 m
- Length of distribution section	L	3 m
- Bottom altitude of distribution section	H bottom	3.33 m
- Top altitude of distribution section	H top	7.1 m
8 Water distribution tray		
- Width	B	0.3 m
- Length	L	3 m
- Height of water level in tray	H	0.3 m
- Cross- bottom tray 60 degree		

IV. Specification of Lamella settling tank

1 Length	L	6.9 m
2 Width	B	3 m
3 Jagged water inlet tray after filtering (02 trays)		
- Width	B	0.5 m
- Length	L	6.9 m
- Height of water level in tray	H	0.4 m
- Distance between 2 jaggies	d	0.2 m
4 Water distribution tray to filtering tank (02 tráy)		
- Width per tray	B	0.3 m
- Length per tray	L	3 m
- Height of water level in tray no. 1	H1	1.1 m
- Height of water level in tray no. 2	H2	1.1 m
5 Distribution hole & pipe to settling tank		
- Pipe diameter (02 pipes)	D	0.3 m
- Number of hole row per pipe(02 hàng/01 ống)	n1	2
- Number of hole per row	n2	65
- Holes arranges belong to water distribution pipe to create angle 45 with pipe axis and downstream		
6 Height of Lamella settling tank		
- Height of sedimentation area	H1	2.8 m
- Height of distribution water layer	H2	1.7 m
- Height of Lamella settling plate	H3	0.915 m
- Height of water after filtering	H4	1.16 m
- Protection height	H5	0.4 m
7 Altitude of reaction tank		
- Bottom altitude of sludge collecting pit	Hc1	0.16 m
- Top altitude of sludge collecting pit	Hc2	2.925 m
- Center altitude of distribution pipe	H pipe	3.32 m
- Bottom altitude of lamella settling block	Hlm 1	4.63 m
- Top altitude lamella settling block	Hlm 2	5.54 m
- Bottom altitude of jagged water inlet tray	Hrc	6.3 m
- Top altitude lamella settling tank	Hd	7.1 m
- Bottom altitude water inlet tray after filtered	Hm	5.54 m

V. Operating specification

1 Operating time		24 h
2 Sludge circle of settling tank in drought season	T1	24 h
3 Sludge circle of settling tank in season	T2	96 h
4 Sludge circle of settling tank in dry season	T3	846 h

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MECHANICAL MIXER

Design capacity:	Q_{ngd}	=	3,000 m^3/ngd
Operating time	T	=	24 h
hourly caculation capacity	$Q_h = Q_{ngd}/T$	=	125 000 m^3/h
Secondly caculation capacity	$Q_s = Q_h/3600$	=	0.035 m^3/s
	$Q_l = Q_h/3.6$	=	34.72 l/s
Mixing time	t	=	7 Phút
Mixing tank's volume	$V = t \cdot Q$	=	14 583 m^3
Number of tank	N_b	=	2 bể
Size per tank:			
Working height	H_{ct}	=	3.3 m
Tank area	$F = V/(11 \cdot N_b)$	=	2.21 m^2
Width	B	=	1.5 m
Length	L	=	1.5 m
Working height	H_{ct1}	=	3.3
Working height	H_{ct2}	=	3.3 m
Stirring arm:			
Length Stirring arm	$D_k = (B/2)$	=	0.60 m
Flange slab area	$F = F_b \cdot 20\%$	=	0.44 m^2
	H	=	0.60 m
Stirrer:			
Number of Stirrer	N_k	=	2 Machine
Energy for water tank no. 1	$P_1 = G_1^2 V \mu$	=	7291.67 W
Energy for water tank no. 1	$P_2 = G_2^2 V \mu$	=	7291.67 W
In which:			
Mixing strength in tank no.1	G_1	=	1000 s-1
Mixing strength in tank no.2	G_2	=	1000 s-1
Mixing tank's volume	V	=	7.3 m^3
Water liquid y viscosity ratio	μ	=	0.001
Motor capacity of machine 1	$N = P/(N_k \cdot \eta)$	=	4557.29 W
In which:			
Motor performance	η	=	0.8
Stirring speed of tank1	$n = (P_1/K \cdot \rho \cdot D_k^5)^{(1/3)}$	=	160 v/ph
Stirring speed of tank2	$n = (P_2/K \cdot \rho \cdot D_k^5)^{(1/3)}$	=	160 v/ph
In which:			
Specific volume of water	ρ	=	1000 kg/ m^3
Energy for water tank no. 1	P_1	=	7291.67 W
Energy for water tank no. 1	P_2	=	7291.67 W
Water driving resistance ratio	K	=	5
Length Stirring arm	D_k	=	0.60 m
Calculation for water distribution hole & pipe to lamella settling tank			
Selecting two distribution pipe to settling tank			
Flow per pipe	$Q_{\hat{o}} = Q_s/2$	=	0.017 m^3/s
Pipe diameter	D	=	300 mm
water speed in pipe	v	=	0.25 m/s
Water distribution hole diameter	d_l	=	35 mm
Number of hole per pipe	n_1	=	2 hàng
Distance of holes per row	d	=	100 mm
Number of hole per row	n_2	=	65 lỗ
Total hole per pipe	$n = n_1 \cdot n_2$	=	130 lỗ
Area per pipe	F_l	=	0.000962 m^2

Total area of hole	$F = F_l \cdot n$	=	0.125911 m ²
Speed across hole	v	=	0.14 m/s
Center of water distribution pipe is located from sludge pipe top	h	=	400 mm

Holes install belong to water distribution pipeline with angle 45 comparing to axis and downstream

Raw water pipeline and mechanical reactor diameter

Quantity	Q_s	=	0.035 m ³ /s
Diameter	D	=	200 mm
Velocity	V	=	1.11 m/s

Water distribution ditch

Width	B	=	0.30 m
Length	L	=	3.00 m
Height of water level in ditch	H	=	0.30 m

chamfered ditch 60

Altitude of mechanical reactor

water level loss from distribution chamber to settling tank	$htt1$	=	0.15 m
Altitude of water level in distribution chamber	$h_{pp} = h_{cm1} + htt1$	=	6.85 m
Hydraulic loss from distribution ditch to distribution chamber	$htt2$	=	0.05 m
Altitude of water level in distribution ditch	$h_m = h_{pp} + htt2$	=	6.90 m
Hydraulic loss from reaction tank 2 to distribution ditch	$htt3$	=	0.05 m
Altitude of water level in reaction tank 2	$h_{pu2} = h_m + htt3$	=	6.95
Water level loss from reaction tank 1 to reaction tank 2	$htt4$	=	0.05 m
Altitude of water level in reaction tank 1	$h_{pu1} = h_{pu2} + htt4$	=	7.00 m
Bottom altitude of reaction tank	$h_d = h_{pu} - H_{ct}$	=	3.70 m
Protection height of reaction tank 1	h_{bv1}	=	0.10 m
Center altitude of raw water pipe	h_{δ}	=	6.90 m
Bottom altitude of distribution chamber	h_{dpp}	=	3.20

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Thien - Dong Ngu district- Dong Thap province

D LAMEELA SEDIMENTATION TANK

1 Specification calculation

Design capacity	Q_{ngd}	=	3000 m ³ /ngđ
Operating time	T	=	24 h
Hourly calculation capacity	$Q_h = Q_{ngd}/T$	=	125 m ³ /h
Secondly calculation capacity	$Q_s = Q_h/3600$	=	0.035 m ³ /s
	$Q_l = Q_h/3,6$	=	34.72 l/s

2 Specification of tank

Width of settling tank	B	=	3 m
Length of settling tank	L	=	6.9 m
Area of settling tank	$F = B * L$	=	20.7 m ²
Settling speed of sludge	U_o	=	0.12 mm/s
Load of surface	$P = Q_h/F$	=	6.039 m ³ /m ² /h

3 Checking Reynold factor and Froude criterion

Water speed in settling pipe	$V_o = k * Q / F * \sin \alpha$	=	0.002 m/s
Hydraulic radius	$R = f/c$	=	0.0009 m
Reynold factor	$Rc = V_o * R / \nu$	=	1.37
V: Kinematic coefficient of viscosity of water	ν	=	$31 * 10^{-6}$ m ² /s
Reynold factor $Rc < 500$, water in settling pipe with laminar structure			

Froude criterion	$Fr = V_o^2 / (G * R)$	=	0.00044
Froude criterion $Fr > 10^{-5}$, stable flow in settling pipe			

4 Sludge holding chamber calculation

Volume of sludge holding area	$W = T * Q * k * (C_{max} - m) / (\delta * n)$	=	18.5 m ³
In which:			
T: Circle between 2 discharge times		=	24 h
With height of sludge holding area is h_c , circle of sludge drain in dry season and normal as the following.			
Diameter of discharge pipe in settling tank	D	=	150 mm

5 Jagged water inlet tray after settling

Calculation method: Selecting length according to ditch load

Water load per length 1m from 1-3 l/s/m length

Selecting flow	q	=	2.5 l/s/m dài
Length of jagged water inlet tray	$L = Q_l / q$	=	13.89 m
Number of jagged water inlet tray	n	=	2 máng
Length per ditch	$l = L / n$	=	6.94 m
Selecting jagged tray with 5 jagges/length 1m			
Height of jagged water inlet tray	H	=	420 mm
Height of water level in ditch	H_n	=	400 mm
Width of jagged water inlet tray	B	=	500 mm
Distance between 2 jaggies	d	=	200 mm
Water speed	$v = Q / (n * l * n * B)$	=	0.087 m/s

6 Water inlet tray in settling tank

Final water inlet tray settling tank split 2 chambers to stabilize water level before to filtering tank

Size per ditch:

Width of ditch	B	=	0.25 m
Length of ditch	L	=	3 m
Water level height in ditch 1	H1	=	1.1 m
Water level height in ditch 2	H2	=	1.06 m
Water speed	$v = Q/(B * L)$	=	0.046 m/s

7 Water pipe diameter after settling to filtering tank

Flow	Qs	=	0.035 m ³ /s
Selected diameter	D	=	250 mm
Speed	v	=	0.14 m/s
Altitude of final water collection pipe in settling tank	H _{loc}	=	6.600 m
Loss across 2 final collection chamber in settling tank	H _{ttl}	=	0.100 m
Altitude of water level in settling tank	H _{mcl} = H _{loc} + H _{ttl}	=	6.700 m
Bottom altitude of jagged water inlet tray	H _{rc} = H _{mcl} - H _n	=	6.300 m
Water level height after settling	H _{sl}	=	1.160 m
Surface altitude of lamella settling block	H _{m1a} = H _{mcl} - H _{sl}	=	5.540 m
Bottom altitude of lamella settling block	H _{d1a} = H _{m1a} - H _l	=	4.625 m
Height of distribution water layer before settling	H _{pp}	=	1.700 m
Top altitude of sludge collection hole	H _{dc} = H _{d1a} - H _{pp}	=	2.925 m
Bottom altitude of sludge collection hole	H _d = H _{dc} - H _c	=	0.164 m
Center altitude of distribution water pipe in settling tank	H _{opp} = H _{dc} + H _l	=	3.30 m
Protection height	H _{bv}	=	0.4 m
Bottom altitude of settling tank lamella	H _d	=	7.100 m
Bottom altitude of water inlet tray after filtering	H _m	=	5.540 m

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Lien - Dong Ngu district- Dong Thap province

E Non-valve self-cleaning filter

Design capacity	Q_{ngd}	=	3,000 m ³ /ngd
Operating time	T	=	23 h
Hourly calculation capacity	$Q_h = Q_{ngd} / T$	=	130.43 m ³ /h
Secondly calculation capacity	$Q_s = Q_h / 3600$	=	0.036 m ³ /s
	$Q_l = Q_h \cdot 3.6$	=	36.23 l/s

Selected filtering material is high-oden sand:

- d = 0,5-1 mm
- Empty hole m = 0,41
- Weight $\gamma = 2,65$
- Length of high-oden sand is $h_c = 0,7$ m
- Supporting material is gravel, Supporting material thickness: $h_d = 0,3$ m

1 Area calculation of filtering tanks

Filtering tank area of WTP calculated according to formula:

	$F = Q \cdot a / \gamma \cdot V_{tb}$	=	15.1 m ²
Selecting	F	=	15.10 m ²
Inwhich:			
Q - Useful power of WTP		=	3000.00 m ³ /ngd
T - Operating time of WTP per day/night		=	23.00 h
V_{tb} - Calculated filtering velocity in normal mode $V = 5-10$ m/h		=	9.00 m/h
a - water using factor; $a = 1,03-1,05$		=	1.04

Number of filtering tank N

Number of filtering tank calculated according to empiric formula:

$N = 0,5 \cdot \sqrt{F}$	=	1.94 bđ
Number of selected filtering tank N	=	2.00 bđ

Filtering area of a filtering tank

$f = F / N$	=	7.76 m ²
Round tank has 4 filtering pipe connecting to water holding area = 100 mm	=	0.10 m

Selecting useful area of tank

$f_b = f + 4 \cdot (\pi \cdot d \cdot d_{\text{ống}}) / 4 =$ size	=	7.80 m ²
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$D = \sqrt{4 \cdot f_b / \pi}$	=	3.15 m
Selecting D	=	3.20 m

2 Height of filtering tank

Cleaning strength		
Min. cleaning strength: W_{min}	=	5.00 l/s.m ²
Max. cleaning strength: W_{max}	=	15.00 l/s.m ²
Ununiformity coefficient: K	=	1.50

Average cleaning strength	=	7.00 l/s.m ²
t _n - cleaning time	=	6.00 Phút

Volume of cleaning layer

$$h_r = (60 \cdot q_{tb} \cdot t \cdot f) / (f_b \cdot 1000) = 2.51 \text{ m}$$

Selecti on = 2.60 m

Height of water level in tank

$$H = h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8$$

In which:

h ₁ : Concentration height of bottom water	selecting h ₁	=	0.30 m
h ₂ : height of filtering slab	h ₂	=	0.02 m
h ₃ : height of filtering material layer	h ₃	=	1.03 m
h ₄ : height of water layer	h ₄	=	0.90 m
h ₅ : height of water holding tank	h ₅	=	2.60 m
h ₆ : height of top slab	h ₆	=	0.10 m
h ₇ : Static height	h ₇	=	0.55 m
h ₈ : Protection height	h ₈	=	1.15 m
Total height	H =	=	6.65 m

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Thien - Dong Ngu district- Dong Thap province

F CLEAN WATER RESERVOIR

Design capacity	Q_d	=	$\boxed{3000}$ m ³ /ngd
Operating time	T	=	$\boxed{24}$ h
Hourly calculation capacity	$Q_l = Q_{ngd}/T$	=	125.000 m ³ /h
Secondly calculation capacity	$Q_s = Q_h/3600$	=	0.035 m ³ /s
	$Q_l = Q_h/3.6$	=	34.72 l/s
Reservoir Capacity	$W = W_{dh} + W_{bt} + W^{3h}_{cc}$	=	985 m ³
In which			
Wdh - Regulation volume of reservoir	W_{dh}	=	$\boxed{18.76\%}$ Qngd
Define by table	W_{dh}	=	562.8 m ³
Wbt - Capacity for plant	W_{bt}	=	$\boxed{5\%}$ Qngd
	W_{bt}	=	150 m ³
W3hcc - Fire-fighting Capacity in 3 h	$W^{3h}_{cc} = 3 \cdot Q_{cc} + 3 \cdot Q_{max} - Q_l$	=	272 m ³
In which			
Fire- fighting Capacity	Q_{cc}	=	$\boxed{10}$ l/s
Total water Capacity uses in 3h max	$3 \cdot Q_{max}$	=	$\boxed{18\%}$ Qngd
	$3 \cdot Q_{max}$	=	539.4 m ³
Flow per hour TB1	Q_l	=	$\boxed{4.17\%}$ Qngd
	Q_l	=	125 m ³
Size			
Number of holding tank	N_b	=	1 b ^ê
Working height	H_n	=	4 m
Area per 1 tank	$F_{l\ddot{a}c} = W/(H_n \cdot N_b)$	=	246.225 m ²
Tank diameter	D	=	17.710517 m
Selected diameter tank	D	=	18.00 m
Flow	$Q_v = Q_s$	=	0.035 m ³ /s
Diameter	D_v	=	$\boxed{200}$ mm
Velocity	V_v	=	1.11 m/s

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi 1 en - Dong Ngu district- Dong Thap province

G SECOND PUMPING PLANT

Design capacity	Q_{ngd}	=	3,000 m ³ /ngd
Operating time	T	=	24 h
Calculation capacity of hour	$Q_h = Q_{ngd}/T$	=	125.0 m ³ /h
Calculation capacity of second	$Q_s = Q_l / 3600$	=	0.035 m ³ /s
	$Q_l = Q_h / 3.6$	=	34.72 l/s

In Pump house level 2, installing clean water pump for water supply network, installing washing water pump

1 Domestic water pump

Selecting booster pump system is pump unit

Number of operating pump	n_1	=	2 bơm
Number of stand by pump	n_2	=	1 bơm
Total pump	$N = n_1 + n_2$	=	3 bơm
Simultaneous operation coefficient	β	=	1

Flow:

Total water volume supply for network in the highest using hour according to water consumption table	Q_{hmax}	=	138.67 m ³ /h
	Q_{smax}	=	0.039 m ³ /s
	Q_l	=	38.5 l/s
Flow in 1 pump:	$Q_{1b} = (Q_{hmax} / (n_1 * \beta))$	=	69 m ³ /h
		=	0.019 m ³ /s
		=	19.3 l/s

Head pressure:

Total head of pump	$H_{tp} = H_b + h_h + h_{nb}$	=	35.9 m
Where:			
H_b - head at the beginning of ML by T ₁	H_b	=	32.8 m
h_h - Geometric height	$h_h = Z_{tb2} - Z_{bc}$	=	2 m
Z_{tb2} - Height of pump-house level 2	Z_{tb2}	=	12 m
Z_{bc} - height at tank	Z_{bc}	=	10 m
h_{nb} - local loss in plant	$h_{nb} = (h_{l1} + h_{h2} + h_{dd1} + h_{d2}) + h_{cb}$	=	1.141 m
	h_{cb}	=	1.0 m

Selection of pump with parameters :

Flow	Q_b	=	69 m ³ /h
Head	H_b	=	36 m
Erosion preventive backup	NPSH	=	4.48 m
Axial capacity	P	=	7.5 kW
Number of circle	n	=	1450 v/ph

Pump capacity (calculated)

Where:	Q_{1b}	=	0.019 m ³ /s
Diameter	D_{1h}	=	200 mm
Velocity	V_{1h}	=	0.61 m/s
Hazen Willam factor	C	=	110
Unit loss	i	=	0.003 m'/m
Length	L_r	=	1 m
Loss	h_{hl}	=	0.003 m

Common suction pipeline

Flow	$Q_{4b} = Q_{smax}$	=	0.039 m ³ /s
Diameter	D_h	=	200 mm
Velocity	V_h	=	1.23 m/s
Hazen Willam factor	C	=	110
Unit loss	i	=	0.011 m/m
Length	L_c	=	10 m
Loss	h_{h2}	=	0.108 m

Discharge pipeline for each pump

Flow	Q_{1b}	=	0.019 m ³ /s
Diameter	D_{1d}	=	150 mm
Velocity	V_{1d}	=	1.09 m/s
Hazen Willam factor	C	=	110
Unit loss	i	=	0.012 m/m
Length	L	=	1 m
Loss	h_{d1}	=	0.012 m

Common discharge pipeline to network

Flow	$Q_{4b} = Q_{smax}$	=	0.039 m ³ /s
Diameter	D_d	=	250 mm
Velocity	V_d	=	0.78 m/s
Hazen Willam factor	C	=	110
Unit loss	i	=	0.004 m/m
Length	L	=	5 m
Loss	h_{d2}	=	0.018 m

Pump axial core

	$Z_b \leq h_{hh} + Z_{bc}$	=	14.48 m
Floor leveling of pump station	H_s	=	0.20 m
Selecting leveling of pump shaft	Z_b	=	0.70 m

Pump axial core

	$Z_b < H_{hd}^h + Z_{MNTN}^{BC}$	=	5.29 m
Selection of pump axial core	Z_b	=	12.50 m

Where

Z_{MNTN}^{BC} : Lowest water level in clean water tank	=	1.0 m
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H_{dh}^h : geometric suction height of pump	$H_{dh}^h \leq (P_a - P_{bh}) / \gamma - h_{hh} - NPSHA$	=	4.31 m
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Where:

P_a - atmospheric pressure	P_a	=	10000 kg/m ²
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P_{bh} - saturated evaporation pressure	P_{bh}	=	280.8 kg/m ²
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γ -water density	γ	=	1000 kg/m ³
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h_{hh} - Total pressure loss on suction pipe	$h_{hh} = l_c + h_r$	=	0.43 m
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h_c - Total loss on common suction pipeline	$h_c = i \cdot L_c + T\zeta \cdot v^2 / (2 \cdot g)$	=	0.39 m
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i	=	0.003 m/m
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L_c	=	1 m
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v	=	1.23 m/s
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g	=	9.81
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From suction pipe to pump, there are	$T\zeta$	=	5
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1 khóa / 1	=	2
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1 phễu / 1 ζ_2	=	0.5
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2 Tê ζ_3	=	2
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1 Cút 90 độ ζ_4	=	0.5
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hr- Total loss on separate suction pipe	$h_r = i \cdot L_r + T \zeta \cdot v^2 / (2 \cdot g)$	=	0.04 m
To each pump	i	=	0.003 m/m
	L_r	=	1 m
	v	=	0.61 m/s
	g	=	9.81
From separate suction pipe to pump, the	$T \zeta$	=	2.1
	1 khóa ζ_1	=	2
	1 côn ζ_2	=	0.1
NPSHA- Allowable erosion preventive backup factor	$NPSH_A \geq NPSH_R + 0.5$	=	5.0 m

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CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tie n - Dong Ngu district- Dong Thap province

H Chlorine house

Design capacity:	Q_{ng1}	=	$\boxed{3,000}$ m ³ /ngd
Operation time	T	=	$\boxed{24}$ h
Hourly calculating capacity	$Q_h = Q_{ngd}/T$	=	125.00 m ³ /h
Secondly calculating capacity	$Q_s = Q_h/3600$	=	0.035 m ³ /s
	$Q_l = Q_h/3.6$	=	34.72 l/s

Principle:

Using Chlorine as post-filter water disinfecting chemicals:

Liquid Chlorine → gassy Chlorine → Chlorine gas dispenser → Gassy Chlorine and water mix
→ Chlorine disinfecting liquid → water

Calculation

Total consuming Chlorine	Lcl	=	1.5 mg/l
Where:			
Chlorine used in water disinfection	Lkt	=	$\boxed{1.5}$ mg/l
Chlorine dose uses to Chlorinate	Lcl.b	=	$\boxed{0}$ mg/l
Chlorine used in 1 h:	$q_{cl1} = Q_h * Lcl/1000$	=	0.188 kg/h
Number of Chlorine tank concurrently used	$N_{cl} = q_{cl2}/C_s$	=	0.27 bình
Where:			
Cs- evaporation capacity of 1 Chlorine	Cs	=	$\boxed{0.7}$ kg/h
Water amount calculated from working Chlorine	q_{nc1}	=	0.6 m ³ /kg clo
Water flow for Chlorine warehouse	$q_{nc2} = q_{nc1} * q_{cl2}$	=	0.113 m ³ /h
Diameter	D_{nc1}	=	$\boxed{15}$ mm
Velocity	V_{nc1}	=	0.18 m/s
Chlorine used in 1 day	$Q_{nc2} = T * q_{cl2}$	=	4.5 kg/ngd
Water used in 1 day	$Q_{nc2} = T * q_{nc2}$	=	2.7 m ³ /ngd
Number of day for Chlorine storage in plant	N_{dt}	=	$\boxed{180}$ ngày
Water used in 180 days	$Q_{c3} = N_{dt} * Q_{nc2}$	=	810 kg
Liquid Chlorine density	γ	=	1.4 kg/l
Total Chlorine liquid stored in 180 days	$Q_{ddCl} = Q_{c3}/\gamma$	=	579 l
Chlorine tank volume	G	=	$\boxed{150}$ kg
Capacity of 1 Chlorine tank	W_{clo}	=	107 l
Number of Chlorine tank in plant	$N_{cldt} = Q_{ddCl}/W_{clo}$	=	5 bình

Water pump for Chlorator

Flow pump	Q_{cl}	=	750.0 l/h
Head	H_{cl}	=	35 m

Chlorator

Operating number	N_{clr1}	=	$\boxed{1}$ Chlorator
Stand by number	N_{clr2}	=	$\boxed{1}$ Chlorator
Capacity	Q_{clr}	=	0.2 kg/h

Structure of Chlorine warehouse

- The warehouse is build separately with the surrounding with closed door, having regular air vent. With frequency by 12 times of wind circulation. Air is absorb at low point.
- In the warehouse, arranging high pressure water spraying range, neutralized Chlorine liquid tank. In the event of error, the tank has sufficient capacity to neutralize

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tien - Dong Ngu district- Dong Thap province

1 CHEMICAL HOUSE

Design capacity:	Q_{ngd}	=	$\frac{3,000}{24} m^3/ngd$
Operating time	T	=	24 h
Hourly Calculation capacity	$Q_h = Q_{ngd} / T$	=	125.00 m^3/h
Secondly Calculation capacity	$Q_s = Q_h / 3600$	=	0.035 m^3/s
	$Q_l = Q_h / .6$	=	34.72 l/s

1 Mixing tank - consuming PAC alum

Tank volume	$W1 = Q * n * La / (10000 * p1 * \gamma)$	=	0.9 m^3
In which:			
Q - Flow of treated water	Q	=	125.00 m^3/h
n - Time between 2 times of chemical m:n	n	=	24 h
La : PAC alume dose	$La = La1 + La2$	=	15.00 g/m^3
La1 : Alumn dose into mixing tank	La1	=	10.00 g/m^3
La2 : Alumn dose into lamella settling tank	La2	=	5.00 g/m^3
p1 - consumed alum liquid concentration	p1	=	5%
γ - alum liquid density	γ	=	1 $tấn/m^3$
δ - Raw rate	δ	=	98%
Number of operating tank	Ntr	=	2 bể
Number of stand by tank	Ndp	=	1
Total number of tank	$N = Ntr + Ndp$	=	3
Capacity of 1 mixing tank	$W1b = W1 / Ntr$	=	0.5 m^3

Selecting round tank

Tank size

Working height	Hn	=	0.7 m
Area	$F1b = \sqrt{W1b / Hn}$	=	0.66 m^2
Diameter	$Dtph = \sqrt{4 * F1b / \pi}$	=	0.9 m
Diameter of sludge discharge pipe	dx	=	100 mm
Constructing inclined sludge compartme: α	α	=	45 độ
Height of sludge compartment	$Hc = tg(\alpha) * (Dtph - dx) / 2$	=	0.5 m
Tank height	$Htph = Hn + Hc + hbv$	=	1.5 m
Protective height	hbv	=	0.3 m

Mixer (plate fin type)

Number of revolution on stirrer blade	$axnp$	=	30 v/ph
Number of mixer	nk	=	1 máy
Length of paddle from axis of revolution	$Lc = 0.4 * Dtph / nk$	=	0.4 m
Area of paddle	$fcq = 0.15 * W1b / nk$	=	0.07 m^2
Width of paddle	$bcq = 100 * fcq / (2 * Lc)$	=	9 cm
Capacity of mixer engine	$N = 0.5 * (\rho / \eta) * h * (ns^3) * (d^4) * z$	=	1.7 kW
Where:			
ρ - density of liquid	ρ	=	1000 kg/m^3
h - Width of paddle	$h = bcq$	=	0.09 m
ns - number of paddle revolution	$ns = 1 p / 60$	=	0.5 v/s
d - Diameter of paddle	$d = 2 * Lc$	=	0.7 m
η - factor of mechanical drive	η	=	1
z - Number of paddle on axis	z	=	1

Rated pump

Number of operating pump	Ndl	=	2 bơm
Flow of 1 pump	$Qdl = 100 * Q * a / (10000 * p1 * Ndl)$	=	1.9 l/h
Head	Hdl	=	60 m
Pipe			
Diameter of liquid pipe	D1b	=	15 mm
Velocity	V1b	=	0.003 m/s
Selected pump has specification as the follow Q		=	0-30 l/h

CALCULATION OF EACH PROCESS CAPACITY

Project: Water supply system for Thuong Thoi Tam - Dong Ngu district- Dong Thap province

J THICKENER & SLUDGE DRYING TANK

Design capacity	Q_{ngd}	$=$	$\boxed{3,000}$ m ³ /ngd
Operating time	T	$=$	$\boxed{24}$ h
Hourly calculation capacity	$Q_h = Q_{ngd}/T$	$=$	125.00 m ³ /h
Secondly calculation capacity	$Q_s = Q_h/3600$	$=$	0.035 m ³ /s
	$Q_l = Q_h/3.6$	$=$	34.72 l/s
Total Matter per day	$G_1 = G_{sl} + G_{bla}$	$=$	264 kg/ngd
Amount of Matter per day from primary settling tank	$G_{sl} = Q_{ngd} * (C_1 - C_2) / 1000$	$=$	-24.75 kg/ngd
In which::			
C1 - Matter content into primary settling tank	C_1	$=$	98 mg/l
C2 - Matter content out from primary settling tank	C_2	$=$	106.25 mg/l
Matter content emit per day from primary settling tank	$G_{bla} = Q_{ngd} * (C_2 - C_3) / 1000$	$=$	288.75 kg/ngd
C2 - Matter content into settling tank	C_2	$=$	106.25 mg/l
C3 - Matter content out from settling tank	C_3	$=$	10 mg/l
total sludge have to be pressed in 1 month	$G_2 = 30 * T_n * G_1$	$=$	7920 kg
In which::			
T_n - time for pressing	T_n	$=$	$\boxed{1}$ tháng
Area of necessary tank surface	$F_h = G_2/a$	$=$	72 m ²
In which::			
a - sludge load	a	$=$	$\boxed{110}$ kg/m ²
<i>Sludge is holed in a month water drain to drying sludge in a month</i>			
Sludge density	γ	$=$	1.2 T/m ³
Drying sludge capacity in tank	$V_{bk} = G_2 / (1000 * \gamma)$	$=$	6.6 m ³
Drying sludge height	$h_{bk} = V_{bk} / F_h$	$=$	0.092 m
Matter weight emits per day	$G_3 = G_1 / \rho$	$=$	66000 kg
In which::			
ρ - Matter content	ρ	$=$	0.4 %
Sludge volume	$V_{bl} = G_3 / (1000 * \gamma)$	$=$	65 m ³
In which::			
γ - Matter content	γ	$=$	$\boxed{1.011}$ T/m ³
Sludge height	$h_{bl} = V_{bl} / F_h$	$=$	0.91 m
Depth of matter holding	$h_{cc} = h_{bk} + h_{bl}$	$=$	1.00 m
Tank depth	$H_h = h_d + h_{cc} + h_{dt}$	$=$	1.7 m
In which::			
h_d - height of gravel support layers	h_d	$=$	$\boxed{0.4}$ m
h_{dt} - Stand by height	h_{dt}	$=$	$\boxed{0.3}$ m
Tank size			
Number of tank	N_h	$=$	$\boxed{2}$ hồ
Area of tank	$F_{1h} = F_h / N_h$	$=$	36 m ²
Width	B_h	$=$	$\boxed{10}$ m
Length	$L_h = F_{1h} / B_h$	$=$	4 m
Width	H_h	$=$	1.7 m
Technical pipe			
Water inlet pipe -inside	D_{tr}	$=$	$\boxed{150}$ mm
Bottom water drain pipe	D_d	$=$	$\boxed{150}$ mm

Annex B: The summary of total investment cost.

Produced with ScanTOPDF

WATER SUPPLY PROJECT IN THUONG THOI TIEN TOWN

FUND STRUCTURE

Exchange rate 1 EURO = 26,000 VND

No.	Item	Italian fund (1000VND)	Counterpart fund (1000VND)	Total (1000VND)
1	Source work	1,750,000	1,080,000	2,830,000
2	Raw water pipeline to WWTP	105,179	50,085	155,264
3	Clean water treatment plant, capacity 3000 m3/day	10,175,000	4,926,833	15,101,833
4	Network to distribution/service pipeline, house connection	-	12,155,442	12,155,442
5	Indirect investment cost	-	2,874,339	2,874,339
6	VAT (10%)	-	3,311,688	3,311,688
7	Contingency (10%)	-	3,642,856	3,642,856
8	Total (1000VND)	12,030,179	28,041,244	40,071,421
9	In EURO	462,699	1,078,509	1,541,209
	Exchange rate %	30.02%	69.98%	

COST ESTIMATE SUMMARY

1 EURO = 26000 VND					Unit: 1000 VND	
STT	Content	Symbol	Value before tax	VAT 10%	Value after tax	
I	Construction cost	G _{XD}	19,557,538	1,955,754	21,513,291	
II	Equipment cost	G _{TB}	10,685,000	1,068,500	11,753,500	
III	Project management cost	G _{QLDA}	525,345	52,535	577,880	
IV	Cost for consultant preparing FS	G _{TV}				
IV.1	Preparation of FS	G _{TV1}	131,630	13,163	144,793	
IV.2	Design detailed drawings - preparation of total cost estimate	G _{TV2}	538,946	53,895	592,840	
IV.3	Appraisal for detailed design	G _{TV3}	27,162	2,716	29,879	
IV.4	Appraisal for total cost estimate	G _{TV4}	26,185	2,618	28,803	
IV.5	Preparation of Bidding document, evaluation of construction bids	G _{TV5}	50,100	5,010	55,110	
IV.6	Preparation of Bidding document, evaluation of equipment bids	G _{TV6}	24,975	2,498	27,473	
IV.7	Construction supervision	G _{TV7}	355,160	35,516	390,676	
IV.8	Equipment installation supervision	G _{TV8}	68,039	6,804	74,842	
IV.9	Topographical survey for basic design	G _{TV9}	245,622	24,562	270,184	
IV.11	Topographical survey for detailed design	G _{TV11}	540,368	54,037	594,405	
V	Compensation and site clearance	G _{TRGPMB}	0	0	0	
VI	Others	G _K				
	Work insurance	G _{K1}	90,728	9,073	99,800	
	Training commissioning, technology transfer	G _{K2}	50,000	5,000	55,000	
	FS appraisal	G _{K3}	6,135	613	6,748	
	Technical design appraisal	G _{K4}	10,056	1,006	11,062	
	Cost estimate appraisal	G _{K5}	11,170	1,117	12,286	
	Bidding result appraisal	G _{K6}	3,024	302	3,327	
	Auditing	G _{K7}	101,302	10,130	111,432	
	Final settlement appraisal and approval	G _{K8}	68,394	6,839	75,233	
VII	Contingency	G _{DP}			3,642,856	
	TOTAL (ROUNDED)		33,116,877	3,311,688	40,071,421	
	IN EURO				1,541,209	

TOTAL COST SUMMARY

		1 EURO =			26,000 VND			Unit: 1000 VND		
No.	Item	Unit	Quan.	Civil part		Mechanical part		Equipment		Total
A DIRECT COST				Unit price	Amount	Unit price	Amount	Unit price	Amount	
I	Source work									
	Constructing and installing inlet structure and primary pumping station including construction of station and installation of 02 pumps with capacity Q=125m ³ /h, H=20m	Item	1	650,000	650,000	100,000	100,000	600,000	1,200,000	1,950,000
	Technical pipeline and auxiliary in raw water pumping station	Item	1	50,000	50,000	200,000	200,000		0	250,000
	Lighting system/Controlling electricity	Item	1	80,000	80,000	250,000	250,000	0	0	330,000
	Constructing flow barrier, screening bar	Item	1	300,000	300,000	0	0	0	0	300,000
	Total I				1,080,000		550,000		1,200,000	2,830,000
II	Raw water pipeline to WWTP									
	Constructing and installing raw water pipeline DN250 (by steel and HDPE)	m	135	371	50,085	742	100,170		0	150,255
	Valve, connecting auxiliary (5% of pipeline)	Item	1	1	50,085		5,009			5,009
	Total II:				50,085		105,179		0	155,404
III	Clean water treatment plant, capacity 3000 m ³ /day									
	Chemical mixing equipment	Item	1	50,000	50,000		0		0	50,000
	Treatment cluster (reactor+Lanella settler + gravity filter)	Item	1	300,000	300,000	150,000	150,000	3,600,000	3,600,000	4,050,000
	Steel tank V=900m ³	Item	1	200,000	200,000		0	2,500,000	2,500,000	2,700,000
	Clean water pump, Q=100m ³ /h, H=36m (02 on duty, 01 standby)	Each	3		0		0	500,000	1,500,000	1,500,000
	Pumping leaked water in pumping station, Q=5m ³ /h, H=20m	Each	1		0		0	35,000	35,000	35,000
	Constructing house of secondary pumping station 2	m ²	71.3	3,000	213,900		0		0	213,900
	Chemical house (Alum) + disinfection (chlorine)	Item	1	120,000	120,000	150,000	150,000	300,000	300,000	570,000
	Constructing administrative office (6m x 13.2m)	m ²	79.2	3,500	277,200		0		0	277,200
	Constructing guard house (3.5m x 3.5 m)	m ²	12.25	2,000	24,500		0		0	24,500
	Constructing garage (3.5m x 16m)	m ²	56	1,500	84,000		0		0	84,000

TOTAL COST SUMMARY

Unit: 1000 VND									
1 EURO = 26,000 VND									
No.	Item	Unit	Quan.	Civil part		Mechanical part		Equipment	
				Unit price	Amount	Unit price	Amount	Unit price	Amount
	Technical pipeline and fitting in pumping station (flow meter, valve, flexible joint, water supply pipeline, water drainage pipeline, sewage channel)	Item	1	200,000	200,000	500,000	500,000	50,000	50,000
	Low voltage transformer	Item	1	50,000	50,000	50,000	50,000	400,000	400,000
	Controlling electricity (semi-automatic)	Item	1	50,000	50,000	150,000	150,000	300,000	300,000
	Lighting system	Item	1	120,000	120,000	140,000	140,000	200,000	200,000
	Installing SCADA system	Item	1					400,000	400,000
	Equipping test facility	Item	1					200,000	200,000
	Constructing fence and gate of treatment plant	m	516	600	309,600		0	0	309,600
	Constructing internal road and ground	m2	1826.65	250	456,663		0	0	456,663
	Backfilling treatment plant	m3	28,871	70	2,020,970		0	0	2,020,970
	Total III:				4,476,833		1,140,000		9,485,000
	Network to distribution/service pipeline, house connection								
IV.1	Distribution network uPVC								
	Constructing and installing pipe DN250-uPVC	m	2,739	88	239,936	438	1,199,682		1,439,618
	Constructing and installing pipe DN200-uPVC	m	8,149	56	457,974	281	2,289,869		2,747,843
	Constructing and installing pipe DN150-uPVC	m	3,417	45	154,619	181	618,477		773,096
	Constructing and installing pipe DN110-HDPE	m	8,983	33	296,439	110	790,504		1,086,943
	Valve, connecting fittings (10% of pipe)	Item	1			489,853	489,853		489,853
	Total IV.1				1,148,968		5,388,385	0	6,537,354
IV.2	Service network (HDPE-PN8)								
	Pipe D63	m	47,576	14	642,276	45	2,140,920		2,783,196
	Valve, connecting fittings (10% of pipe)	Item	1			214,092	214,092		214,092
	Total IV.2				642,276		2,355,012	0	2,997,288
IV.3	House connection								
	House connection (including pipe DN15-HDPE-PN12.5, valve and meter) -estimated as 80% of number of households	Household	2240	300	672,000	870	1,948,800	0	2,620,800
	Total IV.3				672,000		1,948,800	0	2,620,800
	Total IV:				2,463,244		9,692,197	0	12,155,442
	Direct costs before tax (Gxltt)				8,070,162		11,487,376		30,242,538
	VAT			10%	807,016	10%	1,148,738	10%	3,024,254
	Direct costs after tax (A)				8,877,178		12,636,113		33,266,791

TOTAL COST SUMMARY

1 EURO = 26,000 VND										Unit: 1000 VND	
No.	Item	Unit	Quan.	Civil part		Mechanical part		Equipment		Total	
				Unit price	Amount	Unit price	Amount	Unit price	Amount		
B	INDIRECT COSTS										
I	Project management cost		=	1.737% *(Construction cost before tax+Equipment cost before tax)							525,345
II	FS cost										
	FS preparation		=	0.435% *(Construction cost before tax+Equipment cost before tax)							131,630
	Detailed drawings - total cost estimate			See enclosed annex							
	Detailed drawings appraisal		=	0.139% * Construction cost before tax							538,946
	Cost estimate appraisal		=	0.134% * Construction cost before tax							27,162
	Preparation of Bidding document, appraisal of construction bids		=	0.256% * Construction cost before tax							26,185
	Preparation of Bidding Document, evaluation of bids of equipment supply		=	0.234% * Equipment cost before tax							50,100
	Construction supervision		=	1.816% * Construction cost before tax							24,975
	Supervision of installing equipment		=	0.637% * Equipment cost before tax							355,160
	Geographical-topographical survey for basic design			Paid as annex 03a							68,039
	Geographical-topographical survey for detailed design			Estimated							245,622
III	Compensation and site clearance			Official dispatch No.1244/UBND-HC 12/12/2012							340,260
IV	Others										0
	Work insurance		=	0.300% *(construction cost before tax + equipment cost before tax)							90,728
	Training commissioning, technology transfer			Estimated							50,000
	FS appraisal		=	0.016% * Total cost							6,135
	Technical design appraisal		=	0.025% * Total cost							10,056
	Cost estimate appraisal		=	0.028% * Total cost							11,170
	Bidding result appraisal		=	0.010% *(construction cost before tax + equipment cost before tax)							3,024
	Auditing		=	0.256% * Total cost							101,302
	Final settlement appraisal and approval		=	0.173% * Total cost							68,394
	Indirect costs before tax										2,874,339
	VAT (10%)										287,434
	Indirect cost after tax (B)										3,161,773
C	TOTAL A+B										36,428,564
D	CONTINGENCY (10%)										3,642,856
E	TOTAL COST (ROUNDED):										40,071,421
F	IN EURO										1,541,209

Annex C: The financial analysis tables.

Produced with ScanTOPDF

WATER SUPPLY SYSTEM PROJECT OF THUONG THOI TIEN TOWN - HONG NGU DISTRICT - DONG THAP PROVINCE
FINANCIAL ANALYSIS

GENERAL TOTAL INVESTMENT ON TECHNOLOGY, CONSTRUCTION AND EQUIPMENT
(For depreciation calculation)

No.	Items	Investment capital (1000VND)				Total (1000 VND)
		Construction	Technology/ electric	Equipment	Other amounts	
1	Raw water pumping station	1,080,000	550,000	1,200,000		2,830,000
2	Raw water pipeline	50,085	105,179	0		155,264
3	Water treatment plant	4,476,833	1,140,000	9,485,000		15,101,833
4	Pipeline network	2,463,244	9,692,197	0		12,155,442
5	Indirect investment				2,874,339	2,874,339
6	Value added tax	807,016	1,148,738	1,068,500	287,434	3,311,688
7	Contingency (10%)	887,718	1,263,611	1,175,350	316,177	3,642,856
8	Total - rounded (1000VND)	9,764,896	13,899,725	12,928,850	3,477,950	40,071,421

WATER SUPPLY SYSTEM PROJECT OF THUONG THOI TIEN TOWN - HONG NGU DISTRICT - DONG THAP PROVINCE

FINANCIAL ANALYSIS

FINANCIAL ANALYSIS

Capacity of water supply system Q = 3,000 m3/day																												
Year		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
No		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	Depreciation rate of construction	9,765																										
2	Depreciation rate of mechanic electric	13,900																										
3	Depreciation rate of equipment	12,029																										
DEPRECIATION (VND MILLION)																												
4	Depreciation duration of construction	25	nam																									
5	Depreciation duration of mechanic electric	20	nam																									
6	Depreciation duration of equipment	10	nam																									
7	Depreciation percentage (%)	100%																										
8	Construction (VND million)	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391
9	Mechanic electric (VND million)	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695	695
10	Equipment (VND million)	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293	1,293
11	millflow	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378
BUSINESS REPORT																												
12	Revenue (VND million)	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538
13	Revenue receipts	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538	4,538
14	Net revenue	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084	4,084
15	Expenditures (VND million)	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992
16	Operation management	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378
17	Depreciation	3,911	4,002	4,035	4,068	4,102	4,136	4,171	4,207	4,244	4,281	4,318	4,355	4,392	4,429	4,466	4,503	4,540	4,577	4,614	4,651	4,688	4,725	4,762	4,799	4,836	4,873	4,910
18	Total	113	82	49	16	-18	-30	-42	-54	-66	-78	-90	-102	-114	-126	-138	-150	-162	-174	-186	-198	-210	-222	-234	-246	-258	-270	-282
19	Benefits (VND million)	113	82	49	16	-18	-30	-42	-54	-66	-78	-90	-102	-114	-126	-138	-150	-162	-174	-186	-198	-210	-222	-234	-246	-258	-270	-282
20	Benefits before tax	28	20	12	4	0	283	274	265	256	246	237	228	219	210	201	192	183	174	165	156	147	138	129	120	111	102	93
21	Income tax (25%)	85	61	37	12	-18	-44	-82	-120	-158	-196	-234	-272	-310	-348	-386	-424	-462	-500	-538	-576	-614	-652	-690	-728	-766	-804	-842
22	Benefits after tax																											
CALCULATE FINANCIAL CAPACITY:																												
23	Input cash flow (VND million)	0	61	37	12	-18	-44	-82	-120	-158	-196	-234	-272	-310	-348	-386	-424	-462	-500	-538	-576	-614	-652	-690	-728	-766	-804	-842
24	Benefits	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2,378
25	Depreciation	0	2,440	2,415	2,390	2,365	2,340	2,315	2,290	2,265	2,240	2,215	2,190	2,165	2,140	2,115	2,090	2,065	2,040	2,015	1,990	1,965	1,940	1,915	1,890	1,865	1,840	1,815
26	Total input cash flow																											
27	Output cash flow (VND million)																											
28	Initial investment	28,041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Total output cash flow	28,041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	Financial balance (VND million)	28,041	2,440	2,415	2,390	2,365	2,340	2,315	2,290	2,265	2,240	2,215	2,190	2,165	2,140	2,115	2,090	2,065	2,040	2,015	1,990	1,965	1,940	1,915	1,890	1,865	1,840	1,815
31	Accumulation (VND million)	28,041	25,578	23,115	20,652	18,189	15,726	13,263	10,800	8,337	5,874	3,411	948	-1,015	-3,478	-5,941	-8,404	-10,867	-13,330	-15,793	-18,256	-20,719	-23,182	-25,645	-28,108	-30,571	-33,034	-35,497
32	Inflation rate (%)	5.0%																										
33	Net inflation rate																											
34	NPV (VND million)	28,041	2,946	2,213	2,086	1,967	1,850	1,732	1,614	1,496	1,378	1,260	1,142	1,024	906	788	670	552	434	316	198	80	-138	-256	-374	-492	-610	-728
35	250 NPV (VND million)	19,897																										
36	Accumulated NPV (VND million)	28,041	25,555	23,482	21,356	19,179	17,053	14,927	12,801	10,675	8,549	6,423	4,297	2,171	104	-112	-324	-536	-748	-960	-1,172	-1,384	-1,596	-1,808	-2,020	-2,232	-2,444	-2,656
37	IRR																											

water supply system project of thuong thoi tien town - hong ngu district - dong thap province
financial analysis

OPERATION AND MANAGEMENT COSTS

Capacity of treatment plant:					3,000		(m3/day)		Unit: VND		
No.	Work items	Unit	Rated	Quantity	Price	Amount					
1	Energy cost per year					591,300,000					
	Energy cost of pumping station grade 1	Kw	0.18	197,100	1,200	236,520,000					
	Energy cost of treatment plant	Kw	0.27	295,650	1,200	354,780,000					
2	Chemical cost					14,892,000					
	Chlorine disinfection, 1.6 g/m3	kg	0.0016	1,752	8,500						
	Alum (50 g/1m3 with purified alum 50%)	kg	0.035	38,325	13,500	517,387,500					
3	Minor repair per year (5% of basic depreciated rate)	Item		1	5% khấu hao	118,923,353					
4	Worker salary per year	labour	0.004	1,095,000	62,500	273,750,000					
	Total (1+2+3+4):					1,516,252,853					
	General management cost per year	Item		1	5%*(1+2+3+4)	75,812,643					
	Total (rounded):					1,592,065,000					
	Operation and management costs is calculated for 1m3 of water (VND)									1,454	

CALCULATE WATER TARIFF FOR DOMESTIC DEMAND

Capacity of treatment plant:	3,000	(m3/day)
Total capacity per year:	1,095,000	m3/year

1. Basis for calculating water tariff

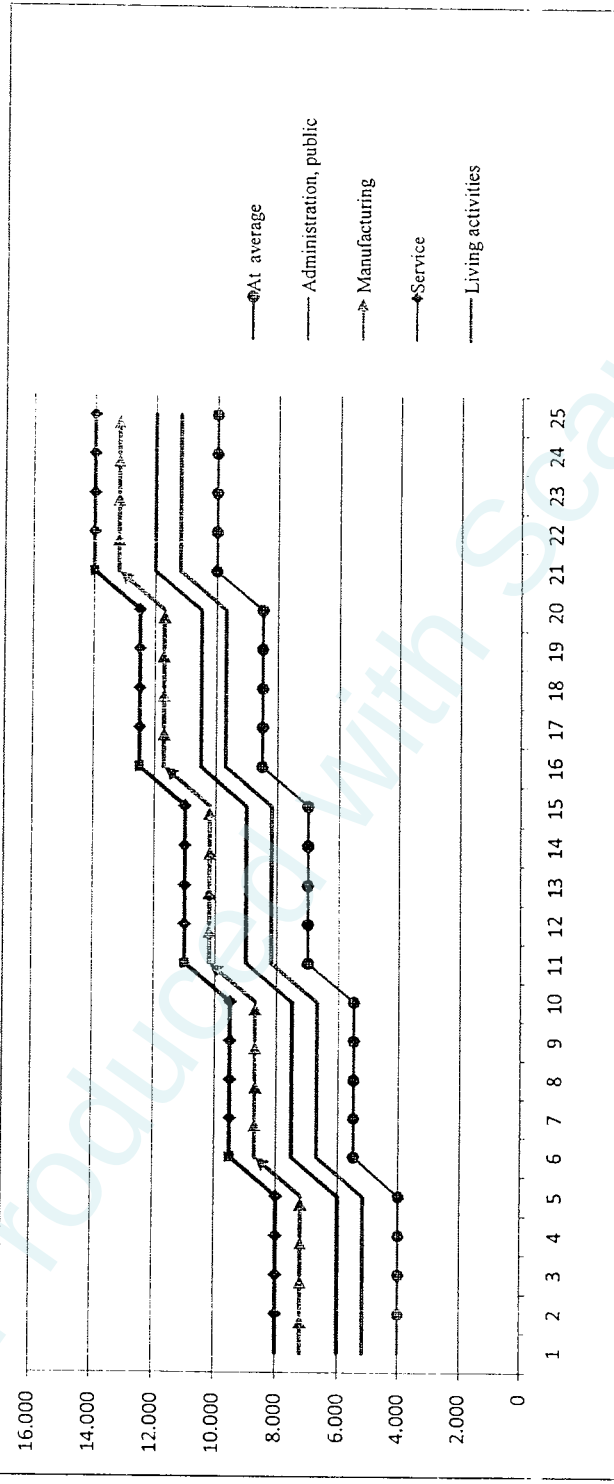
- Water tariff is calculated based on the satisfaction of production costs and benefits and tax payment.
- Calculate sufficient and accurate to ensure operation and maintenance costs.

2. Determination of water tariff for domestic demand

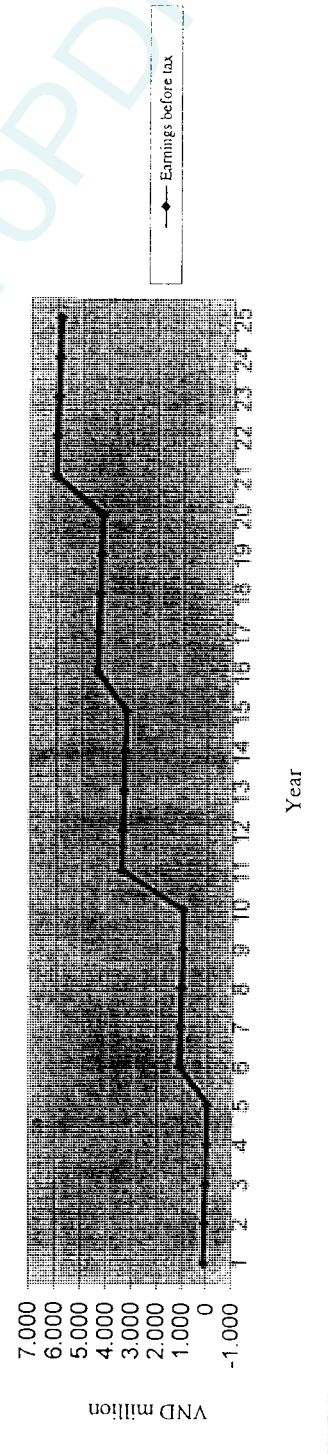
No.	Items	Unit	Amount
I	Direct cost		
1	Electric	VND/m ³	540.00
2	Chemical	VND/m ³	486.10
3	Worker	VND/m ³	250.00
4	Minor repair and maintenance	VND/m ³	108.61
5	General management	VND/m ³	69.24
II	Fixed-asset depreciation		
1	Depreciation	VND/m ³	2,172.12
III	Total		3,626.06
IV	Interest rate and enterprise income tax		
1	Interest rate 3% (III)	VND/m ³	109
2	Enterprise income tax (25% interest rate)	VND/m ³	27
V	Water tariff before tax VAT (III+IV)	VND/m³	3,762
	VAT (10%)	VND/m ³	188
	Water tariff for domestic demand	VND/m³	4,000

water supply system project of thương thời tiên town - hồng ngu district - đông tháp province
financial analysis

ROADMAP FOR WATER TARIFF INCREASE



BENEFITS



PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THIAP
ECONOMIC ANALYSIS

BENEFITS OF PARTICIPANTS

Unit: VND million

No.	Items	Government	Client	Beneficiaries	Total
I	Benefits				
	Revenues		175,695.4		175,695.4
	Consumer surplus			46,303.6	46,303.6
	Import tax				-
	Value added tax	8,291.3			8,291.3
	Income tax	26,210.2			26,210.2
	Land tax				-
	Total	34,501.5	175,695.4	46,303.6	256,500.5
II	Expenditures				
	Investment	-	21,722		21,722.4
	Production		131,129		131,129.2
	Total	-	152,851.6	-	152,851.6
III	Net benefits	34,501.5	22,843.8	46,303.6	103,648.9
	Ratio (%)	33%	22%	45%	100%

Produced with Scantopdf

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS

CÁC CHỈ SỐ KINH TẾ

No.	Items	Total	2010	Operation phases										2021	2022
				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
A. BENEFITS AND EXPENDITURES															
I	Annual benefits	175,695.40													
1	Net profits		5,883.08	5,883.08	5,883.08	5,883.08	5,883.08	5,883.08	7,131.38	7,131.38	7,131.38	7,131.38	7,131.38	7,375.70	7,375.70
2	Worker payment		438.72	447.50	456.45	465.38	474.89	484.38	494.07	503.95	514.03	524.31	534.80	545.50	545.50
3	Tax		1,157.42	1,146.36	1,135.07	1,123.57	1,111.83	1,477.63	1,465.42	1,452.96	1,440.26	1,427.40	1,540.86	1,527.38	1,527.38
	Depreciation		1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37
4	Consuming surplus	46,303.57	-159.58	-37.62	107.95	270.22	514.74	-279.97	-59.82	176.03	563.46	918.73	571.87	571.87	571.87
5	Annual total benefit	129,391.83	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91	5,293.91
II Annual expenditure															
1	Operation		4,730.22	4,763.41	4,797.25	4,831.77	4,866.99	5,214.98	5,251.61	5,288.98	5,327.10	5,365.97	4,438.21	4,478.66	4,478.66
2	Investment	39,882.31													
3	Total		4,730.22	4,763.41	4,797.25	4,831.77	4,866.99	5,214.98	5,251.61	5,288.98	5,327.10	5,365.97	4,438.21	4,478.66	4,478.66
III	Net economic value (NV)		1,189.79	4,276.28	4,385.67	4,511.04	4,717.97	5,198.82	5,379.81	5,575.72	5,922.40	6,236.12	5,467.88	5,856.90	5,856.90
B ECONOMIC ANALYSIS INDICATORS															
I	Depreciation rate	10.0%	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.47	0.39	0.35	0.32	0.32
2	Initial investment	39,882.31													
3	Annual net benefits	97,490	0	8,109.10	7,470.81	6,899.26	6,381.27	5,951.48	5,878.32	5,068.46	5,247.97	4,473.11	3,479.03	3,286.85	3,286.85
4	Annual net expenditure	85,922	39,882.31	4,300.20	3,936.70	3,604.25	3,300.17	3,022.02	2,694.72	2,467.35	2,485.13	2,068.82	1,555.57	1,427.04	1,427.04
5	ENPV	11,569	-39,882.31	3,808.90	3,534.11	3,295.02	3,081.10	2,979.46	2,934.60	2,601.11	2,762.84	2,404.29	1,923.47	1,859.82	1,859.82
6	Benefit - expenditure (EBCR)	1.13													
7	EIRR	12.89%													

No.	Items	Total	2010	Operation phases										2033	2034	2035
				2023	2024	2025	2026	2027	2028	2029	2030	2031	2032			
A. BENEFITS AND EXPENDITURES																
I	Annual benefits															
1	Net profits			6,127.40	6,127.40	6,127.40	6,127.40	7,375.70	7,375.70	7,375.70	7,375.70	7,375.70	7,375.70	8,621.50	8,621.50	8,621.50
	Worker payment			556.41	567.53	578.88	590.46	602.27	614.32	626.60	639.13	651.92	664.96	678.25	691.82	705.66
	Tax			1,135.85	1,121.82	1,107.52	1,092.92	1,455.81	1,440.63	1,425.14	1,409.34	1,392.60	1,375.94	1,359.18	1,342.42	1,325.66
	Depreciation			571.87	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37
2	Consuming surplus			1,085.23	1,750.84	2,449.87	1,020.20	1,789.82	2,596.74	3,442.02	4,326.68	5,098.17	5,868.69	6,639.55	7,410.45	8,181.35
3	Annual total benefit			9,475.75	11,657.57	11,657.57	11,657.57	12,721.59	13,427.76	14,469.83	15,351.75	16,174.59	17,147.65	18,201.43	19,337.75	20,557.75
B. ECONOMIC ANALYSIS INDICATORS																
I. Net economic value (NAV)																
3	Total			4,207.84	5,278.42	5,321.35	5,365.13	5,721.86	5,767.41	5,813.88	5,861.27	5,937.11	5,698.50	5,748.79	5,800.09	5,852.41
II. ECONOMIC ANALYSIS INDICATORS																
1	Depreciation rate			0.29	0.26	0.24	0.22	0.20	0.18	0.16	0.15	0.14	0.12	0.11	0.10	0.09
2	Initial investment															
3	Annual net benefits			2,745.08	2,940.88	2,840.16	2,270.17	2,537.16	2,451.07	2,365.93	2,281.86	1,830.26	1,983.44	1,915.02	1,847.91	1,781.29
4	Annual net expenditure			1,218.86	1,389.97	1,267.69	1,167.61	1,132.04	1,037.32	950.62	871.24	721.21	700.04	642.01	588.86	540.15
5	ENPV			1,526.22	1,550.90	1,566.27	1,102.56	1,405.12	1,413.75	1,415.32	1,410.62	1,109.05	1,382.40	1,273.00	1,259.06	1,241.14
6	Benefit - expenditure (EBCR)															
7	EIRR															

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP

ECONOMIC ANALYSIS

INCOME CALCULATION

Đơn vị: Triệu VND

No.	Items	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A. REVENUES													
1	Annual amount of water billed	876	876	876	876	876	876	876	876	876	876	876	876
2	Average water tariff	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0	5,472.0
3	revenue	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5	4,793.5
4	VAT (5%)	239.7	239.7	239.7	239.7	239.7	239.7	239.7	239.7	239.7	239.7	239.7	239.7
5	Indirect cost depreciation	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3	1,329.3
6	Net revenues	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1	5,883.1
B. PRODUCTION COSTS													
	Production costs	2,212.1	2,256.4	2,301.5	2,347.5	2,394.5	2,442.4	2,491.2	2,541.0	2,591.8	2,643.7	2,696.6	2,750.5
C. BENEFITS													
1	Pre-tax income	3,671.0	3,626.7	3,581.6	3,535.6	3,488.6	3,439.0	3,389.9	3,340.1	3,290.3	3,240.4	3,190.5	3,140.6
2	Enterprise tax	917.7	906.7	895.4	883.9	872.2	860.5	848.8	837.1	825.4	813.7	802.0	790.3
3	Net profit	2,753.2	2,720.0	2,686.2	2,651.7	2,616.5	2,578.5	2,541.1	2,503.0	2,464.9	2,426.7	2,388.5	2,350.3
D. OPERATION COST													
	Total production cost and enterprise income tax	3,129.9	3,163.0	3,196.9	3,231.4	3,266.6	3,301.9	3,337.6	3,373.3	3,409.0	3,444.7	3,480.4	3,516.1
	Direct cost depreciation	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4
	Total economic contribution	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4

No.	Items	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
A. REVENUES														
1	Annual amount of water billed	876	876	876	876	876	876	876	876	876	876	876	876	876
2	Average water tariff	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0	6,972.0
3	revenue	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5	6,107.5
4	VAT (5%)	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4	305.4
5	Indirect cost depreciation	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3	325.3
6	Net revenues	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4	6,127.4
B. PRODUCTION COSTS														
	Production costs	2,805.5	2,861.6	2,918.8	2,977.2	3,036.8	3,097.5	3,159.4	3,222.6	3,287.1	3,352.8	3,419.9	3,488.3	3,558.0
C. BENEFITS														
1	Pre-tax income	3,321.9	3,265.8	3,208.6	3,150.2	3,089.6	3,028.9	2,968.0	2,906.8	2,845.3	2,783.6	2,721.9	2,660.1	2,598.4
2	Enterprise tax	830.5	816.5	802.1	787.5	772.9	758.4	743.9	729.4	714.9	700.4	685.9	671.4	656.9
3	Net profit	2,491.4	2,449.4	2,406.4	2,362.6	2,316.6	2,270.5	2,224.1	2,177.4	2,130.4	2,083.2	2,035.9	1,988.7	1,941.5
D. OPERATION COST														
	Total production cost and enterprise income tax	3,636.0	3,678.1	3,721.0	3,764.8	3,808.6	3,852.4	3,896.1	3,939.8	3,983.5	4,027.2	4,070.9	4,114.6	4,158.3
	Direct cost depreciation	571.9	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4
	Total economic contribution	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4	1,600.4

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS

THẠNG DƯ TIÊU DÙNG

Đơn vị: 1.000 VND

No.	Items	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A	POPULATION													
1	Population served	Người	18.622	18.816	16.024	16.185	18.957	19.146	19.338	19.531	25.937	26.196	26.458	26.723
B	WITHOUT PROJECT													
1	Water consumption standard	l/d	55.0	56.1	57.2	58.4	59.5	60.7	61.9	63.2	64.4	65.7	67.0	68.4
2	Total volume of water served Q ₂	m ³	372,834	385,280	324,038	334,793	411,926	424,366	437,182	450,385	610,059	628,483	647,463	667,017
3	Average water tariff	VND/m ³	4,500	4,725	4,961	5,209	5,470	5,743	6,030	6,332	6,649	6,981	7,330	7,697
	CPI	5%	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
C	WITH PROJECT													
1	Water consumption standard	l/d	80	80	110	110	110	110	110	110	110	110	110	110
2	Total volume of water served Q ₂	m ³	343,758	349,419	643,882	649,816	561,112	768,723	776,410	784,174	1,041,360	1,051,773	1,062,299	1,072,914
3	Average water tariff	VND/m ³	4,793	4,793	4,793	4,793	4,793	6,107	6,107	6,107	6,107	6,107	7,421	7,421
D	CONSUMING SURPLUS													
1	Cost saving A		-109,710	-26,381	56,153	143,380	278,588	-154,556	-33,681	101,102	330,089	548,983	-59,208	183,466
2	Consuming surplus B		-49,868	-11,239	51,792	126,840	236,157	-125,416	-26,135	74,929	233,367	369,746	-37,934	111,644
	Total		-159,578	-37,620	107,945	270,220	514,745	-779,973	-59,816	176,031	563,456	918,729	-97,142	295,110

No.	Items	Unit	2.022	2.023	2.024	2.025	2.026	2.027	2.028	2.029	2.030	2.031	2.032	2.033	2.034
A	POPULATION														
1	Population served	Người	29,989	30,289	30,592	30,897	31,206	31,518	31,834	32,152	32,474	32,798	33,126	33,457	33,792
B	WITHOUT PROJECT														
1	Water consumption standard	l/d	69.8	71.1	72.6	74.0	75.5	77.0	78.6	80.1	81.7	83.4	85.0	86.7	88.5
2	Total volume of water served Q ₂	m ³	763,512	786,570	810,324	834,796	860,007	885,979	912,736	940,300	968,697	997,952	1,028,090	1,059,139	1,091,125
3	Average water tariff	VND/m ³	8,081	8,485	8,910	9,355	9,823	10,314	10,830	11,371	11,940	12,537	13,164	13,822	14,513
	CPI	5%	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
C	WITH PROJECT														
1	Water consumption standard	l/d	110	110	110	110	110	110	110	110	110	110	110	110	110
2	Total volume of water served Q ₂	m ³	1,200,048	1,211,088	1,228,249	1,240,532	1,252,937	1,265,466	1,278,121	1,290,902	1,303,811	1,316,849	1,330,018	1,343,318	1,356,751
3	Average water tariff	VND/m ³	7,421	7,421	7,421	8,735	8,735	8,735	8,735	8,735	10,049	10,049	10,049	10,049	10,049
D	CONSUMING SURPLUS														
1	Cost saving A		794,529	1,293,856	1,827,905	768,763	1,362,523	1,997,678	2,676,787	3,402,565	2,464,683	3,275,478	4,141,943	5,067,513	6,055,829
2	Consuming surplus B		290,701	456,986	621,964	251,436	427,297	599,062	765,232	924,118	633,488	793,212	940,263	1,072,034	1,185,618
	Total		1,085,230	1,750,842	2,449,869	1,020,200	1,789,820	2,596,741	3,442,019	4,326,683	3,098,171	4,068,690	5,082,206	6,139,547	7,241,447

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS

PRODUCTION EXPENDITURES

		Operation phases											Đơn vị	Triệu VNĐ
No.	Items	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
A MATERIAL COSTS														
1	Electric	1,117	1,139	1,162	1,185	1,209	1,233	1,258	1,283	1,309	1,335	1,361	1,389	
2	Chemical	754	769	784	800	816	832	849	866	883	901	919	938	
3	Minor repair	99.52	101.51	103.54	105.61	107.72	109.88	112.07	114.31	116.60	118.93	121.31	123.74	
	Total	1,970.43	2,009.84	2,050.04	2,091.04	2,132.86	2,175.52	2,219.03	2,263.41	2,308.68	2,354.85	2,401.95	2,449.99	
B Tax														
	VAT (10%)	197.04	200.98	205.00	209.10	213.29	217.55	221.90	226.34	230.87	235.49	240.19	245.00	
	Total	197.04	200.98	205.00	209.10	213.29	217.55	221.90	226.34	230.87	235.49	240.19	245.00	
C Total material cost														
		1,773.39	1,808.86	1,845.04	1,880.14	1,919.58	1,957.07	1,997.13	2,037.07	2,077.81	2,119.57	2,161.75	2,204.99	
D WORKER PAYMENT														
1	Worker payment	324.00	330.48	337.09	343.83	350.71	357.72	364.88	372.17	379.62	387.21	394.95	402.85	
2	General management cost	114.72	117.02	119.36	121.74	124.18	126.66	129.20	131.78	134.41	137.10	139.85	142.64	
	Total	438.72	447.50	456.45	465.58	474.89	484.38	494.07	503.95	514.03	524.31	534.80	545.50	
E ECONOMIC COST														
		2,212.11	2,256.36	2,301.48	2,345.71	2,394.46	2,442.58	2,491.20	2,541.02	2,591.84	2,643.68	2,696.55	2,750.48	

STT	Items	Operation phases												
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
A MATERIAL COSTS														
1	Electric	1,416.50	1,444.83	1,473.73	1,503.20	1,533.26	1,563.93	1,595.21	1,627.11	1,659.65	1,692.85	1,726.70	1,761.24	1,796.46
2	Chemical	956.28	975.40	994.91	1,014.81	1,035.10	1,055.81	1,076.92	1,098.46	1,120.43	1,142.84	1,165.69	1,189.01	1,212.79
3	Minor repair	126.21	128.74	131.31	133.94	136.62	139.35	142.14	144.98	147.88	150.84	153.85	156.93	160.07
	Total	2,498.99	2,548.97	2,599.95	2,651.95	2,704.98	2,759.08	2,814.27	2,870.55	2,927.96	2,986.52	3,046.25	3,107.18	3,169.32
B Tax														
	VAT (10%)	249.90	254.90	259.99	265.19	270.50	275.91	281.43	287.06	292.80	298.65	304.63	310.72	316.93
	Total	249.90	254.90	259.99	265.19	270.50	275.91	281.43	287.06	292.80	298.65	304.63	310.72	316.93
C	Total material cost	2,249.09	2,299.73	2,353.95	2,418.39	2,475.48	2,539.84	2,598.84	2,658.61	2,719.76	2,781.50	2,841.63	2,906.46	2,952.39
D WORKER PAYMENT														
1	Worker payment	410.91	419.13	427.51	436.06	444.78	453.68	462.75	472.01	481.45	491.08	500.90	510.92	521.13
2	General management cost	145.49	148.40	151.37	154.40	157.49	160.64	163.85	167.13	170.47	173.88	177.36	180.90	184.52
	Total	556.41	567.53	578.88	590.46	602.27	614.32	626.60	639.13	651.92	664.96	678.25	691.82	705.66
E	TOTAL PRODUCTION COST	2,805.49	2,867.26	2,918.84	2,977.21	3,036.76	3,097.49	3,159.44	3,222.63	3,287.08	3,352.83	3,419.88	3,488.28	3,558.04

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS

DEPRECIATION CALCULATION

		Đơn vị: Triệu VND													
		Depreciation duration	Investment	Operation phases											
No.	Items			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
				1	2	3	4	5	6	7	8	9	10	11	12
A. Loan															
1	Construction	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	Technology	20	11,437.38	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	
3	Equipment	10	10,285.00	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	
5	Direct expenditures	10	2,172.24	217.22	217.22	217.22	217.22	217.22	217.22	217.22	217.22	217.22	217.22	217.22	
	Total A		23,894.61	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	1,817.59	571.87	
B. Counterpart fund															
1	Construction	25	8,070.16	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	
2	Technology	20	50.00	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
3	Equipment	10	400.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	
5	Direct expenditures	10	7,467.54	746.75	746.75	746.75	746.75	746.75	746.75	746.75	746.75	746.75	0	0	
	Total B		15,987.70	1,112.06	1,112.06	1,112.06	1,112.06	1,112.06	1,112.06	1,112.06	1,112.06	1,112.06	325.31	325.31	
	Total (A-B)		8,906.91	705.53	705.53	705.53	705.53	705.53	705.53	705.53	705.53	705.53	897.18	897.18	
A. Loan															
1	Construction	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	Technology	20	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	571.87	
3	Equipment	10	0.00	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	1,028.50	
5	Direct expenditures	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total A		571.87	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,600.37	1,028.50	1,028.50	
B. Counterpart fund															
1	Construction	25	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	322.8	
2	Technology	20	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
3	Equipment	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5	Direct expenditures	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total B		325.31	325.31	325.31	325.31	325.31	325.31	325.31	325.31	325.31	325.31	322.81	322.81	
	Total (A-B)		246.56	1,275.06	1,275.06	1,275.06	1,275.06	1,275.06	1,275.06	1,275.06	1,275.06	1,275.06	705.69	705.69	

**PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS**

DEPRECIATION DETERMINATION

No.	Items	Investment capital			VAT (10%)		Rate	Economic investment		Tax		
		Counterpart	Borrow		Counterpart	Borrow		Counterpart	Borrow	VAT	Insurance	Total
1	Construction	8,070	0		807			8,070	0	807.02		807.02
1	Technology	50	11,437		1,149		1.00	50	11,437	1,148.74		1,148.74
2	Equipment	400	10,285		1,069		1.00	400	10,285	1,068.50		1,068.50
3	Direct expenditures (included contingency)	7,468	2,172		569	0.00	1.00	7,468	2,172	568.75		569
	Total	15,988	23,895		3,593	0		15,988	23,895	3,593		3,593

Đơn vị: Triệu VND

SENSITIVITY ANALYSIS

Changeable plans	Value	Origin	Changeable cases	
Total investment	Ratio (%)	0%	-10%	10%
	NPV (VND million)	19,697	37,117	-1.369
	IRR (%)	10.21%	15.36%	4.64%
Percentage of NRW	Ratio (%)	20%	15%	25%
	NPV (VND million)	19,697	37,117	-1.369
	IRR (%)	10.21%	15.36%	4.64%
Depreciation rate (%)	Depreciation	100%	150%	50%
	NPV (VND million)	19,697	37,117	-1.369
	IRR (%)	10.21%	15.36%	4.64%
	Domestic water tariff (VND)	4,000	4,800	2,800

DETERMINE WATER TARIFF IN ACCORDANCE WITH WATER CONSUM

- The determination of water tariff for each water consumer aimed to calculate accurate and sufficient in accordance with regulations of State on applying different tariffs for each water consumer.
- Water tariff is calculated at the time the work began to use in 2012

Pursuant to Decision No. 16/2011/ QĐ-UBND on July 07, 2011 on the issuance of water tariff for domestic water, production, business and service water demand in Dong Thap Province included:

Đơn vị: VNĐ/1 m³

No.	Water consumer	Ratio %	Water tariff
1	Domestic water	65.0%	4,000
2	Administration, public, school, hospital, etc.	5.0%	6,000
3	Production, basic construction, enterprises, etc.	15.0%	7,200
4	Business, service, restaurant and other services	15.0%	8,000
	Average water tariff		5,180

PROJECT: WATER SUPPLY SYSTEM OF THUONG THOI TIEN TOWN - HONG NGU - DONG THAP
ECONOMIC ANALYSIS

TOTAL INVESTMENT

Đơn vị: 1000 VND

No.	Items	Investment capital				Economic investment			Tax and social insurance		
		Pre-tax investment		VAT (10%)							
		Counterpart fund	ODA funded by Italian	Counterpart fund	ODA funded by Italian	Counterpart fund	ODA funded by Italian	VAT	Insurance	Total	
A	Direct investment	8,520,162	21,722,376	3,024,254		8,520,162	21,722,376	3,024,254		3,024,254	
B	Contingency	3,952,301	0			3,952,301.11	0.00	0		0	
C	Indirect investment	5,687,472	0	568,747		5,687,472.41	0.00	568,747		568,747	
	Total	18,159,935	21,722,376	3,593,001		18,159,935.46	21,722,376	3,593,001		3,593,001	