

**THE SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF AGRICULTURE AND
RURAL DEVELOPMENT
BEN TRE PEOPLE'S COMMITTEE**

**THE SOCIALIST REPUBLIC OF VIETNAM
THE PREPARATORY SURVEY FOR
BEN TRE WATER MANAGEMENT PROJECT**

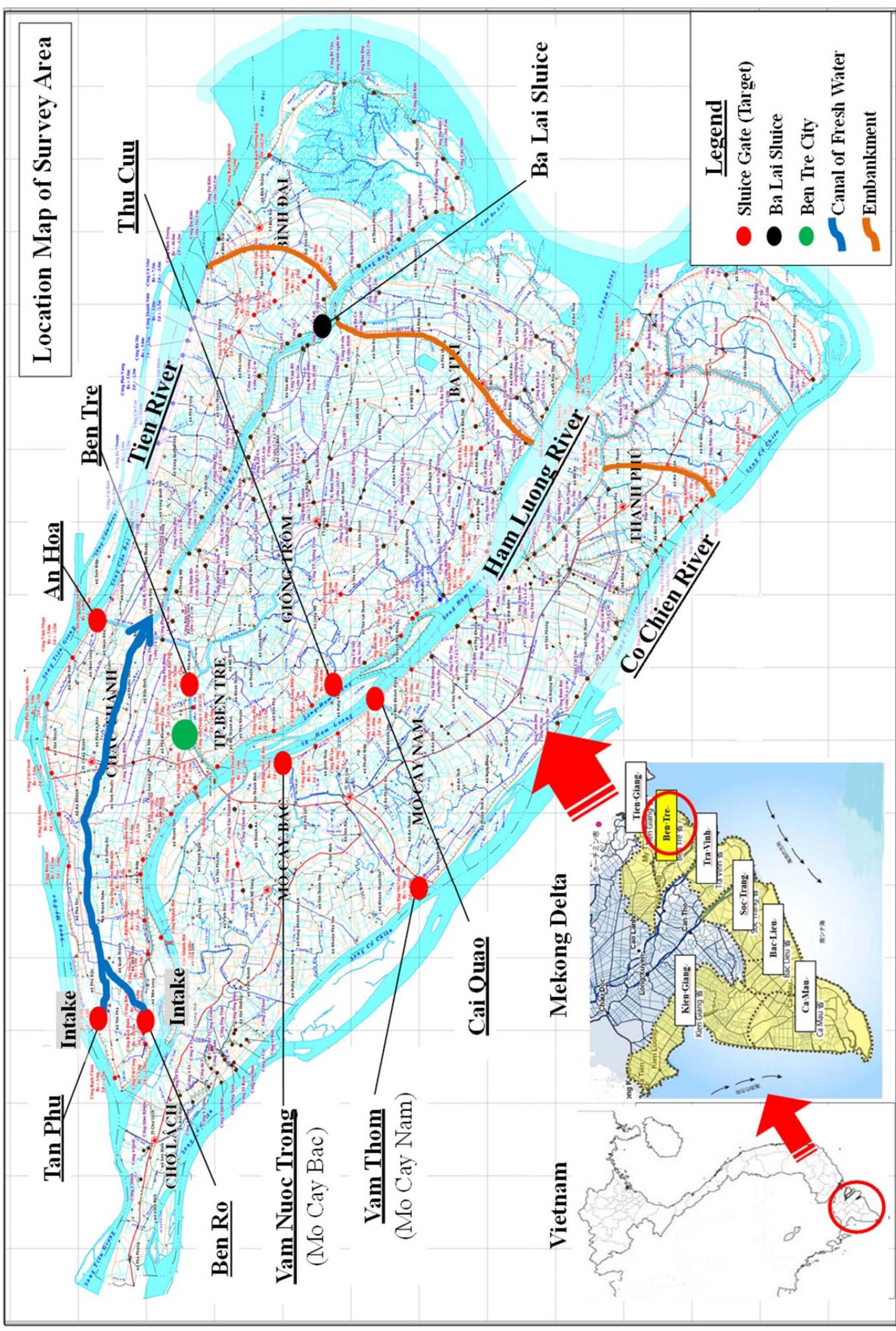
FINAL REPORT

OCTOBER 2016

JAPAN INTERNATIONAL COOPERATION AGENCY

**SANYU CONSULTANTS INC.
CTI ENGINEERING INTERNATIONAL CO., LTD.
NEWJEC INC.**

Location Map of Survey Area



Tan Phu

Intake

An Hoa

Ben Tre

Tien River

Thu Cuu

Ben Ro

Vam Nuoc Trong
(Mo Cay Bac)

Vam Thom
(Mo Cay Nam)

Cai Quao

Vietnam

Mekong Delta

Ba Lai Sluice

Legend

- Sluice Gate (Target)
- Ba Lai Sluice
- Ben Tre City
- Canal of Fresh Water
- Embankment

EXECUTIVE SUMMARY

1. RATIONAL AND OBJECTIVES OF THE PROJECT

The Mekong Delta is considered vulnerable against climate change, due to damages caused by sea level rise, such as severe flooding in the rainy season and saline intrusion in the dry season. Particularly, damages of saline water intrusion in Ben Tre Province as results of sea level rise are serious, and it is envisaged that fruit production will be also seriously affected, in addition to paddy production, by a high level of salinity. According to the report of the former JICA study on “the Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development Coastal Mekong Delta” in April 2013 (JICA Study (2013)), the estimated costs of damages in Ben Tre Province is the highest among the seven coastal provinces.

This preparatory survey aims at developing an implementation plan of a Japanese ODA loan project, through examining project outline, costs, implementation setup, organizational capacity, operation and maintenance (O&M) arrangements, environmental and social considerations, and others. The targeted Ben Tre Water Management Project (project) aims at contributing to an improvement on the livelihoods of the people of Ben Tre Province in Southern Vietnam where severe loss in agriculture caused by saline intrusion has been recorded. To do so, the project will construct structures and facilities to control saline intrusion, which allow the Ben Tre people to provide water with lower salinity to their farming plots, hence, an improvement on the productivity of their produce. With such improved productivity, the Ben Tre people could better adapt to Climate Change impacts and enhance rural and regional development.

The counterpart organizations of the survey are the Central Project Office (CPO) under the Ministry of Agriculture and Rural Development (MARD) and the Department of Agriculture and Rural Development (DARD) under the Ben Tre Provincial People’s Committee (PPC). DARD arranged a focal person for the survey team. The survey was conducted from August 2015 to June 2016. The major components of the survey were: simulation of saline water intrusion, based on sea level rise projections under climate change; social and environmental impact assessment including the consultation through stakeholder consultation meetings, the in-situ geological and topographic survey coupled with laboratory test, the field investigation on agriculture, basic design of construction works and other related studies.

Although primary industries (agriculture, forestry and fishery sectors) have only an 18% share of the GDP in Vietnam, they account in Ben Tre Province for approximately 44% of the provincial GDP, followed by tertiary industries with 36% and secondary industries with 22%. This means that primary industries in the Ben Tre Province play a key role for poverty reduction and further economic growth.

Today in Vietnam there are programs and plans to promote agricultural and rural development. The National Target Program for New Rural Development (NTP-NRD) is a nationwide rural development program, which is under the implementation. There are 2 key policies at the provincial level: 1) The Ben Tre Social and Economic Development Plan (BT-SEDP) and 2) The Ben Tre Agricultural Development Plan. The project aims at contributing to agricultural and rural development by addressing saline water intrusion, and therefore, it is consistent with the existing program and plans, and it can complement them.

2. SURVEY AREA

2.1. The Ben Tre Province is located between Tien Giang Province to the North and the Vinh Long and Tra Vinh Provinces to the southwest. The total population is estimated as 1.26 million; About 60% of the population lives in North Ben Tre, and the remaining 40% lives in South Ben Tre. The total farmland in Ben Tre is 137,224 ha, and the project benefits approximately 80% of the total farmland (110,442 ha). The beneficiaries of the project are assumed to be 207,275 households in total.

2.2. GDP in Ben Tre Province of 2014 was VND 90,095 billion (USD 4,097 million) and GDP per

capita was VND 71 million (USD 3,246). The GDP per capita in Ben Tre is approximately 1.6 times higher than that of the national average. This is the 9th position among the 12 provinces in the Mekong Delta Region. The GDP growth of manufacturing and communications in Ben Tre show nearly 100% development; while, agriculture-forestry-fishery and wholesale show less than 20% development (between 2010 and 2014 at constant 2010 prices).

2.3. The Mekong Delta is located in the tropical monsoon region, which is usually featured with hot and humid climate. The average temperature ranges approximately from 25C° to 30C°. The rainy season starts in May and ends in November. The monthly rainfall in the rainy season fluctuates year by year. In 2014, the rainfall amount was low in May, October and November in comparison with the average monthly rainfall of the same months between 2010 and 2014. The annual rainfall amount between 2011 and 2014 was at around 1,400mm.

2.4. Ben Tre Province has dense canal networks with about 6,000km in total extension. Canals are connected to one of the main rivers, and their average length is about 1-2km. There are more than 60 canals having over 50m of width. The freight transportation volume by the inland waterway in Ben Tre is larger than the volume by road. Yet, the number of passengers by the inland waterway transportation has been decreasing gradually. In the project area, there is seen riverbank erosion, and the project shall deal with the riverbank erosion in the vicinities of the construction sites of the proposed sluice gates.

2.5. The Southern Regional Hydro-Meteorological Station (SRHMS), Ben Tre Irrigation Works Exploitation One-Member Limited Liability Company (IWEC) and the Department of Natural Resources and Environment of Ben Tre Province (DONRE) measure the salinity in canal water in the province during the dry season: SRHMS observes salinity with 5 stations in the Ben Tre Province, the Ben Tre Hydro-Meteorological Station (BTHMS) issues a salinity forecast every 10 days and IWEC observes salinity at the 20 existing sluices once a day during the dry season. According to the report issued by DARD, damages of saline water intrusion have been observed since 1998. DONRE also measures surface water and ground water quality. There are 54 sampling points for water quality measurement. According to its monitoring report, 54% of the measurement points have recorded the worst ever level of water pollution to an extent which requires purification measures.

2.6. The water supply in the Ben Tre Province is managed and provided by two agencies: the Ben Tre Water Supply One-member Limited Liability Company (WSC) and the Center of Rural Water and Environment Sanitation (CRWES) Ben Tre Province. WSC operates 2 water-pumping stations designed with the water supply capacity of 52,800 m³/day, and it provided water supply services to 59,684 customers in 2015. CRWES operates 42 water supply plants and provide the water amount of 1,583 m³/h to 51,383 households in rural areas. Saline water intrusion has caused serious problems for water supply both in urban and rural areas. This is because salt water enters into the boreholes and the intake points of fresh water. As a result, taking water from these boreholes and intake points has been forced to stop.

2.7. DARD has formulated a water management plan targeted for the year 2020 including the construction of structural measures against flood, high tide, and seawater intrusion, such as dykes, sluice gates and canals. DARD plans to complete construction of all the necessary sluice gates along canals to prevent saline intrusion, before the project completes. IWEC has the direct authority for irrigation structure in Ben Tre Province and O&M of water management structures. During the construction period of the sluice gates, a joint management committee would be established at different administrative levels to control and manage construction works for irrigation facilities. The decision on to which level the committee would be established will be made in consideration of the scale of construction works and their costs.

2.8. In terms of land use, there are 4 major crops in the Ben Tre Province: fruits, coconut, paddy and brackish aquaculture (typically shrimp). In the upper streams of the province, perennial plants and

ornamental plants are prevalent. On the other hand, paddy is predominant in the downstream areas. Coconut and aquaculture have an increasing trend between 2010 and 2014; while the share of paddy has decreased 6 percent from 36% to 30% in the same period. Paddy is no longer the most popular crop in the province. In fact, the field survey revealed that farmers had been attracted to coconuts more than paddy, due to their high market prices and relatively high tolerance to saline water.

2.9. There are 5 major cropping patterns: 1) the intensive cropping of paddy, which is common in the midstream to downstream areas of Ben Tre, 2) two times of cropping of paddy, sometimes combined with freshwater aquaculture during the dry season, 3) combination of one-time cultivation of paddy and brackish aquaculture, 4) brackish aquaculture in coastal areas and 5) cultivation of perennial crops such as coconut trees and fruit trees throughout the year. These cropping patterns feature diversified farming and frequent changes in commodities. Farmers practice with a mixture of various types of crop production and cattle raising. They also pursue market trends and do not hesitate to change the land use or cropping pattern.

2.10. The coastal areas of Ben Tre Province are characterized by brackish aquaculture, especially shrimp cultivation. Brackish shrimp culture accounts for 80% of the aquaculture area. Brackish aquaculture is seen as a “high-risk and high-return” commodity in the Mekong Delta Region, because of the experience of the unknown disease pandemics in the past. Brackish water is fully accessible outside of the dyke; yet, fresh water is also necessary to regulate saline water concentration in shrimp ponds. The use of groundwater is strictly prohibited due to the risk of land subsidence; therefore, aquaculture households secure water from rain or from canal, where available.

2.11. A large percentage of agricultural produce is exported to the international market, especially aquaculture products, coconuts and some particular types of fruits. By contrast, rice is consumed almost everywhere in the region. The prices of rice and coconut oil have stable trend, the price of orange, however, has seasonal fluctuation every year and also reflects the effect of bad weather. Shrimp producers have enjoyed a high-value season in the past few years (2013-2015) after a terrible outbreak of disease in 2012; yet, the price fell at the end of 2015 again.

2.12. An average yield of paddy is 4.86 ton/ha, and the highest average yield of paddy is 5.39 ton/ha in the summer-autumn season; whereas the lowest average yield is 4.27 ton/ha in the autumn-winter season. The net income of paddy per season per ha is VND 10,679,000 (USD 481) at financial values. As for fruits production, the net income per ha is about VND 69,102,000 (USD 3,116) from coconut production per year and VND 69,871,000 (USD 3,150) from the production of other fruits. On an average of all types of shrimp culture, the net income is estimated at approximately VND 89,610,000 per household (USD 4,040).

2.13. In Ben Tre Province, the poverty rate of the rural area is nearly 2 times higher than the urban area all the time, but both areas have reduced their poverty rate in the past 10 years to about 30% of the rate of the year 2005. In addition, monthly average income per capita has more than tripled between 2006 and 2014. Yet, it has increased more than four times in the same period in the whole nation. It is, therefore, concluded that Ben Tre Province is developing but behind the pace of the whole nation. Saline intrusion is one of the urgent issues to be addressed in Ben Tre, but at the same time, farmers in Ben Tre are highly business-oriented and flexible to pursue higher market prices. These potentials indicate that development of agriculture and aquaculture is a key strategy for further development.

2.14. In light of climate change and sea level rise, the central and local agencies of the government as well as international donors and NGOs are implementing various projects in the Ben Tre Province. There are 2 projects under implementation: Adaptation to Climate Change in the Mekong Delta in Ben Tre and Tra Vinh Provinces implemented by the International Fund for Agricultural Development (IFAD) and The Response and Adaptation to Disasters and Climate Change implemented by Oxfam.

In addition, the World Bank (WB) is preparing the project called The Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project. The Ben Tre Water Management Project and these three projects can produce synergy effect. Like the Ben Tre Water Management Project does, both the projects supported by IFAD and WB also have a component of the installation and operation of surface water monitoring system. It is important for the Ben Tre Water Management Project to continue communicating with these two projects aiming at avoiding unnecessary duplications and assuring the coordination and complementarity among the three projects.

3. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

3.1. Environmental Consideration

Possible Environmental Impacts and the Mitigation Measures

Environmental Items	Possible Adverse Impacts	Main Mitigation Measures
Air Pollution	It might be possible that the use of construction vehicles bring about the emissions of dust and air pollutants. The project also includes access roads connecting to existing roads, resulting in the slight increase in dust and exhaust gas emissions. However, the air impacts will be within the permissible range.	<ul style="list-style-type: none"> - Vehicles carrying demolition and construction materials must have waterproof covering tarps to prevent the emission of air pollution sources - Sprinkling water in the demolition areas and the transport roads to diminish dust - Controlling the quality of vehicles and machinery and periodically maintaining them for limiting excessive exhaust emissions.
Water Pollution	Wastewater discharge and surface water runoff from construction sites may carry organic, sediment loads that deteriorate surface/groundwater sources. It is predicted that the closure of sluice gates might create water stagnancy, then accumulation of wastes and water pollution, if no countermeasures taken.	<ul style="list-style-type: none"> - Prohibiting defecation and disposal of wastes into the river. - Installing toilets at construction sites with temporary wastewater treatment system (septic tanks) -Raising awareness of local residents in environmental protection; and setting policies to discourage the release of untreated wastewater and wastes into the canals/river. <p>The gates will not remain closed through the dry season. The gates will be opened or closed depending on the salinity and water quality situations. This will be preventing measures for possible water pollution.</p>
Wastes	Through the construction phase different types of waste such as construction wastes, excavation materials, felled vegetation, and possible oil spills, will be generated. Wastes from domestic, agricultural sources could be also trapped when gates are closed, if no countermeasures are taken.	<ul style="list-style-type: none"> - Demolition and construction wastes are gathered and segregated into sources. - Spilled materials have to be collected and treated just like other wastes.
Noise and Vibration	Noise of construction machinery may affect residents living near construction sites. The increase in traffic volume will be limited and therefore, it will not cause noise problem at residential areas.	<ul style="list-style-type: none"> - Anti-noise equipment should be installed for the machinery such as generator, air compressor, etc. - Construction vehicles and machinery should be inactive from 6pm to 6am.
Ecosystems	The project is anticipated to have some certain impacts on ecosystems, mainly by discharging industrial wastes. Closing sluice gates in the dry season, may interrupt the movement of migratory fishes, thus may affect their recruitment and survival.	<ul style="list-style-type: none"> - Prohibiting illegal wastes disposal and leakage of materials to rivers /canals. - The revetment method will be applied to both sides of the river, where vegetation will be cut down for the construction of sluice gates, in order to prevent soil runoff which might have impact on the ecosystem.. - Installing auxiliary structures (fishway) to facilitate the fish migration in the An Hoa Sluice Gate, Ben Tre Sluice Gate, Vam Nuoc Trong Sluice Gate, and Vam Thom Sluice Gate. - Only closing the sluice gates when necessary in the dry season, keeping the gates open at maximum in sensitive period (e.g. breeding season).
Hydrology	There is a possibility that the project would exert impacts on hydrological regimes in the construction and operation phases, including narrowing and reducing river flow through the gates, while increasing water flow in other areas.	This project has mitigation measures of revetment of riverbanks and riverbed protection in all areas to be hydrologically affected by the construction and operation of proposed sluice gates operations

In addition, the following items are proposed for the environmental monitoring by project phase.

【Construction Phase】 : Air Quality, Surface Water Quality, Groundwater Quality, Noise, and Ecosystems (Fishes)

【Operation Phase】 : Air Quality, Surface Water Quality, and Ecosystems (Fishes)

Furthermore, to respond the local people's concerns, it is recommended that pollution load analyses to identify the pollution sources, including pollution sources no related to this project should be done. Effective measures against identified pollution sources, including the installation of waste water treatment facilities, will be examined, based on the results of the analyses.

3.2. Social Consideration

Social impacts - assessment and mitigation measures

1) Involuntary resettlement

It is predicted that the project will need to acquire the land from 160 households. Among them, 71 households will be significantly affected, because the land area to be acquired will be larger than 20% of their total land. Besides, 22 households would lose their residential land and will be forced to relocate their house. Of which, 14 households may build new houses in their remaining land (on-site resettlement), but the other 8 households will be forced to relocate somewhere else, because their remaining land is not large enough to build new houses.

In addition, 3 factories and 1 company would lose their land for the project. Among them, 2 factories (producing coconut coir) would be significantly affected because more than 50% of their land will be acquired and it will be difficult for them to continue their production activities in the remaining land.

During the survey, the resettlement action plan (RAP) prepared in 2014 was updated in line with relevant Vietnam regulations and the JICA Guidelines for Environmental and Social Considerations. Proposed measures to mitigate impacts of involuntary resettlement are described in the updated RAP.

In addition, in order to create local people's consensus and promote their participation into the project planning, the survey had carried out various activities to diffuse information on the project to local people, and organized 5 rounds of consultation meetings to discuss with local people on the project-related issues.

2) Local economy such as employment and livelihoods

Agriculture is the main economic activity in the project area. Coconut tree is the most popular crop since it is tolerant to a relatively-high salinity. Besides, horticulture and animal husbandry also play important roles in the local economy. Prevalent domestic animals such as pig, goats, cows, poultry, etc., are also widely raised.

According to participants of the stakeholder consultation meetings, the most concerned issues of Ben Tre farmers are: (1) the lack of freshwater, and (2) water pollution. They expect that the sluice gates after being brought to operation will stably supply freshwater throughout the year, and help local people develop high value-added agricultural production such as fruit, livestock, etc. In addition, bridges and access roads planned with the sluice gates may contribute to the improvement of local road network, and promote local economy and industrial development.

However, the waterway transportation will be partly obstructed due to the closure of sluice gates for several months in the dry season, particularly at the sluice gates without navigation locks. And a ferryman near Vam Nuoc Trong Sluice Gate would be forced to suspend his service due to the newly-constructed bridge over the sluice gate.

During the survey, a number of sub-surveys were carried out to predict and assess impacts that may be caused by the project to waterway users. In order to mitigate adverse impacts on affected waterway users, the measures proposed in the Policy Framework for Waterway Users shall be further examined and implemented after having consent/approval by Ben Tre PPC and/or ICMB9.

3) Organization of stakeholder consultation meetings

During the survey, 5 rounds of stakeholder consultation meeting (SHCM) were organized.

The First SHCM was organized in Ben Tre City to discuss with participants from Ben Tre Province PC, DARD, DONRE, and to-be-affected city/districts, etc., about the SHCM organization plan, the selection of communes where SHCM will be organized, and the methods to select the persons to be invited to the SHCMs in the communes.

The Second SHCMs were organized in the 20 selected communes to discuss with local residents and representatives from local agencies, local mass organizations, etc., about the project plan, estimated significant impacts, plan and schedule of environmental and social surveys, etc.

The Third SHCMs were organized again in the 20 selected communes, with almost the same participants as those of the Second SHCMs. During these meetings, the agricultural development vision, the draft of the land use plan, the proposed water distribution plan, etc., were explained to the participants.

The Fourth SHCM was held in Ben Tre City with participants from Ben Tre PPC (DARD, DONRE, etc.), to-be-affected city/districts, and representatives from selected communes. This SHCM had aims to explain the results of the Third SHCMs, and discuss with participants on the finalization of the draft land use plan, water distribution plan, etc.

The Fifth SHCMs were organized again in the 20 selected communes, with almost the same participants as those of the Second SHCMs, to discuss with participants about the results of environmental and social surveys, the contents of the draft Environment Impact Assessment (EIA) report, proposed impact mitigation measures, environmental management plan (EMP), etc. In addition, in these meetings, participants were consulted about the finalized land use plan, water distribution plan, anticipated impacts of water pollution, etc.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Based on the results of various analysis mentioned in the previous chapters, this survey concludes that the implementation of the project would be the most appropriate comprehensive approach in coping with unforeseeable circumstances for the agriculture and rural development, and the Government of Vietnam should, therefore, embark on commencement of project implementation.

4.2 Recommendations

- 1) Taking into account the seriousness of saline water intrusion, the Project should be implemented as early as possible. Especially, Chu Cuu and Cai Quao sluice gates' construction should be prioritized.
- 2) Stainless steel should be selected as material for the sluice gates and advanced technology on thick-soft foundation should be applied for their construction. To reduce future maintenance costs may facilitate the prioritization of budget allocation to the gate operation for securing freshwater supply and keeping appropriate water quality.
- 3) Human resource development is the most important issue of the project to attain controlling and managing their water resources by their own hands. In order that the local officers can develop their capacity in tackling against and/or coping with various unforeseeable circumstances under climate change and dry season water resource development/use in upstream countries of the Mekong River basin, on the Job Training (OJT) in tandem with financial cooperation is indispensable. JICA has been providing such a comprehensive support backed by accumulated experience and know-how.
- 4) Information sharing with stakeholders will be the base of activities for the integrated surface water management in Ben Tre. The establishment of an inter-active communication system between governmental organizations and peoples in communes is essential and it is highly recommended to support the establishment process through the technical cooperation scheme.

- 5) Since 'Ben Tre water management project' is a project with sluice gate operation oriented as aforementioned, those existing sluice gates should be also included into the systematic sluice gate operation. Thus, the construction of the new sluice gates in three (3) candidate canals in South Ben Tre and the rehabilitation of existing gates with the installation of intentional operation system shall be combined together to form a subsequent candidate project.
- 6) After the commencement of the sluice gate operation, the trend in cargo and passenger transportation should be monitored carefully, so that such trend can be considered into relevant development plans to be developed for Ben Tre.

TABLE OF CONTENTS

COMPOSITION OF THE REPORT

MAIN REPORT, EN, VN, JP Versions

LOCATION MAP OF THE PROJECT AREA

EXECUTIVE SUMMARY

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION AND ACRONYM

CHAPTER 1 RATIONALE AND OBJECTIVES OF THE PROJECT	1
1.1 RATIONALE OF THE PROJECT.....	1
1.2 OBJECTIVES OF THE PROJECT AND THE SURVEY.....	2
1.3 SCHEDULE OF THE SURVEY	2
1.4 IMPLEMENTATION ARRANGEMENT OF THE SURVEY.....	2
1.5 AGRICULTURAL AND RURAL DEVELOPMENT	4
1.5.1 ROLES OF AGRICULTURAL SECTOR.....	4
1.5.2 AGRICULTURAL DEVELOPMENT PLANS/SCENARIOS IN THE NATIONAL CONTEXT ...	4
1.5.3 AGRICULTURAL DEVELOPMENT PLANS/SCENARIOS OF BEN TRE PROVINCE	5
CHAPTER 2 SURVEY AREA	9
2.1 SPATIAL SETTINGS, DEMOGRAPHY, AND ECONOMY.....	9
2.1.1 SPATIAL SETTINGS	9
2.1.2 AREA, POPULATION AND BENEFICIARIES.....	9
2.1.3 EMPLOYMENT AND ECONOMY	11
2.2 METEOROLOGY	13
2.3 WATER RESOURCES, WATER SUPPLY SYSTEMS, AND FLOOD PROTECTION	14
2.3.1 WATER WAY NETWORK AND BANK EROSION	14
2.3.2 SURFACE WATER AND QUALITY	18
2.3.3 GROUND WATER AND QUALITY	24
2.3.4 WATER SUPPLY AND CONTROL SYSTEMS.....	25
2.3.5 FLOOD AND FLOOD CONTROL SYSTEMS.....	32
2.3.6 ISSUES AND POTENTIALS FOR FUTURE DEVELOPMENT	35
2.4 FARM AND FARMERS ECONOMY	37
2.4.1 AGRICULTURAL AND AQUACULTURE LAND USE	38
2.4.2 CROPPING PATTERNS AND FARMING SYSTEMS.....	41
2.4.3 AQUACULTURE.....	43
2.4.4 MARKETING	43
2.4.5 FARM ECONOMY BY MAJOR CROPS.....	46
2.4.6 FARMERS ECONOMY: INCOME AND ITS DISTRIBUTION	49
2.4.7 ISSUES AND POTENTIAL FOR FUTURE DEVELOPMENT	52
2.5 ACTIVITIES OF INTERNATIONAL DONORS/NGOS AND VIETNAM GOVERNMENT	53
2.5.1 INTERNATIONAL DONORS AND NGOS	53

2.5.2 VIETNAM GOVERNMENT AND LOCAL NGOS.....	59
2.5.3 LESSONS FROM THE PAST PROJECTS	60
CHAPTER 3 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS	63
3.1 OVERVIEWS OF PROJECT COMPONENTS RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS.....	63
3.1.1 BACKGROUND OF THE SURVEY	63
3.1.2 RELEVANT TO THE MASTER PLAN	63
3.1.3 OBJECTIVES OF THE SURVEY.....	63
3.1.4 TARGET AREA OF THE SURVEY.....	63
3.2 CURRENT ENVIRONMENTAL AND SOCIAL SITUATIONS RELEVANT TO THE PROJECT.....	64
3.2.1 ENVIRONMENTAL SITUATIONS.....	64
3.2.2 SOCIAL SITUATIONS.....	76
3.3 LEGAL AND INSTITUTIONAL FRAMEWORK IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS.....	80
3.3.1 LEGAL AND INSTITUTIONAL FRAMEWORK IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS	80
3.3.2 GAP ANALYSIS WITH JICA ENVIRONMENTAL GUIDELINES	89
3.3.3 GAP ANALYSIS BETWEEN JICA GUIDELINES AND VIETNAM LEGAL FRAMEWORK ON INVOLUNTARY RESETTLEMENT.....	94
3.3.4 ORGANIZATION IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS	97
3.4 ALTERNATIVE ANALYSIS AND SCOPING	100
3.4.1 ALTERNATIVE ANALYSIS.....	100
3.4.2 SCOPING.....	114
3.4.3 TOR OF THIS ENVIRONMENTAL AND SOCIAL CONSIDERATIONS	117
3.5 ENVIRONMENTAL AND SOCIAL SURVEY RESULTS AND IMPACT EVALUATION.....	120
3.5.1 ENVIRONMENTAL SURVEY RESULTS AND IMPACT EVALUATION	120
3.5.2 SOCIAL SURVEY RESULTS AND IMPACT EVALUATION	131
3.6 MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT/ MONITORING PLAN.....	140
3.6.1 MITIGATION MEASURES FOR ENVIRONMENTAL IMPACTS	140
3.6.2 MITIGATION MEASURES FOR SOCIAL IMPACTS	142
3.7 ENVIRONMENTAL MANAGEMENT/MONITORING PLAN.....	146
3.7.1 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN	146
3.7.2 PROPOSED ENVIRONMENTAL MONITORING PLAN	147
3.7.3 PROPOSED SOCIAL ENVIRONMENTAL MONITORING PLAN	148
3.8 STAKEHOLDER CONSULTATION MEETINGS (SHCM)	149
CHAPTER 4 CONCLUSION AND RECOMMENDATIONS.....	157
4.1 CONCLUSION.....	157
4.2 RECOMMENDATIONS.....	158

LIST OF TABLES

Table 1.2.1	Features and Functions of Proposed Sluice gates	2
Table 1.3.1	Overall survey Schedule with Major Components	2
Table 1.4.1	Implementation Arrangement for the survey	3
Table 1.5.1	Outline of National Target Program for New Rural Development	5
Table 1.5.2	Outline of Social Economic Development Plan.....	6
Table 1.5.3	Outline of Ben Tre Agricultural Development Plan.....	7
Table 1.5.4	Major Indicators of Ben Tre Agricultural Development Plan	8
Table 2.1.1	Area and Population of the Project Area.....	10
Table 2.1.2	Area and Population of the Project Area.....	10
Table 2.3.1	Types of Erosion observed in and around Ben Tre Province	16
Table 2.3.2	Change of Discharge in Future with Climate Change by MRC.....	19
Table 2.3.3	Salinity Observation System in Ben Tre Province	20
Table 2.3.4	Damage by Saline water intrusion	21
Table 2.3.5	Damage by Saline water intrusion and Drought (2016 QE)	22
Table 2.3.6	Example of Gate Operation Rule (Mo Cay Nam District)	23
Table 2.3.7	List of Wells	24
Table 2.3.8	Water Price in Ben Tre (unit: Dong/ m3).....	26
Table 2.3.9	Situation of Flood and High Tide Disaster.....	32
Table 2.3.10	Observation System in Ben Tre Province	33
Table 2.3.11	Role of Organizations Related to Water Management Structure.....	34
Table 2.3.12	Non-Structural Measures for Flood.....	35
Table 2.4.1	Planted Area of Agriculture and Aquaculture	39
Table 2.4.2	Planted Area of Fruits.....	40
Table 2.4.3	Major Factors of Change in Planted Area of Fruits	40
Table 2.4.4	Planted Area of Paddy	41
Table 2.4.5	Major Cropping Pattern in Ben Tre Province.....	42
Table 2.4.6	Marketing Destinations of Major Commodities.....	44
Table 2.4.7	Average Net Income of Paddy Cultivation per Hectare at 2015 Current Price.....	47
Table 2.4.8	Average Net Income of Paddy Cultivation per Household at 2015 Current Price.....	47
Table 2.4.9	Average Net Income of Fruits Production at 2015 Current Price	48
Table 2.4.10	Average Net Income of Shrimp Culture at 2015 Current Price.....	49
Table 2.4.11	Poverty Rate of Ben Tre Province by Urban and Rural	50
Table 2.4.12	Poverty Rate of Ben Tre Province by District.....	50
Table 2.4.13	Monthly Average Income per Capita at Current Prices by Residence	51
Table 2.4.14	Monthly Average Income per Capita by Income Source and Region (2014).....	51
Table 2.4.15	Major Issues in Agriculture and Aquaculture.....	52
Table 2.4.16	Remarkable Potential in Agriculture and Aquaculture.....	53
Table 2.5.1	Summary of the On-going & Forthcoming Projects with Support from donors and NGOs.....	57
Table 2.5.2	Sources of lessons learnt	60
Table 2.5.3	Lessons learnt by previous related projects relevant to construction projects and technical cooperation projects.....	61
Table 3.1.1	Details of Sluice Gates in the Target Area.....	64
Table 3.2.1	Monthly Rainfall in Ben Tre Province (year 2005 to year 2014) (unit: mm)	65
Table 3.2.2	Water Quality Index(WQI) based on Each Water Quality Parameter	66
Table 3.2.3	Recent Total Land Changes of Ben Tre Province	68
Table 3.2.4	Natural Protected Areas in Ben Tre Province.....	71
Table 3.2.5	Recent Air Quality Conditions in Ben Tre Province	74
Table 3.2.6	Surface areas and populations of districts/city of Ben Tre Province.....	76
Table 3.2.7	Current land use situation (as of Jun 1, 2014) (unit: ha)	76
Table 3.2.8	Change in Land Area of Fruit Tree Cultivation by Years (unit: ha)	77
Table 3.2.9	Change in Fruit Production by Years (unit: ton)	77
Table 3.2.10	Tendency of paddy production (unit: ton).....	77
Table 3.2.11	Tendency of Paddy Field Area (unit: ha).....	78
Table 3.2.12	Tendency of fishery production (Unit: million ton).....	78

Table 3.2.13	Change in Area for Fishery Production by Years (unit: ha)	78
Table 3.2.14	Change in Area of Several Aquaculture Methods (unit: ha)	79
Table 3.2.15	Change in Area for Freshwater, Brackish Water, and Saline Water Aquaculture (unit: ha)	79
Table 3.2.16	Change in Shrimp Production in the Districts by Year (unit: ton)	79
Table 3.2.17	Change in number of employees by main enterprises/agencies	79
Table 3.2.18	Number of registered cases of waterborne diseases in Ben Tre Province	80
Table 3.3.1	Main Laws and Regulations on Environmental Protection in Vietnam	80
Table 3.3.2	List of International Environmental Conventions/ Agreements/ Treaties signed by Vietnam	82
Table 3.3.3	Laws and regulations relating to land use right, land acquisition, etc. in Vietnam	87
Table 3.3.4	Decisions recently issued by Ben Tre Province PC on land price, property price, and land acquisition in the province territory	87
Table 3.3.5	Gaps between JICA Environmental and Social Considerations Guidelines and Vietnam Legal Framework for EIA	90
Table 3.3.6	Policy gaps between JICA Guidelines and Vietnamese Country System on land acquisition and resettlement	94
Table 3.3.7	Procedure of Compensation, Support and Resettlement	99
Table 3.4.1	Summary of Comparison Results of the Alternatives	101
Table 3.4.2	Summary of the Evaluation Results of the Alternatives	103
Table 3.4.3	Summary of Comparison Results of the Water Level/Salinity Monitoring Systems for the Option 3	108
Table 3.4.4	Scoping Results of This Project	114
Table 3.4.5	TOR for Environmental and Social Considerations	118
Table 3.5.1	Evaluation by Scoping and Environmental survey Results	120
Table 3.5.2	Noise Power Level of Main Heavy Construction Machines	122
Table 3.5.3	Predicted Noise Levels by a Bulldozer at Each Point	122
Table 3.5.4	Estimated Traffic Volume in the proposed 8 Sluice Gates	123
Table 3.5.5	Salt tolerance of the mangroves in the survey Area, and coasts in Ben Tre Province	126
Table 3.5.6	Vegetation areas need to be cleared for the sluice gates construction	127
Table 3.5.7	Migration Categories focused on importance of migration between brackish water and freshwater	128
Table 3.5.8	Scope of land acquisition and resettlement	131
Table 3.5.9	Severity of Impacts on Productive Land	131
Table 3.5.10	Impact on houses	132
Table 3.5.11	Estimated number of vulnerable households to be affected	133
Table 3.5.12	Agriculture in the affected communes	134
Table 3.5.13	Most concerned issues of local residents	135
Table 3.5.14	Evaluation based on Scoping and survey Findings (Social consideration)	138
Table 3.6.1	Mitigation Measures for Possible Adverse Environmental Impacts	140
Table 3.6.2	Major items of RAP	142
Table 3.7.1	Proposed Environmental Monitoring Plan	147
Table 3.7.2	Social impact monitoring plan	148
Table 3.8.1	Schedule and Number of Participants in the First SHCMs	149
Table 3.8.2	The 3rd SHCM organization schedule and number of participants by sex	151
Table 3.8.3	Participants of 3rd SHCM by Occupation (unit: persons)	152
Table 3.8.4	Result of Stakeholders Analysis in the 3rd SHCMs	154
Table 3.8.5	Ranking the Needs and Concerns of Local People	155
Table 3.8.6	The 5th SHCMs organization schedule and number of participants by sex	156

LIST OF FIGURES

Figure 1.4.1	Implementation Arrangement for the Preparatory survey	3
Figure 1.5.1	GDP Share by Industries (Left; Vietnam National GDP, Right; Ben Tre Province GDP)	4
Figure 2.1.1	Administration Boundary of District (Left) and Topographic Condition (Right) of Ben Tre	9
Figure 2.1.2	Project Area and Beneficiary Area	11
Figure 2.1.3	Workforce Share (%) among Several Sectors In Ben Tre	11
Figure 2.1.4	GDP Growth Percentage 2010-2014 (constant price 2010: X-axis), GDP Share (2014: Bubble Size), and correlation coefficient (R2) between poverty rate and GDP development (Y-axis) In Ben Tre (1).....	12
Figure 2.1.5	GDP Growth Percentage 2010-2014 (constant price 2010: X-axis), GDP Share (2014: Bubble Size), and correlation coefficient (R2) between poverty rate and GDP development (Y-axis) In Ben Tre (2).....	12
Figure 2.2.1	Monthly Average Temperature and precipitation (Left) and Monthly Rainfall Year (Right) in Ben Tre (2010-2014)	13
Figure 2.3.1	Canal Network in Ben Tre Province.....	14
Figure 2.3.2	Transition of Cargo Transportation Amount.....	15
Figure 2.3.3	Transition of Cargo Transportation Traffic	15
Figure 2.3.4	Transition of Number of Passenger	15
Figure 2.3.5	Transition of Traffic of Passenger	15
Figure 2.3.6	Observed Bank Erosion (Left: Cai Quao Right: Vam Thom)	16
Figure 2.3.7	Bank Erosion Condition in Ben Tre Province	17
Figure 2.3.8	Distribution of Maximum Velocity (Calculated with Existing Condition).....	17
Figure 2.3.9	Permitted area for Dredging	18
Figure 2.3.10	River Discharge	19
Figure 2.3.11	Location of Saline Monitoring Station in Ben Tre Province and Surrounding Area by SRHMS	20
Figure 2.3.12	Salinity Concentration Meter used at Son Doc 2 Sluice.....	21
Figure 2.3.13	Salinity Distribution by Depth in An Hoa District in Ben Tre Province	22
Figure 2.3.14	Observed Water Quality at 54 Points in Ben Tre Province.....	23
Figure 2.3.15	Location of Wells/ Boreholes.....	24
Figure 2.3.16	Salinity of Groundwater Observed in Ben Tre City and Chau Thanh District	25
Figure 2.3.17	Location Map of Water Supply Plant and Water Supply Area in Ben Tre.....	26
Figure 2.3.18	Change of Number of Customers of Water Supply Company by Users.....	27
Figure 2.3.19	Change of Production of Water Supply Company by Users.....	27
Figure 2.3.20	Damage to Water Supply Plant from Saline water intrusion	28
Figure 2.3.21	Salinity of Raw Water at the Son Dong Water Supply Plant.....	28
Figure 2.3.22	Salinity in the Upstream of Ben Tre during Dry Season (Left: 2010, Right: 2011).....	29
Figure 2.3.23	Location Map of Water Supply Plant in Rural Area by CRWES	29
Figure 2.3.24	Change of Saline water intrusion Area in Ben Tre Province	30
Figure 2.3.25	Water Shortage Situation in Dry Season in Ben Tre Province	30
Figure 2.3.26	Extension Plan of Intake and Pipeline for Rural Water Supply in South Ben Tre.....	31
Figure 2.3.27	Location Map of Industrial Zone in Ben Tre Province.....	31
Figure 2.3.28	Draft Updating Ben Tre Province Water Management Plan.....	34
Figure 2.3.29	Expenditure of DARD from 2012 to 2014	35
Figure 2.3.30	Example of Lock to Prevent Saltwater Intrusion.....	36
Figure 2.3.31	An Example of Lock Operation to Prevent Saltwater Intrusion.....	37
Figure 2.4.1	Current Land Use Map (2013).....	38
Figure 2.4.2	Trend of the Proportion in the Area of Agriculture and Aquaculture	39
Figure 2.4.3	Trend of the Planted Area of Major Fruits.....	40
Figure 2.4.4	Trend in Planted Area of Paddy.....	41
Figure 2.4.5	Trend in Standardized International Price of Major Commodities.....	46
Figure 2.4.6	Trend of Poverty Rate in Ben Tre.....	49
Figure 2.5.1	Locations of Support from Donors and NGOs in Ben Tre Province.....	54
Figure 2.5.2	Organizational Structure of DARD	59

Figure 3.2.1	Water Quality Situations in Ben Tre Province of Dry Season in 2014.....	67
Figure 3.2.2	Recent River Bank Erosion Situations in Ben Tre Province	69
Figure 3.2.3	Nature Reserves within Ben Tre Province.....	70
Figure 3.2.4	Mangrove Distribution Areas within Ben Tre Province	72
Figure 3.2.5	Air Quality Sampling Points in Ben Tre Province of Dry Season in 2014.....	75
Figure 3.3.1	Procedure for Preparation, Appraisal and Approval of EIA in Vietnam.....	86
Figure 3.3.2	Present Organization Chart of Vietnam Environmental Agency (VEA)	98
Figure 3.5.1	Nyoya Palm with Present Vegetation (near Proposed Vam Nuoc Trong Sluice Gate)	126
Figure 3.5.2	Mangrove Apple with Present Vegetation (near Proposed Tan Phu Sluice Gate)	126
Figure 3.5.3	Common water hyacinths with Present Vegetation (near Proposed Tan Phu Sluice Gate)	126
Figure 3.5.4	Coconuts Fruits Garden (near Proposed Tan Phu Sluice Gate)	126
Figure 3.7.1	Proposed Management Organization Framework for Environmental and Social Monitoring.....	146

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
ASS	Acid Slate Soil
AusAID	Australian Aid
B/C	Benefit - Cost Ratio
BOD	Biochemical Oxygen Demand
B-SWAMP	The Preparatory survey for Ben Tre Water Management Project (This survey)
BTHMS	Ben Tre Hydro-meteorological Station
CC	Climate Change
CMD	Construction Management Department, MARD
CMD-DARD	Construction Management Division, DARD
CPC	Commune People's Committee
CPO	Central Project Office, MARD /
CRWES	Center of Rural Water & Environment Sanitation, Ben Tre Province
DANIDA	Danish International Development Agency
DARD	Department of Agriculture and Rural Development, Ben Tre Province
D-DARD	Division of Agriculture and Rural Development (under District People's Committees)
DO	Dissolved Oxygen
DOF	Department of Finance, Ben Tre Province
DONRE	Department of Natural Resources and Environment, Ben Tre Province
DPC	District People's Committee
DPI	Department of Planning and Investment, Ben Tre Province
DWR	Directorate of Water Resources, MARD
E/A	Executing Agency
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
E/N	Exchange of Notes
ENPV	Economic Net Present Value
ESMT	Environmental and Social Monitoring Task Force
FACOD	Center for Transferring of Technology-Services and Community Development for Vietnamese Agriculture – Fisheries
FAO	Food and Agriculture Organization of the United Nations
GOJ	Government of Japan
GOV	Government of the Socialist Republic of Viet Nam
ICB	International Competitive Bidding
ICMB	Hydraulic Project Investment and Construction Management Board /
ICD	International Cooperation Department, MARD
Ic/R	Inception Report
IFAD	International Fund for Agricultural Development
IFPD	Irrigation and Flood Prevention Division, DARD
IRR	Internal Rate of Return
IUCN	International Union for Conservation of Nature
IWAMUs	Integrated Water Management Units
IWEC	Ben Tre Irrigation Works Exploitation One-Member Limited Liability Company
JICA	Japan International Cooperation Agency
JICA Study (2013)	JICA Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta (2013)
L/A	Loan Agreement
LCB	Local Competitive Bidding
MARD	Ministry of Agriculture and Rural Development
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MRC	Mekong River Commission
NGO	Non-Governmental Organization
NPV	Net Present Value
NTP-NRD	National Target Programme on New Rural Development
O&M	Operation and Maintenance

ODA	Official Development Assistance
OJT	On-the-Job Training
PDM	Project Design Matrix
PIC	Project Implementation Committee
PMB	Program Management Board for Agriculture and Rural Development, DARD
PMU	Project Management Unit
PO	Project Owner
PPC	Provincial Peoples' Committee (of Ben Tre, unless specified)
RADCC	Response and Adaptation to Disasters and Climate Change
RAP	Resettlement Action Plan
SCF	Standard Conversion Factor
SHCM	Stakeholder Consultation Meeting /
SIWRP	Southern Institute of Water Resources Planning
SIWRR	Southern Institute of Water Resources Research
SMS	Short Message Service
SRHMS	Southern Regional Hydro-meteorological Station
VEA	Vietnam Environment Administration
WB	World Bank
WSC	Ben Tre Water Supply One-member Limited Liability Company

UNIT CONVERSION

1 mau = 1 hectare

1 cong= 0.1hetare

VIETNAMESE FISCAL YEAR

January 1 to December 31

CURRENCY EQUIVALENTS [Designated by JICA as of October 2016]

US\$ 1.00 = VND 21,957

US\$ 1.00 = JPY 100.606.

VND 1.00 = JPY 0.004582

CHAPTER 1 RATIONALE AND OBJECTIVES OF THE PROJECT

Submitted herewith is the Draft Final Report compiled according to the Minutes of Discussion (MD) on the Mission for the Japan International Cooperation Agency (JICA) ‘Preparatory survey for the Ben Tre Water Management Project’ (the Project) in the Socialist Republic of Vietnam agreed and signed between the Ministry of Agriculture and Rural Development (MARD) and coupled with the Ben Tre Province People’s Committee (PPC) and Japan International Cooperation Agency (JICA) on February 6th, 2015. The Draft Final Report describes the issues that the JICA survey team has undertaken since the inception of the Project up to the June, 2016. The issues incorporated in the report among others are results of preliminary saline water intrusion situation analysis of the Project area, environmental and social considerations, institutional setup of the project implementation, a part of structural design, project components coupled with cost estimation, etc.

1.1 RATIONALE OF THE PROJECT

The Mekong Delta is known as the Rice Bowl of Vietnam, producing more than half of the total rice paddy production of the country. Not only the rice, but also plenty of other products, such as fruits, coconuts, and vegetables, are also produced in the delta. However, the Mekong Delta is considered to be vulnerable against climate change, such as severe flooding in the rainy season and saline water intrusion in the dry season, which have been caused by a sea level rise. The sea rise measurement shows an average of approximately 15 cm during the recorded period of about 30 years, from 1982 until now in coastal areas. Therefore, the areas of Mekong River tributaries are constantly facing saline water intrusion, particularly in the dry season.

The residents in Ben Tre rely on water from the aforementioned river tributaries for domestic and irrigation purposes. Estuaries of these tributaries are located at the southeast parts of Ben Tre; this is why this area is one of the most affected areas by saline water intrusion in Vietnam under the climate change phenomena. Brine damage by saline instruction will widely and seriously spread into Ben Tre Province; the high level of salinity is expected and it will cause serious damages at not only the paddy fields in the central areas, but also the fruit farms widely developed in the upstream areas. In fact, the damage cost was estimated as the highest among 7 coastal provinces based on the saline water intrusion simulation reported in the former JICA study on ‘the Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta’ in April 2013 (JICA Study (2013)).

Under the such circumstances, the Vietnamese government has established ‘Ben Tre Province Water Management Plan for 2020’, which is the policy for preventing saline intrusion mainly composed of structural measures represented by sluice gate construction. Based on the plan, series of sluice gates have been constructed from the downstream side. The Ba Lai sluice gate construction was implemented in 2002, which is located at Ba Lai River; one of the main tributaries of the Mekong River. The Vietnamese government plans not to stop sluice gate construction and has capacity to incur budget for small scale sluice gate but there will be difficulty to arrange budget for large scale sluice gate construction. This is because the Vietnamese government requested JICA a technical assistance for large scale sluice gate project plan formulation. A series of discussions and meetings were made among MARD, PPC, and JICA. As the results of the discussions and meetings, it was agreed in February 2015 to carry out a preparatory survey for the purpose of examination on the development plan of sluice gates and related structures against the impact of climate change. With this background, the Preparatory survey for the Ben Tre Water Management Project in the Socialist Republic of Vietnam was commenced at the beginning of August, 2015.

1.2 OBJECTIVES OF THE PROJECT AND THE SURVEY

This preparatory survey aims at formulating a project plan for the Japanese Official Development Assistance (ODA) Loan. The survey examines the objective, outline, costs, implementation, organization, operation-and-maintenance organization, environmental and social consideration, and others.

This project aims at contributing to an improvement on the livelihoods of the people of Ben Tre Province in Southern Vietnam where severe loss in agriculture caused by saline intrusion has been recorded. To do so, the project will construct structures and facilities to control saline intrusion, which allow the Ben Tre people to provide water with lower salinity to their farming plots, hence, an improvement on the productivity of their produce. With such improved productivity, the Ben Tre people could better adapt to Climate Change impacts and enhance rural and regional development. In this project, the construction of sluice gates in 8 sites (Northern Ben Tre: 5 sites, and Southern Ben Tre: 3 sites) and procurement of the monitoring equipment are expected. The proposed features of sluice gates are summarized and shown in the following table. The location of each sluice gate is shown at the location map at the top of the report.

Table 1.2.1 Features and Functions of Proposed Sluice gates

No.	Name	Polder Area	Length (m)	Depth(m)	Functions
1	Tan Phu	Northern Ben Tre	20.0	-4.0	Fresh water is planned to be recruited from Tan Phu and Ben Ro. The recruited fresh water flows along Ba Lai River, which had dredged to increase water flow capacity. Other sluice gates will be closed for saline water intrusion.
2	Ben Ro		20.0	-4.0	
3	An Hoa		120.0	-6.0	
4	Ben Tre		70.0	-5.5	
5	Thu Cuu		60.0	-5.0	
1	Vam Nuoc Trong	Southern Ben Tre	90.0	-6.0	Open canals along the Co Chien/Ham Long Rivers are utilized as fresh water intakes. All sluice gates to be constructed aim to prevent saline water intrusion.
2	Vam Thom		70.0	-5.5	
3	Cai Quao		60.0	-5.0	

Source: JICA survey team (2016)

1.3 SCHEDULE OF THE SURVEY

To attain the objectives, this survey is carried out, examining major components, such as: saline water intrusion simulation based on a sea level rise projection under the climate change phenomena, social and environmental impacts based on Stakeholder Consultation Meeting(SHCM), in-situ geological and topographic survey coupled with laboratory tests, the preparation of a project implementation plan based on field investigation, basic design, and other related studies. The survey is scheduled to be carried out from August 2015 to June 2016 as follows:

Table 1.3.1 Overall survey Schedule with Major Components

Month	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Saline water intrusion Simulation	■													
Stake Holder Consultation Meeting	■			■		■		■						
Project Implementation Plan	■			■		■		■						△
Report	IcR				ITR						DFR			FR

Where; IC/R: Inception Report, ITR: Interim Report, DFR: Draft Final Report, FR: Final Report

1.4 IMPLEMENTATION ARRANGEMENT OF THE SURVEY

For the implementation of the Project, JICA has organized a survey team, which is a Joint Venture structure composed of SANYU Consultants Inc, CTI Engineering Co., Ltd, and Newjec Inc. The counterpart organizations of the survey are the Central Project Office (CPO) under MARD and the

Department of Agriculture and Rural Development under PPC. DARD arranged a focal person for the survey team. Figure 1.4.1 below shows the implementation arrangement of the survey.

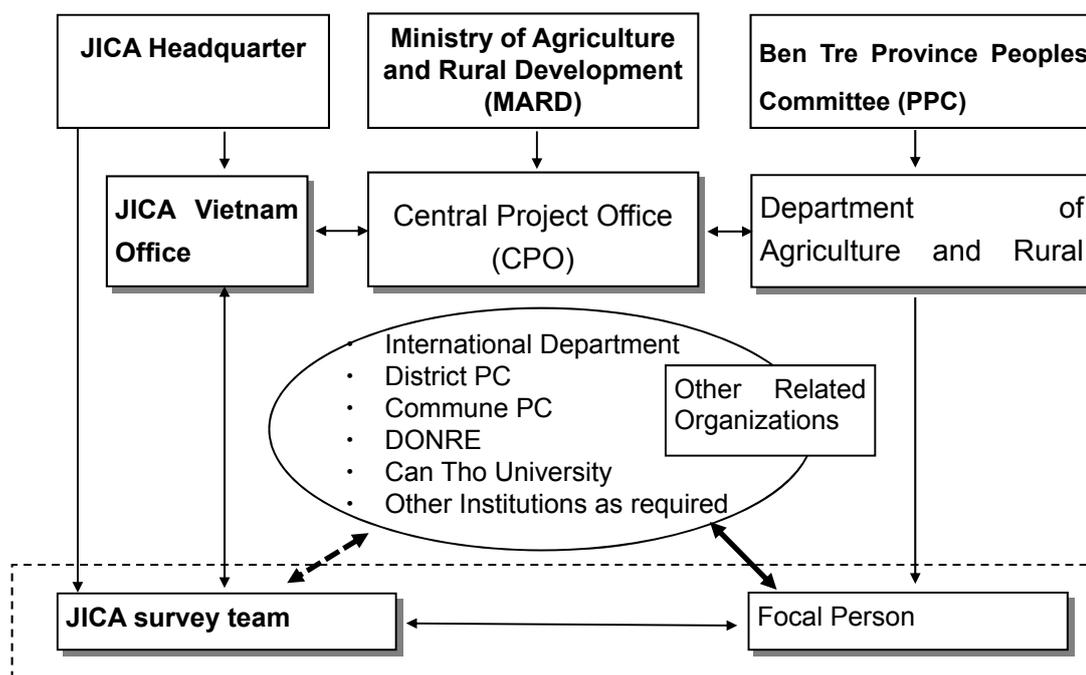


Figure 1.4.1 Implementation Arrangement for the Preparatory survey

Source: JICA survey team (2015)

A comprehensive approach is employed for the survey such as primary and secondary data and information collection, review of plans and designs available, field surveys, and planning and analysis for formulating the project components in the Ben Tre islets. The data and information collection are conducted, aside from relevant offices, at different communes within the beneficiary areas, which are hydrologically to be enclosed by dikes and sluice gates.

Following the data and information collection, data processing and project formulation are conducted to establish a feasible project plan for the Ben Tre islets. The project plan composed of the agricultural development plan, design of sluice gates, cost estimation, environmental and social impact consideration, and feasibility examination for the main and sub components. Implementation arrangements for these surveys are summarized in Table 1.4.1.

Table 1.4.1 Implementation Arrangement for the survey

Items of survey	Data and Information	Source and Data / Information
Irrigations Systems & Diagrams	Existing Situation, Route	DARD, DONRE, District Offices, Field survey
Project Plan	Present and Past Activities	DARD, Water Companies, Field survey
Cropping Pattern	Farming Activities, Future Plans	DARD, SIWRP, Field survey
Price and Cost	Unit Price, Price Escalation Rate	DARD, Statistics, Field survey
Sewage Treatment	Materials, Contamination Source	DONRE, Field survey
Site Condition	Geology and Topography	Field survey
Construction Methods	Type of Structure, Materials	DARD, Statistics, Interviews
Environmental and Social Consideration	Reserved Area, Resettlement, Public Opinions, Environmental Impact	DONRE, Field survey (including SHCM, Fish Catch survey, Water Quality survey, RAP preparation)

Source: JICA survey team (2016)

This survey also includes examination on implementation structures of the project for efficient and prompt project implementation to mitigate saline water intrusion damage and recover from low productivity of farm product in the beneficiary areas.

1.5 AGRICULTURAL AND RURAL DEVELOPMENT

1.5.1 ROLES OF AGRICULTURAL SECTOR

Tertiary industries (service sector) and secondary industries (manufacturing/construction sectors) in Vietnam share more than two thirds of the gross domestic production (GDP) in 2014 while primary industries (agriculture, forestry, and fishery sectors) have only an 18% share of the GDP; however, primary industries can maintain 46.3% of the total workforce in Vietnam. Thus, the development of primary industries in Vietnam has important key roles for poverty reduction and improvement of labor productivity.

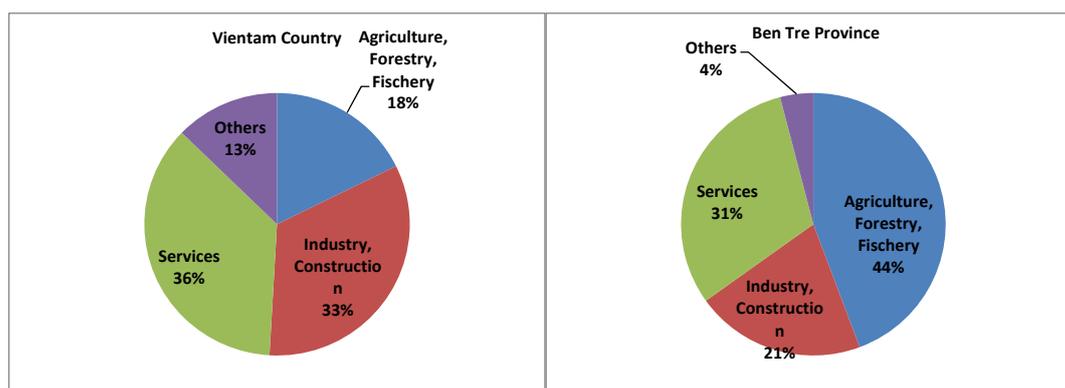


Figure 1.5.1 GDP Share by Industries (Left: Vietnam National GDP, Right: Ben Tre Province GDP)

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015), Statistical Year Book of Vietnam 2014, General Statistics Office (2015)

The Ben Tre Province shows different features in comparison with the national GDP. Primary industries share about 44% of the provincial GDP followed by tertiary industries with a 36% share and secondary industries with a 22% share of the provincial GDP. 10% of the labor force stays in the urban area while the remaining 90% of the labor force stays in the rural area in the Ben Tre Province. Thus, primary industries play the role of an engine for economic development in the Ben Tre Province in comparison with the national level.

1.5.2 AGRICULTURAL DEVELOPMENT PLANS/SCENARIOS IN THE NATIONAL CONTEXT

There is an over-arching program established in Vietnam to enhance rural development: the National Target Program for New Rural Development (NTP-NRD). It has the target year of 2020.

1) National Target Program for New Rural Development (NTP-NRD)

There is a nationwide rural development program, which has the target period from 2010 to 2020. This program aims at ‘New Rural Development (NRD)’ equipped with socio-economic infrastructures and good governance of political systems. NRD is an umbrella program on socio-economic development at community level, incorporating other programs under it. Budget is planned from four (4) sources: funding from the state is 40%, loans/credit from the government is 30%, funding from the economic sector is 20%, and the contribution by the community is 10%. The NRD is composed of 11 components such as “new rural planning,” “socio-economic infrastructure development,” “rural economic restructure and development,” and “clean water supply.” It covers all of the 19 rural criteria, while other programs may cover some of them. The following table summarizes NTP-NRD.

Table 1.5.1 Outline of National Target Program for New Rural Development

Item	Description
Name	National Targeted Program on New Rural Development (NTP on NRD)
Target Period	2010-2020
Organization	Ministry of Construction and MARD
Budget	Funds from the state 40%, loans/credit from government 30%, funds from economic sectors 20%, contribution by community 10%
Target Area	Whole nation at community level
Objectives/ Targets	<ol style="list-style-type: none"> 1) To build new rural communities with modern socio-economic infrastructure, rational economic structure, and forms of production organizations to link agriculture sector with rapid development of industries and services. 2) Socioeconomic infrastructure modernized – Cultural characteristics preserved, intellectual standard of people improved; 3) Ensure Eco-environment green, clean, beautiful; 4) Increase quality of political system operation: Good governance 5) 20% of all communes achieve the full new rural criteria by 2015 6) 50% of all communes achieve the full new rural criteria by 2020
Description	NRD program is an umbrella program on socio-economic development at community level, incorporating other programs under it. NRD is composed of 11 components such as “new rural planning,” “socio-economic infrastructure development,” “rural economic restructure and development,” and “clean water supply.” It covers all of 19 rural criteria, while other program may cover some of them.
Relevance to the Project	<ul style="list-style-type: none"> - Apply science and technologies particularly biotechnologies (hybrid): new varieties of rice such as saline-tolerant ones can be applied. - “Community-based Top-down approach” ensures the participation of farmers; stake holder consultation meeting can be applied for this approach. - Government's Decree No. 106/2008/ND-CP of September 19, 2008 describes about canal and road construction project in order to support inland aquaculture development. - Government's Decree No. 41/2010/ND-CP of April 12, 2010 stipulates commercial credit for agricultural and rural development.

Source: 1) PPT material by the Department of Cooperatives and Rural Development (year unknown)/ 2) Government Decision No. 800/QĐ-TTg (June 4, 2010) on NTP-NRD/ 3) Government Decision No. 491/QĐ-TTg (September 16, 2009) on set of criteria on new rural development.

Note: Criteria for New Rural Development are: 1) Planning and implementation of planning; 2) communications and information; 3) irrigation, 4) electricity, 5) schools, 6) cultural facilities and infrastructure; 7) rural markets, 8) post, 9) residential houses, 10) income, 11) household poverty; 12) labor structure; 13) type of production organizations; 14) education, 15) health care, 16) cultural lives, 17) environment, 18) system of social organization and strong political system, and 19) security and social order.

1.5.3 AGRICULTURAL DEVELOPMENT PLANS/SCENARIOS OF BEN TRE PROVINCE

As far as agricultural development is concerned at the provincial level, there are two main government policies: the Ben Tre Social and Economic Development Plan (BT-SEDP) and the Ben Tre Agricultural Development Plan.

1) Ben Tre Social and Economic Development Plan

The Social and Economic Development Plan (SEDP) is formulated at the province level by DARD, which is then reviewed and approved by PPC and Central Peoples' Committee. Outline of this plan is summarized in Table 1.5.2. It is noted that intensive paddy cultivation is no longer promoted, considering the risk of saline intrusion and relatively lower economic value of paddy.

Table 1.5.2 Outline of Social Economic Development Plan

Item	Description
Name	Five-year socio-economic development plan of Agriculture and Rural development in the 2016 - 2020 period
Target Period	2011-2016, and Vision to 2020
Organization	Ben Tre Peoples' Committee, DARD
Budget	<ul style="list-style-type: none"> - No information for year 2016-2020 - For year 2011-2015, total investment capital for agriculture and rural development was VND 2,075,051 billion, including central budget (1,827,324 B), investment credit capital (68,648 B), foreign investment (143,779 B) and Lottery ticket fund (35,300 B)
Target Area	Ben Tre Province
Objectives/ Targets	<ol style="list-style-type: none"> 1) Continue to build up and improve the provincial main product such as agriculture and aquaculture products, in order to increase productivity, quality, performance result, competitiveness. 2) Change land use for agricultural restructuring to about 173,600 ha (123,500ha for agriculture, 7,833 ha for forestry, 41,300 ha for aquaculture and 900 ha for salt farm) 3) Improve extension operation (management method and implementation) to carry out the agricultural restructuring. 4) Manage the natural resources usage to reduce the negative effect on environment; improve risk management, proactive prevent disaster and cope with climate change
Description	<p>This plan is about agricultural restructuring, rural trades, human resource development and others. To realize the agricultural restructuring in the said period, specific target of the land area is set by the type of commodities such as aquaculture, crops, and livestock.</p> <p>Generally, increase of productive area of each commodity is targeted, <u>except for 2-3 times intensive cultivation of paddy</u> which is prospected to decrease without compromising the total production. For workforce, the higher level employees are trained have a management experience.</p> <p>Others are trained to catch up with farming technology except who are working for private economic sectors. In order to develop the rural trade, not only transportation infrastructure but also linkage with tourism activities such as eco- tourism are planned. As well as consideration for economic development, the SEDP is considered for climate change and sea level rise.</p>
Relevance to the Project	<ul style="list-style-type: none"> - Support farmers using land and water resource, and ensure the environment hygiene on 3 ecosystem: drinking water, brackish water and salt water. - Construction of irrigation systems is planned as a solution for agricultural restructuring - To make investment in multi-function irrigation, including domestic water, scale up the internal irrigation models in Cho Lach district - Manage the natural resources usage to limit the negative effects on environment; improve risk management, proactive prevent disaster and cope with climate change

Source: DARD Ben Tre (2014)

2) Ben Tre Agricultural Development Plan

The Ben Tre Agricultural Development Plan was formulated originally in 2011 and revised in 2015, targeting the agricultural restructuring during 2013-2015 with a vision toward 2020. Outline of this plan is summarized in Table 1.5.3 and the indicators targeted in this plan are shown in Table 1.5.4.

Table 1.5.3 Outline of Ben Tre Agricultural Development Plan

Item	Description
Name	Plan to implement the project for agricultural restructuring toward increasing of added values and sustainable development in Ben Tre Province for the period 2013-2015 and until 2020
Target Period	2013-2015, and vision to 2020
Organization	Ben Tre Peoples' Committee, DARD
Budget	VND 13,228,291 million Central (9,661,451), Provincial (1,794,615), PC (656,444) and Others (1,115,782)
Target Area	Ben Tre Province
Objectives/ Targets	<ol style="list-style-type: none"> 5) Rural per capita income of VND 29 million in 2015 and VND 42 million in 2020 through agricultural restructuring 6) Number of communes meeting new rural area criteria reaches 20% (25 communes) in 2015 and 50% (62) in 2020. 7) Maintain an average agricultural production growth rate of 3.5%-4% during 2011-2015 and 4%-5% during 2016-2020 through quality improvement, application of new technologies, and value addition. 8) Increase forest coverage to 56% in 2015 and 63% in 2020 for proactive prevention of natural calamities and response to climate changes
Description	To realize the agricultural structuring in the said period, specific target of the land area is set by the type of commodities such as aquaculture, crops, and livestock. Generally, increase of productive area of each commodity is targeted, except for 2-3 times intensive cultivation of paddy which is prospected to decrease without compromising the total production. In summary, change of land use is planned at a large scale from intensive paddy cultivation to the others or inefficient model to efficient model.
Relevance to the Project	<ul style="list-style-type: none"> - Response to climate changes is of the primary objectives of the plan - Construction of irrigation systems is planned as a solution for agricultural restructuring - To make investment in multi-function irrigation, including domestic water, scale up the internal irrigation models in Cho Lach district - Post-investment activities to enhance performance in irrigation operation is focused

Source: DARD Ben Tre (2014), revised in 2015

Table 1.5.4 Major Indicators of Ben Tre Agricultural Development Plan

Category	Direction	Indicator	Present as Reference ¹ (2014)	Target		North Ben Tre						South Ben Tre			Area		
				2015	2020	Ba Tri	Giong Trom	Ben Tre	Binh Dai	Chau Thanh	Thanh Phu	Mo Cay Nam	Mo Cay Bac	Cho Lach			
Aquaculture	Stabilizing and exploiting the aquaculture area, including key products of Asian tiger shrimp, white-leg shrimp, clam, pangasius and giant river prawn	Total culture area (Intensive and semi-intensive culture)	47,065ha (12,952ha)	46,000ha (7,000ha)	47,000ha (10,000ha)				X			X			C		
	Expanding intensive and semi-intensive salt-water shrimp farming area outside the dyke					X			X			X			C to B		
Crop Production	Development of 12,000ha of clean and safe special fruit trees (GAP)	Green Pomelo	5,372ha			1,000	220			690			540	1,045	A to B		
		Rambutan	5,557ha							1,739					1,772	A	
		Durian	1,856ha	1,200ha						632						1,060	A
		Mangosteen	1,665ha							304						775	A
		Longan	4,123ha							1,316							C (B)
		Total	18,573ha			1,000	220		1,316	3,365			540	4,652			
Fruit Tree	Focus on five key products: green pomelo, durian, rambutan, longan and mangosteen	Fruit tree area of five key products	18,573ha	29,300ha	30,000ha	X	X	X	X	X	X	X	X	X	A to B		
Coconut Trees	Developing the coconut area, focusing on intensive farming with production and processing model	Coconut area	67,382ha	64,500ha	65,500ha	X				X			X		B to A		
	Coconut development program with Department of Industry and Trade (2013-2016); rehabilitation of inefficient coconut area	Cocoa mixed in the coconut area		7,000ha	10,000ha	X						X			B		
Paddy	Reducing the area of 2-3 season intensive rice cultivation area (probably include the rotation between rice and others)	2-3 rice cultivation area (accumulated area)		18,900ha (55,000ha)	16,500ha (48,000ha)	X	X	X	X	X	X	X	X	X	C to B		
		to aquaculturing	Spring: 18,072ha			X				X					C		
		to fruit tree	Autumn: 19,276ha				X			X			X		A		
		to sugarcane	Winter: 29,246ha			X						X			C		
	Converting the rice land area in inefficient areas to other crops	to coconut and grass for animal husbandry, etc.	Total: 66,594ha		6,000ha			X						A			
Pig	Maintaining the pig herd with conversions from small-scale and scattered one to husbandry farm, family farms and cooperative groups	Number of pigs (head)	468,236h	450,000h	600,000h	X						X			B		
	Studying conditions for environmental pollution management and treatment. 90% of pig farming household have own waste treatment system by 2020																
Cattle	Developing the cattle herd, by implementing the project on artificial insemination	Number of cattle (head)	158,838h	200,000h	250,000h												
	Scaling up the model of cooperative groups for breeding cow and beef as to develop "Ben Tre Cow"					X	X	X	X	X	X	X	X	X	C to B		
	Developing grass planting area from inefficient rice land and intercropping in the gardens					X	X	X	X	X	X	X	X	X	C to B		
Forest	Scaling up the model for cattle breeding with the farm, family farm, and cooperative group models					X	X	X	X	X	X	X	X	X	C to B		
	Increasing the forest coverage area with new forest plantation, including preventative, specialized and production forest	Forest area	Natural: 1,044ha Planted: 3,052ha Total: 4,096ha	4,400ha	5,000ha												

Source: Ben Tre Agricultural Development Plan (2014) or "Plan to Implement the Project for Agricultural Restructuring towards Increasing of Added Values and Sustainable Development in Ben Tre province for Period 2013-2015 and until 2020".
Note: "Present" value does not necessarily represent exactly the same indicator targeted. For example, present value of the paddy area shows the entire area planted, while target value only shows the area with 2-3 season per year cultivation model.

CHAPTER 2 SURVEY AREA

2.1 SPATIAL SETTINGS, DEMOGRAPHY, AND ECONOMY

2.1.1 SPATIAL SETTINGS

The Ben Tre Province is located between the Tien Giang Province to the north and the Vinh Long and Tra Vinh Provinces to the southwest. The Province has a large-scale alluvial fan demarcated by the Tien River in the north and by the Co Chien River in the south, and the alluvial fan is composed of two islets, the North Ben Tre and the South Ben Tre, which are demarcated by the Ham Luong River. The Project area extends from 9 degrees, 47 minutes, 27 seconds to 10 degrees, 20 minutes, 1 second in its north latitude (60 km) and 105 degrees, 55 minutes, 35 seconds to 106 degrees, 47 minutes, 32 seconds in the east longitude (95 km).

The topographical feature in the project area is rather low in altitude, similar to other regions of the Mekong Delta. It is generally very flat with a popular altitude ranging from only 0.5m to 1.5m (accounting for about three-quarters natural land area) and gradually lowers from the northwest to the southeast direction. The whole project area has an average altitude ranging from 0.5m to 0.75m only, which is very susceptible to the rise in sea level now taking place due to climate change.

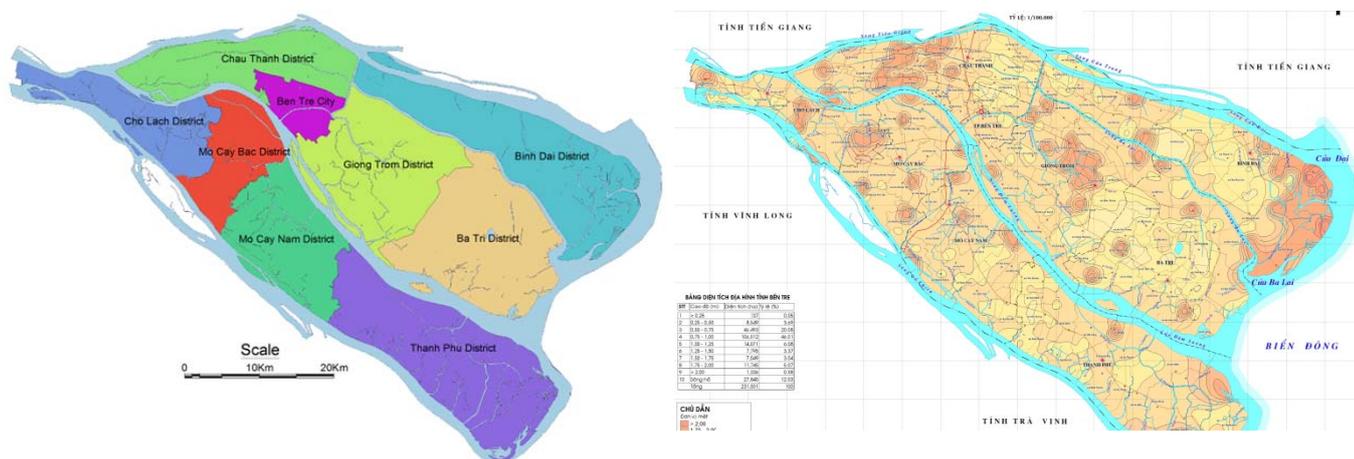


Figure 2.1.1 Administration Boundary of District (Left) and Topographic Condition (Right) of Ben Tre

Source: JICA survey team (2015) for Left, Southern Institute of Water Resource Planning (2014) for Right

The highest terrain belongs to the Chau Thanh district area. West of Binh Dai, the Giong Trom and Cho Lac districts have high altitudes with their average altitude ranging from 1.25 to 1.50 m. On the other hand, the coastal area has altitudes ranging from 0.75-1.25m. In particular, some places are very hollow; some parts of the Binh Dai, Ba Tri, and Thanh Phu districts have altitudes ranging only between 0.30 and 0.50m where waterlogging takes place very often in the rainy season.

2.1.2 AREA, POPULATION AND BENEFICIARIES

1) Area and Population

The population density of Ben Tre is at the 5th position among the Mekong delta provinces, being as much as 535 persons per km². The total population in the Ben Tre Province is estimated at about 1.26 million; North Ben Tre shares about 60% of it and South Ben Tre shares the remaining 40% of the total population. Ben Tre city has a large population in a narrow area, which results in a high population density, being as much as 1,698 persons per km². The two coastal districts, Binh Dai in the North Ben Tre and Thanh Phu in the South Ben Tre, rank the lowest and second lowest in population density with a bit over 300 persons per km², while the Ba Tri district has 522 persons per km², a slightly lower population density than the Ben Tre city average of 535 persons per km².

Paddy production and shrimp farming are dominant in the Ba Tri district; there are some residential houses near irrigation canals in the paddy cultivation areas while such houses are rare in the shrimp farm areas. Domestic use water is available along the irrigation canals, so that people in this district can keep their residences along the irrigation canals. The Chau Thanh district has the second biggest population density after Ben Tre city, which is located at the most upstream side in North Ben Tre, and fruit production is dominant.

Table 2.1.1 Area and Population of the Project Area

District/ Region		Area, km ²	Population (2014)	Pop. Density Persons/km ²
North Ben Tre Islet	Ben Tre City	71.1	120,749	1,698
	Chau Thanh District	225.1	164,037	729
	Giong Trom District	313.2	167,203	534
	Binh Dai District	421.5	130,998	311
	Ba Tri District	358.4	187,161	522
	North Ben Tre Islet	1389.3	770148	554
South Ben Tre Islet	Cho Lach District	167.6	109,387	653
	South Mo Cay District	222.1	145,966	657
	North Mo Cay District	158.2	109,151	690
	Thanh Phu District	422.7	127,553	302
	South Ben Tre Islet	970.6	492057	507
Ben Tre Province		2,359.8	1,262,205	535
Total Mekong Delta		40,576.0	17,517,600	432
Whole Country		330,967.0	90,728,900	274

Source: Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015), Statistical Year Book of Vietnam 2014, General Statistics Office (2015)

2) Beneficiaries

The project will lower saline content in water during the dry season, and such water will be supplied to as much as 110,442 ha out of total 137,224 ha of farmland in Ben Tre, which means about 80% of farmland will be benefited by the project. As the agriculture subsector shares 51.55% of the total workforce as described in the following section, it can calculate that about 80% of the agriculture workforce will be benefited by the project. Other beneficiary will be customer households of domestic water supply systems; a total of 207,275 households will obtain benefit from the project.

Beneficiary areas include all the districts and city excluding Cho Lach, which are: Ben Tre, Giong Trom, Binh Dai, Ba Tri, South Mo Cay, North Mo Cay, and Thanh Phu. Although intake points are located, no particular beneficiary areas are expected in Cho Lach district.

Table 2.1.2 Area and Population of the Project Area

Items	Beneficiary	Total Figure	Remarks
1) Project Area	-	204,270 ha	The Area of Ben Tre
2) Beneficiary Area (Farmland)	110,442 ha	137,224 ha	Simulation results (54% of Ben Tre)
3) Beneficiary Farmers (people)	523,676 people	650,667 people	Total Population X 51.55% X 80%
4) Beneficiary Farmers (HH)	149,622 HH	185,900 HH	3.50 p/HH in rural area, JICA (2013)
5) Rural Domestic Water Users(HH)	103,577 HH		Interview to WSC.
6) Rural Domestic Water Users (people)	362,520 people		3.50 p/HH in rural area, JICA (2013)
7) Urban Domestic Water Users (HH)	57,653 HH		Interview to WSC.
8) Urban Domestic Water Users (people)	194,291 people		3.37 p/HH in urban area, JICA (2013)
9) Estimated Beneficiary HH	207,275 HH		= 4) + 7)
10) Estimated Beneficiary Population	717,967 people		= 5) + 9)

Source: Source : Statistical Year Book Ben Tre 2014, Ben Tre Water Supply One-member Limited Liability Company (WSC.), JICA survey team (2016)

Note: duplication between beneficiary farmers and urban domestic water users has not yet been officially adjusted

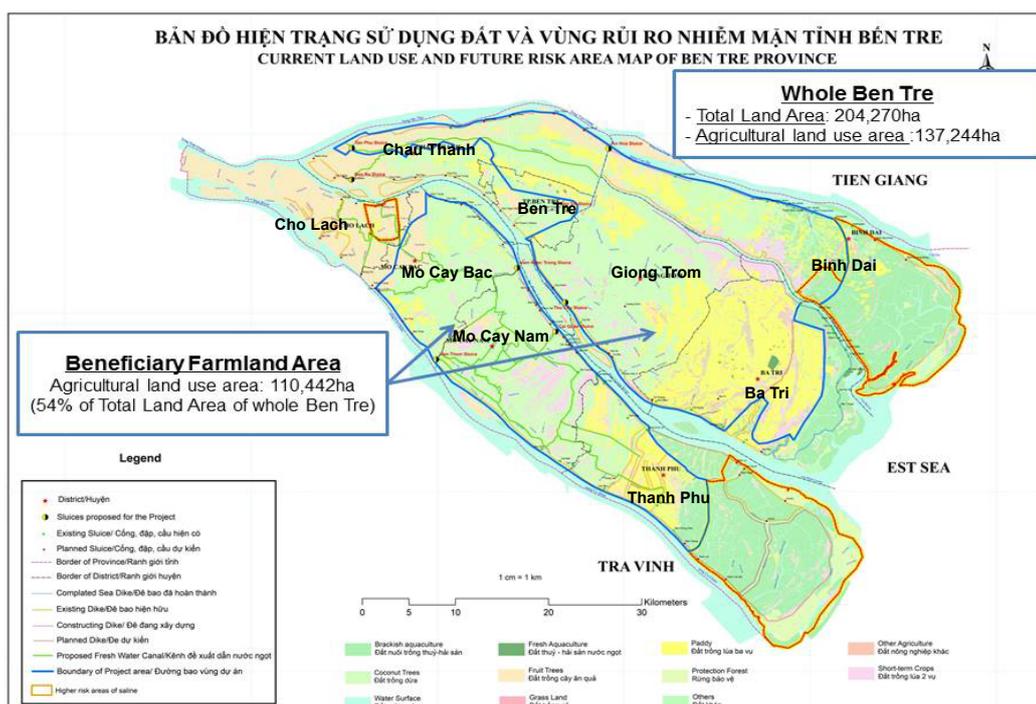


Figure 2.1.2 Project Area and Beneficiary Area

Source: JICA survey team (2016), DARD

2.1.3 EMPLOYMENT AND ECONOMY

The total GDP of the Ben Tre Province in 2014 was VND 90,095 billion (USD 4,097 million) and GDP per capita is VND 71 million /person (USD 3,246/person)¹ while the national GDP per capita is VND 43 million /person (USD 1,974 /person)². The GDP per capita in Ben Tre is about 1.6 times higher than that of the national average while it keeps the 9th position among 12 Mekong delta provinces.

The primary industry keeps the top share with 44% of GDP among all industries in Ben Tre as aforementioned contributing to the creation of job opportunities for 60% of workable peoples in Ben Tre.

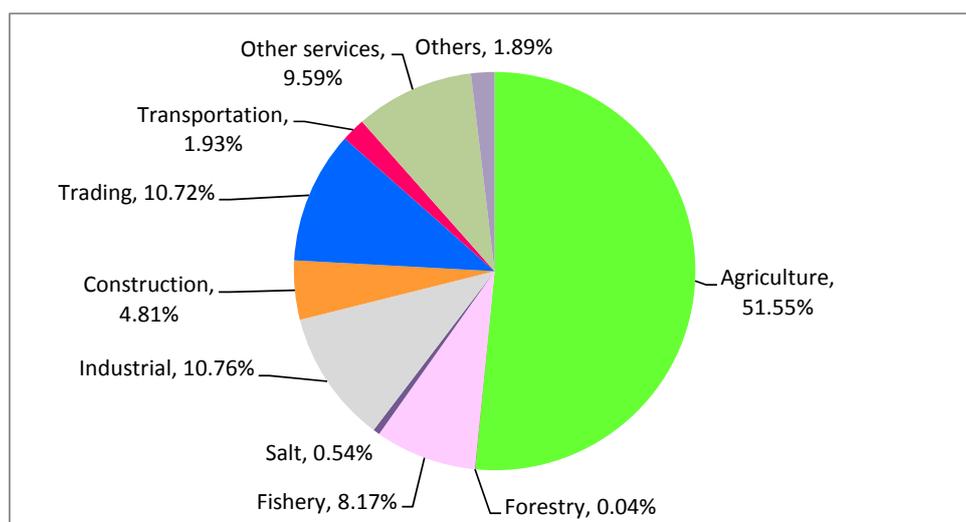


Figure 2.1.3 Workforce Share (%) among Several Sectors In Ben Tre

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

¹ Statistical Yearbook, Ben Tre 2014 (the year 2014 prediction).

² Statistical Year Book of Vietnam, 2014 (the year 2014 prediction)

The recent trend of industry development shows a different face of industrial structure in Ben Tre. The horizontal axis of the following figure shows GDP development percentages of sub-sectors at constant 2010 prices from 2010 to 2014. The sizes of bubbles in the figure show the sub-sector's share in GDP. The GDP growths of manufacturing and communications show nearly 100% development from 2010 while agriculture-forestry-fishery and wholesale show less than 20% development.

The vertical axis indicates a correlation coefficient (R^2) between poverty rate and GDP development. If the GDP of the sub-sector increases, the poverty rate may decrease. It is noted that cause and effect are not quite sure between the sub-sector's GDP development and poverty reduction. Except for wholesale, most subsectors' GDP development may have some direct and/or indirect influences against poverty reduction.

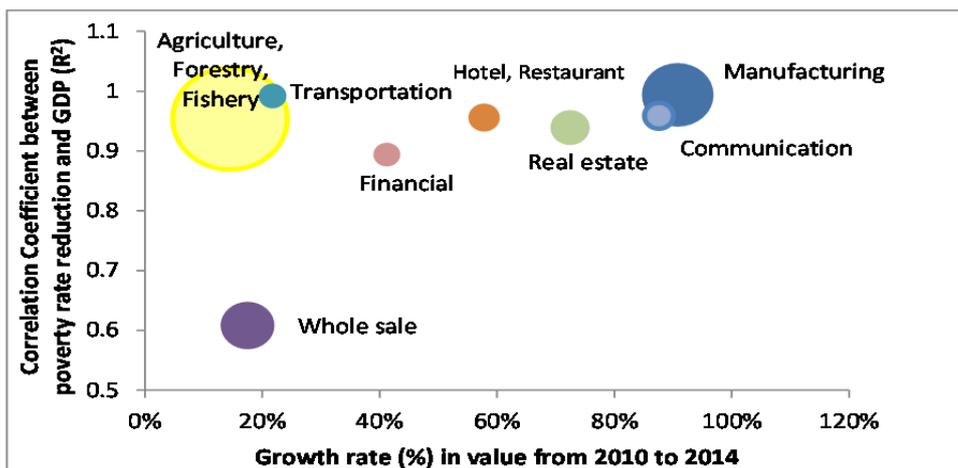


Figure 2.1.4 GDP Growth Percentage 2010-2014 (constant price 2010: X-axis), GDP Share (2014: Bubble Size), and correlation coefficient (R^2) between poverty rate and GDP development (Y-axis) In Ben Tre (1)

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Among sub-sectors in the primary sector, the same figure is developed as shown in the following figure.

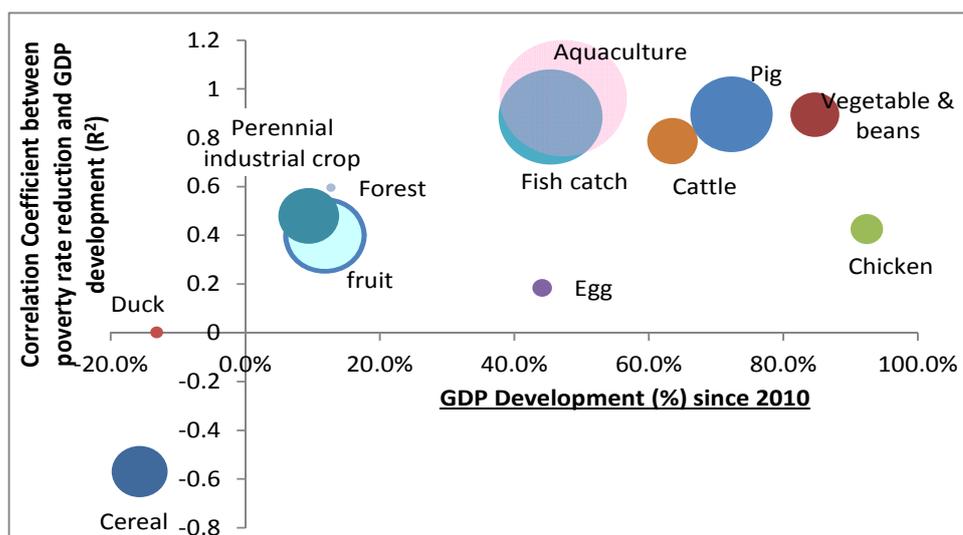


Figure 2.1.5 GDP Growth Percentage 2010-2014 (constant price 2010: X-axis), GDP Share (2014: Bubble Size), and correlation coefficient (R^2) between poverty rate and GDP development (Y-axis) In Ben Tre (2)

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Looking at the x-axis, the livestock subsectors such as the raising of chickens, pigs, and cattle has been developing with a 70-100% growth percentage during the past 5 years. Vegetable and bean production

also shows a strong development trend. Perennial industrial crops, forests, and fruit show low development; these subsectors require continuous land use. This is why rapid developments are difficult for these sectors without expanding planting areas. Cereal production during the last 5 years has declined; this may be due to saline intrusion in Ben Tre.

Regarding the correlation coefficient (R^2) between the poverty rate and GDP development, vegetable and bean production, pig and cattle husbandry, aquaculture, and fishing show high value in comparison with others. Among these economic activities, aquaculture and fish-catching will not be affected so much by saline intrusion while vegetable and bean production, as well as pig and cattle raising will be seriously affected by saline intrusion. In fact, many farmers during the dry season of 2015-2016 purchased drinking water for their pigs and cattle according to the field interview by the survey team. The activities for vegetable and bean production as well as pig and cattle raising will require more freshwater in the future in Ben Tre

2.2 METEOROLOGY

The Mekong Delta is located in the tropical monsoon region, which is usually represented as a hot and humid climate. Some meteorological information is available from data observed by the Ben Tre meteorological observatory located at latitude $10^{\circ} 15' N$, longitude $106^{\circ} 23' E$. Figure 2.2.1 shows the monthly average temperature and precipitation, which were observed for 5 years, from 2010 to 2014.

The average temperature ranges approximately from 25° to 30° . The latest data indicate that the average annual temperature is calculated at 27.1 degrees Celsius; the lowest monthly average is 24.1 degrees Celsius in January and the highest is 29.2 degrees Celsius in May. As shown in the following figure, it remains at high temperatures of over 25° and does not change throughout the year. November is the month that has nearly the same value of annual average temperature: about 27° .

The rainy season starts from May and ends in November, a total of 7 months. Such a seasonal rainfall pattern forms distinct dry and rainy seasons. February is the lowest rainfall month in a year; the dry season has a total of 5 months, starting from December and ending in April. It is noteworthy that monthly rainfall in the rainy season shows severe fluctuation yearly; the peak month changes year after year, and its value fluctuates much. In the rainy season, it's rainy for a very short time in the afternoons -- like a squall. Rainfall in 2014 showed a low value in May, October, and November in comparison with the average rainfall, while rainfall in June, July, and August showed a bit higher than the average. Annual rainfall from 2011-2014 was at around 1,400 mm/year.

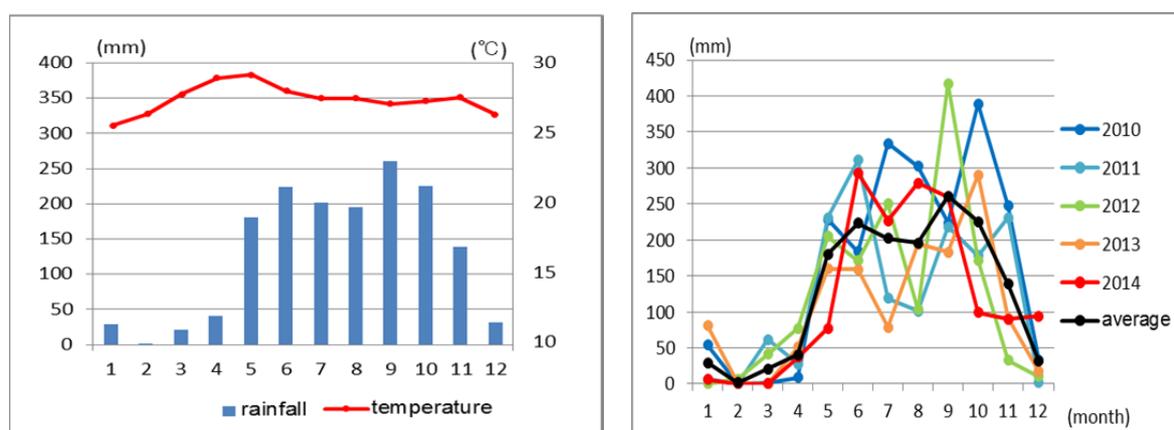


Figure 2.2.1 Monthly Average Temperature and precipitation (Left) and Monthly Rainfall Year (Right) in Ben Tre (2010-2014)

Source : Statistical Year Book Ben Tre 2014(Left), BTHMS(Right)

2.3 WATER RESOURCES, WATER SUPPLY SYSTEMS, AND FLOOD PROTECTION

2.3.1 WATER WAY NETWORK AND BANK EROSION

1) Outline of Canal Network

The Ben Tre Province is located downstream from the Mekong Delta, facing the East Sea. The province has dense canal networks of about 6,000 km in total extension. The canal networks include the following main rivers.

Co Chien River : Extension 82km	Ham Luong River : Extension 71km
Ba Lai River : Extension 59km	Tien River : Extension 83km

Such canal networks enable convenient transportation, the presence of various fish and other aquatic creatures, and freshwater supply to farmland. However, saline water from the East Sea intrudes into the aforementioned rivers. After this saline water intrusion into the rivers, saline water also intrudes into canals in the Ben Tre Province.

There are complicated irrigation networks in the Ben Tre Province. Canals connect to one of the main rivers, showing an average of about a 1-2 km extension. There are more than 60 canals having more than 50 m of width.

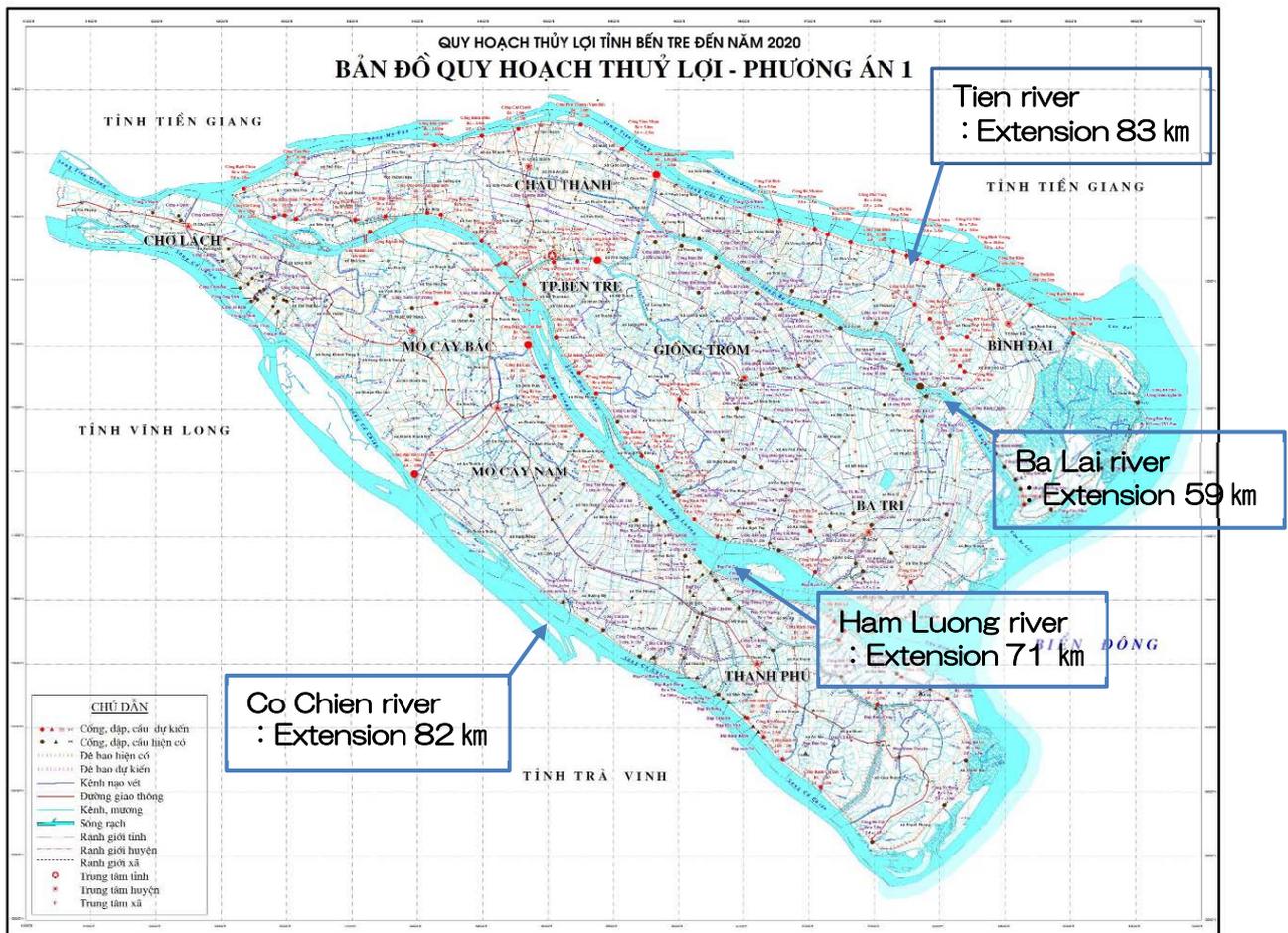


Figure 2.3.1 Canal Network in Ben Tre Province

Source: Data provided by SIWRP (2015)

2) Water Transportation Condition

There are two types of transports in the Mekong delta maritime area, one being transportation by water,

while the other is transportation by road. According to “JICA Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta (2013)”, the transportation by water in the Mekong delta is much different from transport in other regions in Vietnam. The transportation by waterway in the Mekong delta is about 70% while other regions show less than 30% of it in statistical data without air transport in 2009. This region was developed with water transport on a natural channel primitively, and colonial government and the Vietnamese government have continued to develop artificial channels. The government also develops road networks, however transport by water still covers the main part.

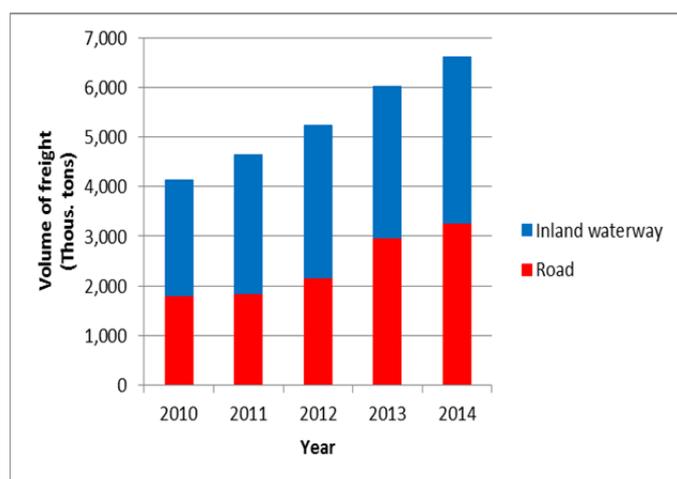


Figure 2.3.2 Transition of Cargo Transportation Amount

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

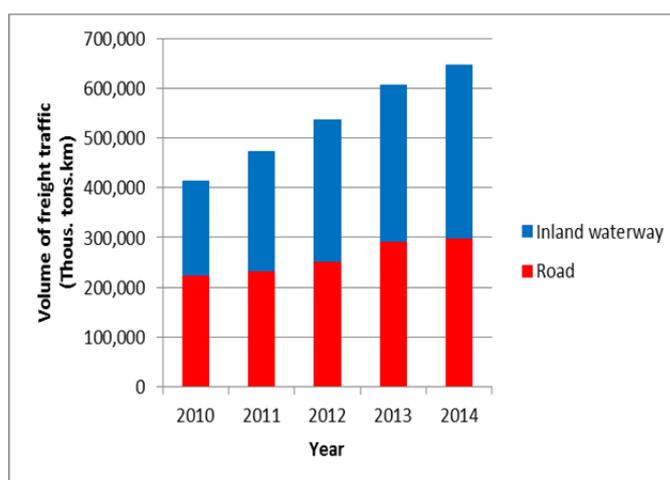


Figure 2.3.3 Transition of Cargo Transportation Traffic³

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

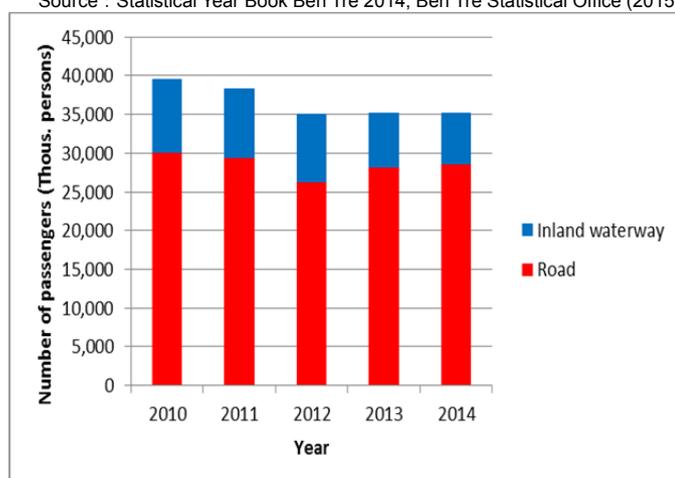


Figure 2.3.4 Transition of Number of Passenger

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

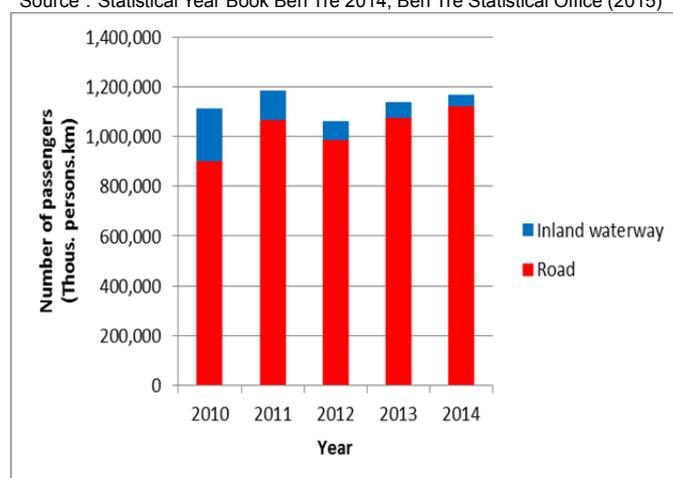


Figure 2.3.5 Transition of Traffic of Passenger

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Trends of cargo transportation in Ben Tre in recent years show increasing tendencies; the cargo transportation is mainly composed of two (2) methods; one is by an inland waterway while the other is by road. The freight transportation amount by the inland waterway in the Ben Tre Province shows more than the amount by road. Road freight transportation has been abruptly increasing from 2012 and is almost half of the total freight volume of 2014. However, the inland waterway still has important roles in freight transportation in Ben Tre.

Regarding passengers, road transportation is dominant in Ben Tre in comparison with inland waterway transportation. The number of passengers by the inland waterway transportation has been decreasing

³Traffic : Sum total of cargo amount (ton) or number of passenger multiplied by distance (kilometer)

gradually. Bridge construction in the Mekong delta may have made an impact on a tendency of the decreasing of passenger numbers. Contrarily, there is much sailing of sightseeing boats because the Ben Tre Province is a tourist spot. The waterway is still in an important position in this area.

3) River Bank Erosion

a) Types of Erosion

Riverbank erosion and sediment deposition are regarded as homeostatic phenomena caused by river force; this is because those natural phenomena are unavoidable in the project area. The project cannot protect all riverbanks from erosion in and around Ben Tre, so that the project shall deal with the riverbank erosions only at and vicinity of the sluice gates to be constructed. In general, some protection works such as riverbank revetment and bed protection are required and provided at up-and-down-streams of sluice gate. It is considered that there are predominantly three types of riverbank erosion in and around the project area; it is summarized in the following table.

Table 2.3.1 Types of Erosion observed in and around Ben Tre Province

Erosion Types	Causes of Erosion in and around Ben Tre
Lateral Erosion	The river flow force flashes soils away from the river banks.
Erosion by Ship-generated Wave	The ship-generated wave flashes soils away from the river banks.
Erosion due to Dredging	Due to over dredging at river bed, river banks are collapsed.

Source: JICA survey team (2016)

According to the ‘River Bank Erosion Report’ produced by the Rural Development Division in DARD, it is reported that there is some bank erosion in canals, including the proposed construction site of eight (8) sluice gates. The JICA survey team has confirmed bank erosion in An Hoa, Vam Nuoc Trong, Vam Thom, and Cai Quao among eight (8) sites surveyed during a field survey in August 2015.



Figure 2.3.6 Observed Bank Erosion (Left: Cai Quao Right: Vam Thom)

Source : JICA survey team (2016)

b) Lateral Erosion

An engineer in charge of riverbank erosion of DARD considers that cause of this riverbank erosion is lateral erosion by running water, not seepage failure. Figure 2.3.7 shows the condition of riverbank erosion in the ‘River Bank Erosion Report’. There are huge bank erosions -- more than 7m in a year -- shown by red-colored lines. In the vicinities of An Hoa, Ben Tre, and Vam Nuoc Trong, the red colored lines can be seen. According to this report, more than a total of 10 ha of residential area was lost and a total of 1,122 households had to evacuate from the bank areas due to bank erosion from 1990 to 2011 in the Ben Tre Province. In addition, it is estimated that 8,928 households will be affected until 2020.

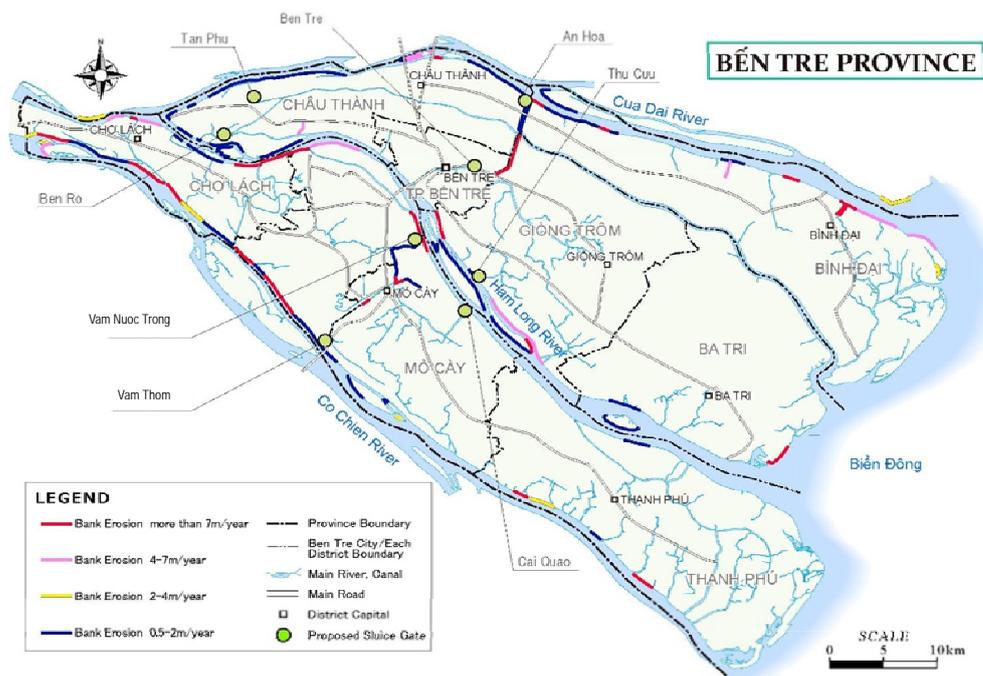


Figure 2.3.7 Bank Erosion Condition in Ben Tre Province

Source : DARD Rural Development Division (2011)

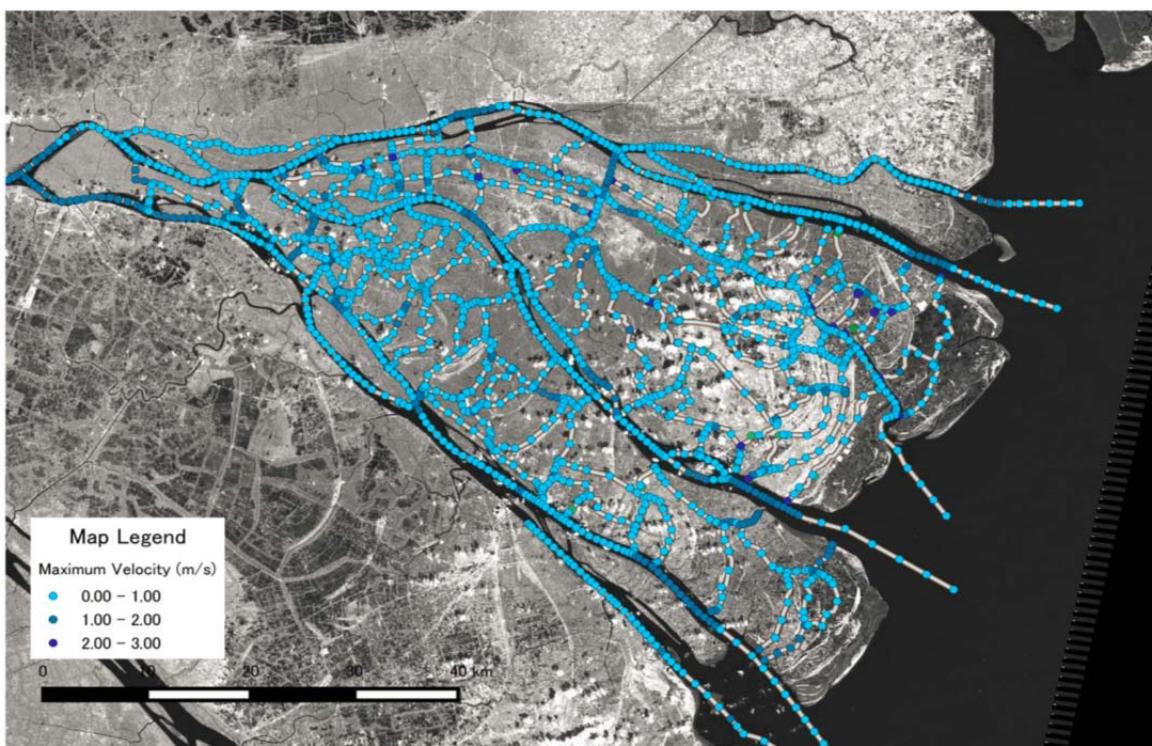


Figure 2.3.8 Distribution of Maximum Velocity (Calculated with Existing Condition)

Source : JICA survey team (2016)

Figure 2.3.8 shows calculated maximum flow velocity in the dry season which was obtained from computer simulation developed under this survey. Maximum flow velocity of the Ben Tre Province is about 3 m/s according to the results. Locations of the maximum flow velocity shown in Figure 2.3.8 mostly corresponds to the severe erosion areas shown in Figure 2.3.7. It means that high flow velocity is the major cause of lateral erosion in and around Ben Tre as the Engineer’s comment aforementioned.

The current velocity around the proposed sluice gates is at most about 2 m/s. This results indicate that revetment works can be applied to prevent riverbank erosion in the lower reaches and the upper reaches of the sluice gates.

c) Ship-generated Waves and Effect of Dredging

Ship-generated waves and effect of dredging are also considered as causes of riverbank erosion. The riverbank in the Arakawa lower reaches undergoes the influence of ships generating waves in Japan⁴. An experiment is being conducted to reduce the effect of ship-generated waves by using Yoshi vegetation planted along the riverbank. (However, this experiment is to protect against erosion along with keeping the natural bank.) High density of waterway transportation in Ben Tre will also cause riverbank erosion and it can be also mitigated by the same method as aforementioned. It's possible to prevent riverbank erosion caused by ship-generated waves by installing revetment works.

There are some sand mines to collect sands for construction in the Ben Tre Province. The sand mining may affect bank erosion and the foundation of the sluice gate. Figure 2.3.9 shows the permitted area on sand dredging. Three areas are identified which correspond to high erosion area ‘7m/year’ shown in Figure 2.3.9. Note that there is a sand mining area near the Thu Cuu sluice gate. Because the river width around the gate is about 500m at Ham Luong River, the sand mining will not affect this sluice gate in case of mining in the center of the river. Ordinary protection works can prevent bank erosion at the Thu Cuu sluice.

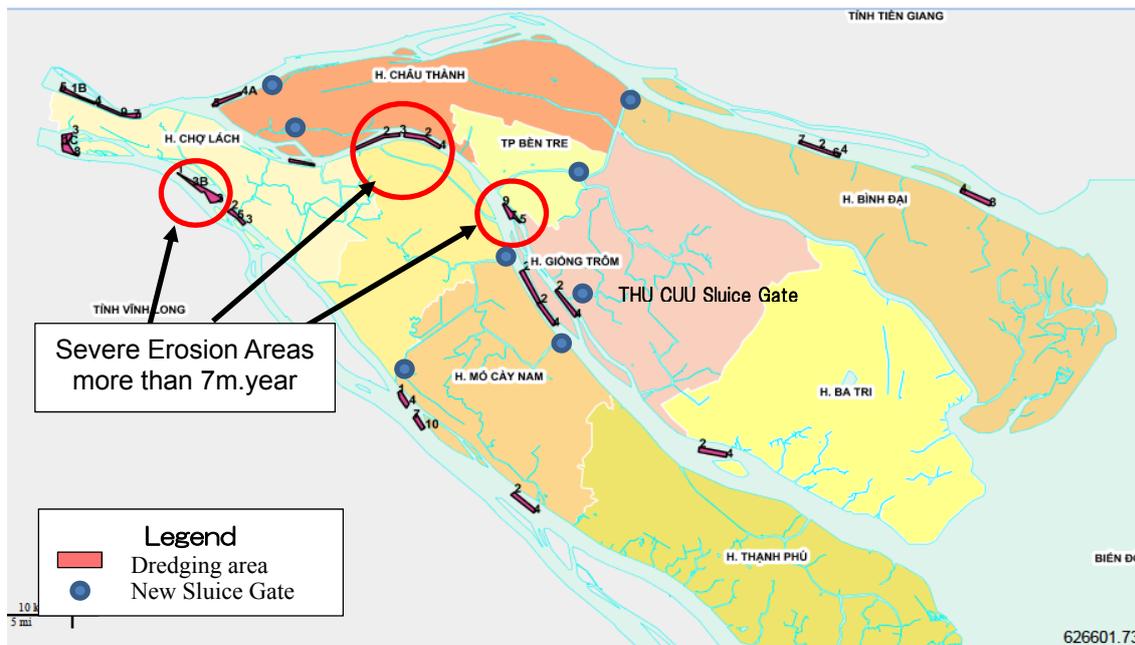


Figure 2.3.9 Permitted area for Dredging

Source : Ben Tre DONRE Website <http://113.163.94.8:8084/gisbt/>

2.3.2 SURFACE WATER AND QUALITY

1) River Discharge

The Southern Regional Hydro-Meteorological Station (SRHMS) under Ministry of Natural Resources and Environment (MONRE) observes hydrological data like water level and discharge.

⁴ Flood Hydraulics and River Design p355. Dr. Shoji Fukuoka. Morikita Publishing Co., Ltd. (2005)

a) Discharge Condition

The Mekong river discharge increases in the rainy season (May-October) and decreases in the dry season (November -April). Figure 2.3.10 shows the discharge in Kratie, Cambodia and in My Thuan in the upper stream of the Ben Tre Province. My Thuan shows less discharge than Kratie because there are many river tributaries before My Thuan and water intake works along the Mekong River. The peak discharge in My Thuan, usually in October, is about 15,000 m³/s while bottom discharge mostly in during a typical year.

Furthermore, the discharge of the Mekong River is estimated to change in the future. Flow forecast until 2050 by the Mekong River commission (MRC) is indicated in Table 2.3.2.

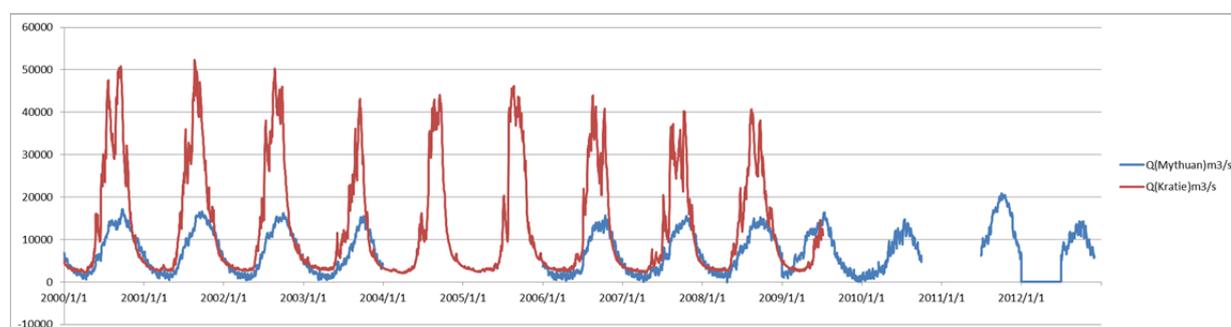


Figure 2.3.10 River Discharge

Source : Data provided by SIWRP (2015)

Table 2.3.2 Change of Discharge in Future with Climate Change by MRC

Water Resources Development in Basin	Flow in Dry season	Flow in Rainy Season
Not developed	The discharge is the increased tendency until the end of March compared with average discharge in 1991-2000. The discharge after April is equal to in 1991-2000 mostly.	The predicted discharge until the middle of September is the mostly same as average discharge in 1991-2000. The discharge will increase since peak of rainy season of middle of September to beginning or middle term of dry season.
Developed	The dry season lowest discharge in Kratie (April-May) doubles compared with 1991-2000. (2,000m ³ /s →4000m ³ /s)	The discharge in dry season will decrease compared with average discharge in 1991-2000.

Source : Mekong River Commission

2) Salinity

a) Observation Agency

The SRHMS, Ben Tre Irrigation Works Exploitation One-Member Limited Liability Company (IWEC) and Department of Natural Resources and environment (DONRE) measure the salinity as a regular observance during the dry season (See Table 2.3.3). There is not any automatic salinity gauge. Other governmental institutes and organizations also observe salinity as needed; such organizations are: SIWRP (Southern Institute of Water Resources Planning) and SIWRR (Southern Institute of Water Resources Research).

According to Adaptation in the Mekong Delta (AMD) in the Ben Tre and Tra Vinh Provinces, projects by International Fund for Agricultural Development (IFAD) and PPC, AMD will install less than 30 telemeter salinity gauges in Ben Tre.

Table 2.3.3 Salinity Observation System in Ben Tre Province

Category	Item	Number of station	Recording Method	Data Transfer Method	Data Center	Organization	Purpose	Problems for Gate Operation
Water Quality	Salinity Concentration	5	Manual 2 times/ day in dry season	Telephone	Regional Center of HMS in HCMC	Ben Tre Hydro-Meteorological Service, MONRE	Observation and alert	Lack of immediate data transfer
Water Quality	Salinity Concentration	20	Manual 1 time/ day in dry season	Telephone	No	IWEC	Gate operation	---
Water Quality	Salinity Concentration	54	Manual 2 times/ year	no	no	DONRE	Monitoring water pollution	Lack of immediate data transfer

Source : JICA survey team (2016)

SRHMS observes salinity concentration along the main river channels of Mekong River. There are five (5) stations in Ben Tre Province and one (1) station in the Vinh Long Province just upstream from the Ben Tre Province (see Figure 2.3.11).

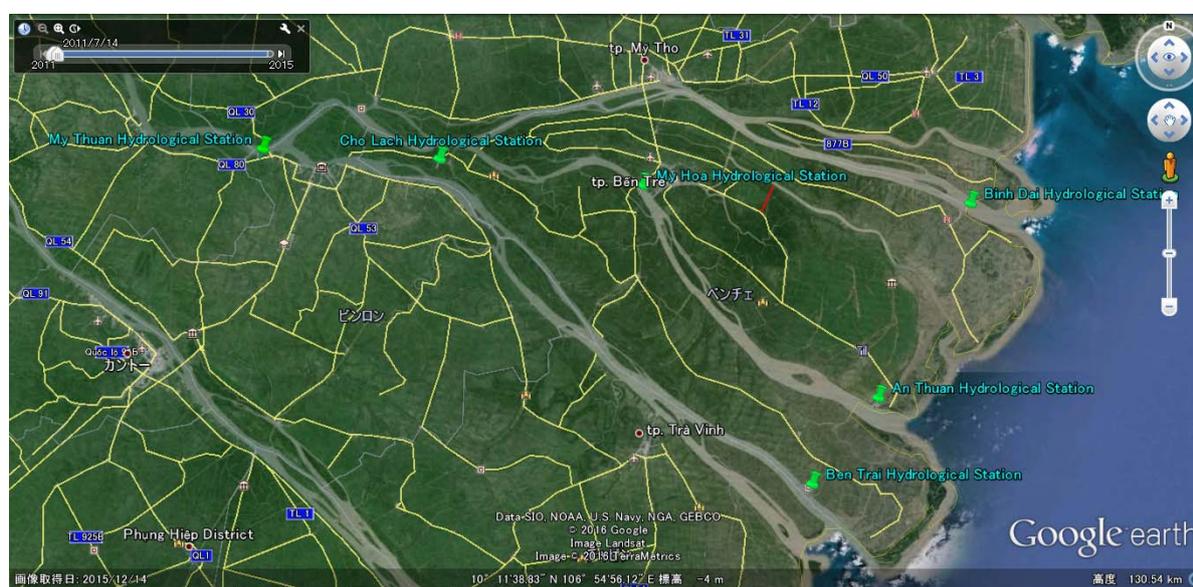


Figure 2.3.11 Location of Saline Monitoring Station in Ben Tre Province and Surrounding Area by SRHMS

Source : JICA survey team (2016)

Ben Tre Hydro-Meteorological Station (BTHMS) under SRHMS issues a salinity forecast every 10 days during the dry season. The period of forecast is 10 days. The forecast result is disseminated to the following organizations by e-mail or facsimile:

1. Provincial Office
2. Steering Committee for Flood and Storm Prevention and Search and Rescue
3. DARD
4. Steering Committee for Flood and Storm Prevention
5. Provincial Television and Radio Station
6. Agriculture and Rural Development Division of Districts and City
7. Irrigation Works Exploitation Company
8. DONRE
9. Forecasting Division of Southern Regional for Hydro-Meteorological Station (SRHMS)
10. Forecast Management Division of Central Hydro-Meteorological Center
11. Archive

IWEC observes salinity concentration at twenty (20) existing sluices once a day during the dry season. IWEC measures salinity at the riverside and the landside of the sluice. IWEC uses a handheld type salinity concentration meter as shown in Figure 2.3.12.



Figure 2.3.12 Salinity Concentration Meter used at Son Doc 2 Sluice

Source : JICA survey team (2016)

b) Salinity and Saline Damage

Negative influence from saline water intrusion is intensifying in the Mekong delta. The Irrigation and Flood Prevention Division (IFPD) in DARD has been issuing ‘a damage report’ since 1993, which says that damage by saline water intrusion became obvious after 1998. Saline water intrusion damages fishing industries and domestic non-commercial water as well as farming. Recently, there was saline damage around the proposed Ben Tre sluice gate construction site in December 2014 and the saline content was recorded as high as more than 4%. The major damages in the past are summarized in the following table. The saline damage has been recorded constantly, and it has been increasing in the last ten years. The immense damage has been recorded once every hundred years approximately between 2015 and 2016,. The definitive value of the damage between 2015 and 2016 will be expected to increase than preliminary estimation in 2016.

Table 2.3.4 Damage by Saline water intrusion

Year	Affected Area (ha)	Damage Cost (VND billion)	Shortage of Domestic water (household)
1998	33,631	119	
1999	40,669	67	
2000	Saline damage was not reported.		
2001	Saline damage was not reported.		
2002	20,292	20	50,000
2003	Saline damage was not reported.		
2004	9,671	12	16,131
2005	53,395	570	112,093
2006		0.08	4,000
2007	450		
2008	Saline damage was not reported.		
2009	Saline damage was not reported.		
2010	33,924	197	
2011	10,063	560	
2012	Saline damage was not reported.		
2013	13,078	80	84,900
2014	Saline damage was not reported.		
2015*	29,000	1,500	83,000

* Damage report is compiled data around February - July every year. In order to calculate include preceding record of dry season, the latest report is compiled as 2015. Data of 2015 shows a preliminary estimation from DARD irrigation division in Aug 2016.(not confirmed)

Source : Damage Report (1993-2014) by Irrigation and Flood Prevention Division.

A preliminary estimation of damage as of April 2016 in a newspaper is shown in Figure 2.3.5⁵.

Table 2.3.5 Damage by Saline water intrusion and Drought (2016 QE)

Year	Affected Area
Total Damage	VND 5,572 billion
Damaged Houses by shortage of daily life water	338,849 HH
Damaged Farm Area (Rice and others)	260,000 ha
Damaged Fruit Farm and Industrial Area	160,000 ha
Damaged Aquaculture Pond	4,500 ha

Source : VNEXPRESS 17, Apr 2016

Note: There are about 90km saline intrusion from sea shore to inland area; MARD offered VND 1,000 billion aid to PM for the damage.

A hydraulic type of saline water intrusion in the Mekong Delta was confirmed in a JICA Study (2013). According to P6-6 of the main report of the JICA Study (2013), there is no salt wedge phenomenon in the Ben Tre Province, while there is an intensive mixing phenomenon of saline water intrusion.

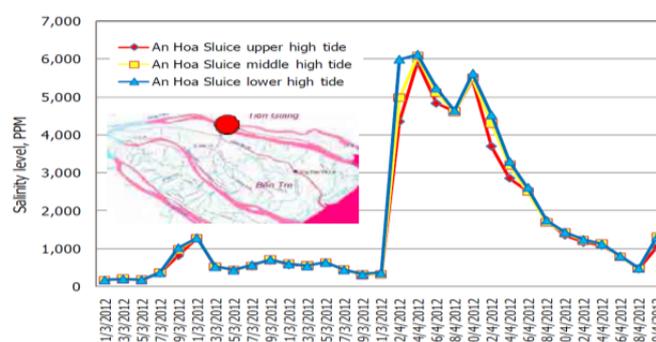


Figure 2.3.13 Salinity Distribution by Depth in An Hoa District in Ben Tre Province

Source : JICA Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta (2013)

c) Gate Operation

Irrigation and Drainage Company under Ben Tre PPC has been delegated roles for the observation of salinity (within and without gates) and gate operation to neighboring farmers. Seventy-seven (77) sluices are managed and operated by IWEC in Ben Tre Province. Sluice gate operation schedules are prepared by the IWEC by District. Irrigation and Drainage Companies established gate operation rules. There is a watering day, a drainage day, and a closed day, which are each based on the lunar calendar in the operation rule. Open and close operation is decided with consideration for the sluice gate roles, the season, lunar age, and salinity. In the case of the open day, it basically opens twice per day during high tide or low tide. An example of a gate operation rule is shown in Table 2.3.6.

⁵ 20160417. VNEXPRESS Hạn, mặn gây thiệt hại gần 5.600 tỷ đồng (only Vietnamese)

Table 2.3.6 Example of Gate Operation Rule (Mo Cay Nam District)

Term	Headworks	Watering	Drainage	Closed
Jan - Apr	Vam Don Tan Huong	No	9, 10 And 24, 25	Remaining days
	Binh Bat	No	9 and 24	Remaining days
	Tan Trung	No	10 and 25	Remaining days
May - Aug	Vam Don Tan Huong	Continuous irrigation during 30 days (If S < 1‰)	No	Days with S>1‰
	Binh Bat	15,16,17 and 30,1,2	No	Remaining days
	Tan Trung	11 and 26 (If S < 1‰)	10 and 25	Remaining days
Sep - Dec	Vam Don Tan Huong	No	From 14 to 20 and from 28 to 4	Remaining days
	Binh Bat	No	14,15,16 and 28,29,30	Remaining days
	Tan Trung	11 and 26 (If S < 1‰)	10 and 25	Remaining days

* Note: S indicates Salinity; Opened and Closed days are Lunar Calendar

Source : Data provided by Irrigation and Drainage Companies (2014)

3) Water Quality

a) Water Quality Condition

DONRE measures water quality twice a year. Sampling points are 54. Measurement items are pH, Dissolved Oxygen (DO), Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), N-NH₄(Ammonia) and Coliform. According to the 'Environmental Monitoring Report' prepared by DONRE (dry season in 2014), there are 54 sampling points in the Ben Tre Province and 54% (29/54) of the points have the worst level of water quality (polluted and purification measures are necessary) in the water quality index. The second worst level of water quality (water transportation or similar uses are possible) is 2% (1/54), and the third level (irrigation or similar uses are possible) is 14% (8/54). The fourth level (available for drinking water but with any treatment necessary) and the fifth level (available for drinking water) are 30% (16/54) (referred to in Figure 2.3.14).

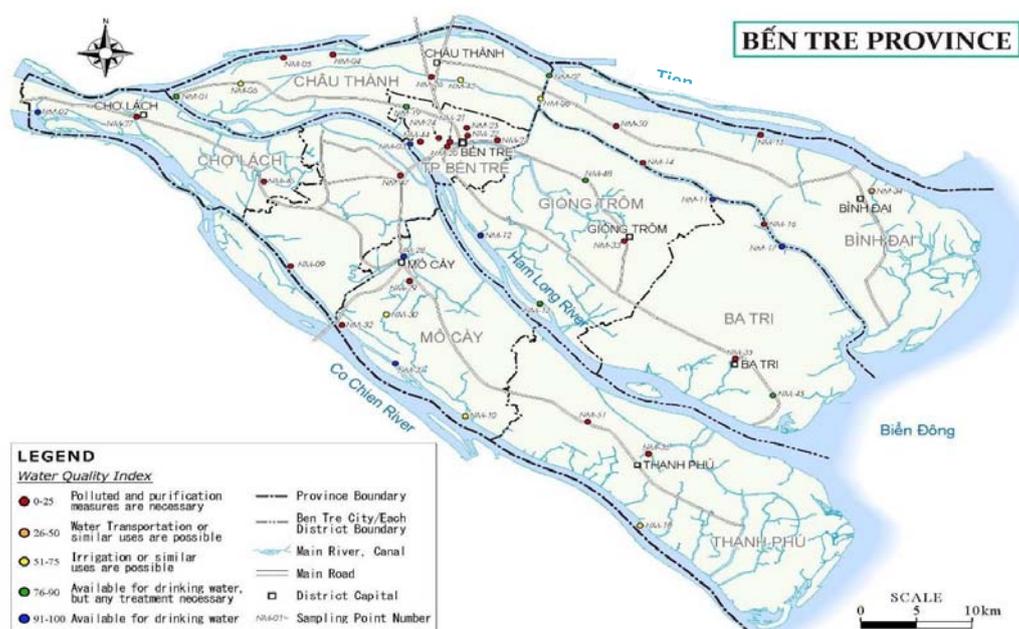


Figure 2.3.14 Observed Water Quality at 54 Points in Ben Tre Province

Source : DONRE (2014)

On the other hand, ammonia and coliform are over 'the water quality standard' in the upper stream in

the dry season. Causes include absence of a sewage plant, growth of population in the upper stream, and the growth of stock farming (pigs, etc.).

2.3.3 GROUND WATER AND QUALITY

In Ben Tre Province, the groundwater data is obtained and processed by Ben Tre Water Supply One-member Limited Liability Company (WSC) and DONRE.

WSC had measured groundwater quality at boreholes, which were usually utilized as water sources for the Huu Dinh Water Supply/ Purification Plant owned by WSC. Those boreholes were distributed in the Chau Thanh District and Ben Tre City as shown in the following figure and table.

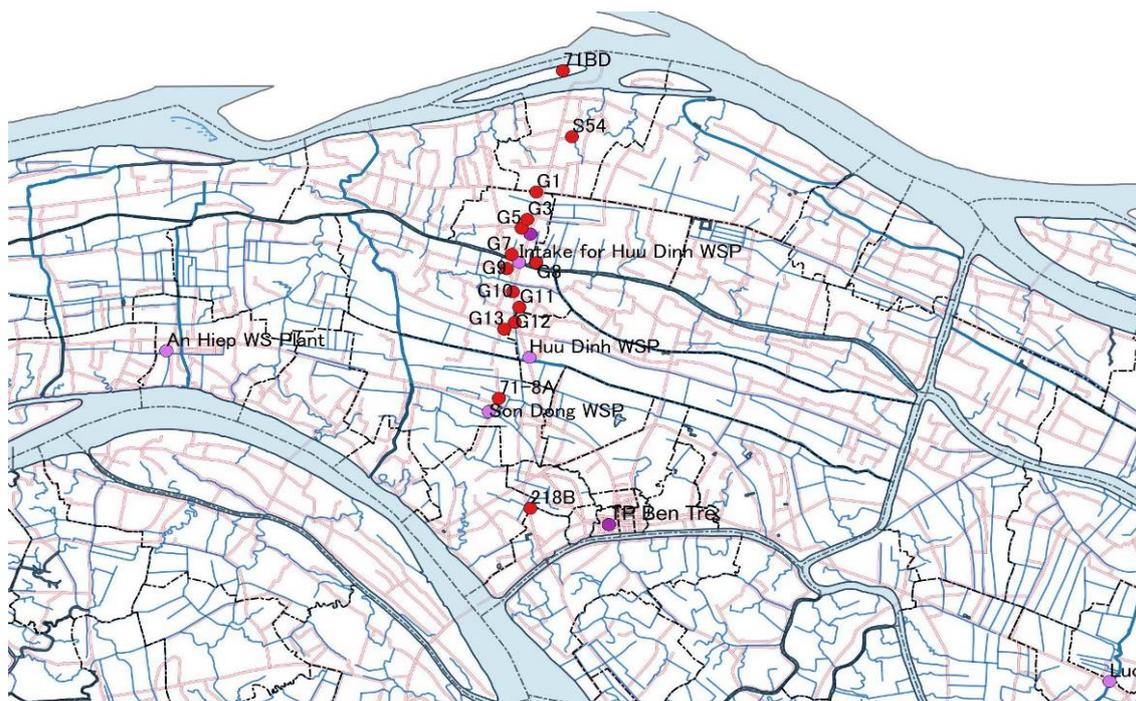


Figure 2.3.15 Location of Wells/ Boreholes

Source: JICA survey team (2016)

Table 2.3.7 List of Wells

No.	Name of wells	Depth (m)	Water level (m)	Salinity 2005 (mg/l)	Salinity 2010 (mg/l)	Salinity 2014 (mg/l)
1	71-BD	417.5	-			
2	S54	465.3	-			
3	G1	458.0	3.0	152	260	270
4	G3	315.0	3.15	95	160	380
5	G5	307.0	2.0	89	180	220
6	G7	316.0	3.0	101	300	500
7	G8	320.0	3.0	214	400	420
8	G9	316.0	2.3	174	340	400
9	G10	310.0	2.5	131	270	290
10	G11	318.0	3.0	202	600	630
11	G12	311.0	2.5	302	2,700	*1
12	G13	305.0	2.8	320	400	*2
13	71-8A	437.5	-			
14	21-8B	457.5	-			

Source: Ben Tre Water Supply One-member Limited Liability Company

Note *1: Stopped exploitation from 2006 because salinity was too high

*2: Stopped exploitation from 2009 because of no-water to pump

In recent years, salinity observed from most of the boreholes exceeds 300 mg/l, a stipulated value in the Vietnam water supply standard. The following figure shows the yearly change of salinity content of the groundwater in Ben Tre City and in the Chau Thanh District.

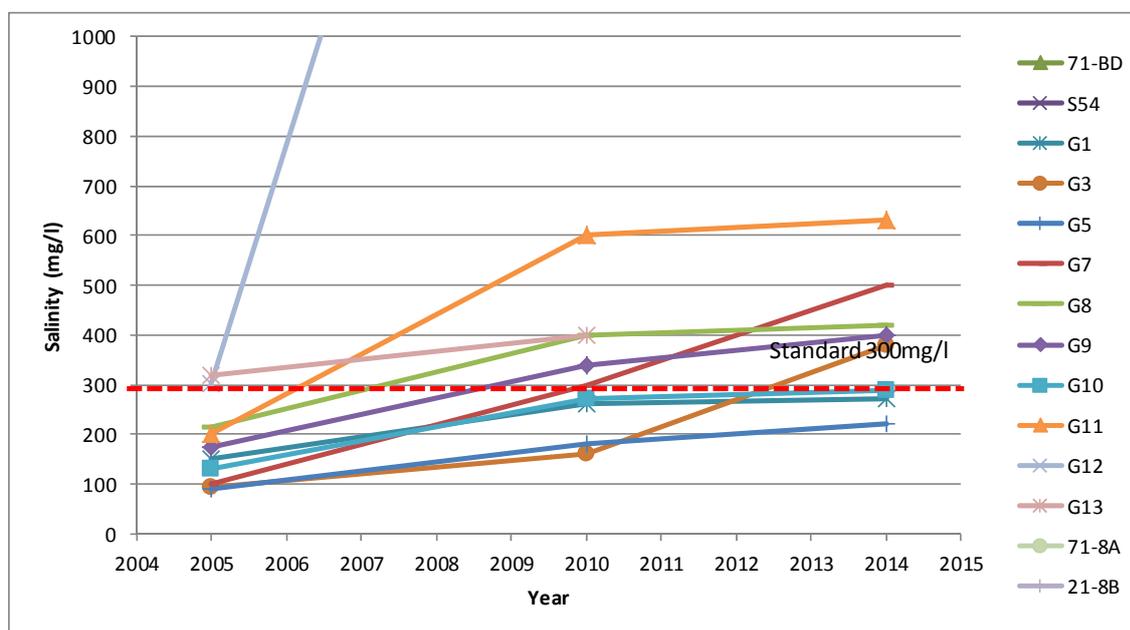


Figure 2.3.16 Salinity of Groundwater Observed in Ben Tre City and Chau Thanh District

Source: JICA survey team (2016)

DONRE measured groundwater quality and quantity at boreholes to assess groundwater potential for domestic and aquaculture water supply in Ben Tre Province from 2010 to 2020. In that report, they concluded as follows;

“About the quality of underground water, generally in the distribution area of light fresh water, it can be used to supply water for drinking and living after treatment of the problems of full hardness, total Fe (iron), and exceeded standard limit of SO_4^{2-} (sulfate ion) and Cd (cadmium).

In the distribution areas of brackish to saline, it almost meet the standard for aquaculture, these parameters which do not meet the standard limit are NH_4^+ (ammonium ion), Cd (cadmium), Phenol, pH (n_1^3 aquifer).

These data suggest that light fresh groundwater potential in Ben Tre is not rich compared to other provinces in the Mekong Delta, but still is an important source to meet the individual needs of water supply in small and medium scale. Brackish to saline water potential is plentiful, which meet the needs of exploitation and service of aquaculture sector.”

2.3.4 WATER SUPPLY AND CONTROL SYSTEMS

1) Organization Related to Water Supply

The Water supply in the Ben Tre Province is conducted by two organizations, namely, the WSC and the ‘Center of Rural Water and Environment Sanitation (CRWES) Ben Tre Province’. The former is responsible for the water supply in the urban area and the surrounding area of Ben Tre City, and the latter is under Ben Tre DARD and responsible for the water supply in the rural area.

2) Water Supply in Urban Area

The water supply area covered by WSC is shown in the following Figure 2.3.17, and four (4) water supply plants are being operated, namely, Son Dong, Huu Dinh, Cho Lach, and Luong Quoi. There are two (2) water-pumping stations to take and send water to the water supply plants. The designed water

supply capacity is 52,800m³/ day in total.

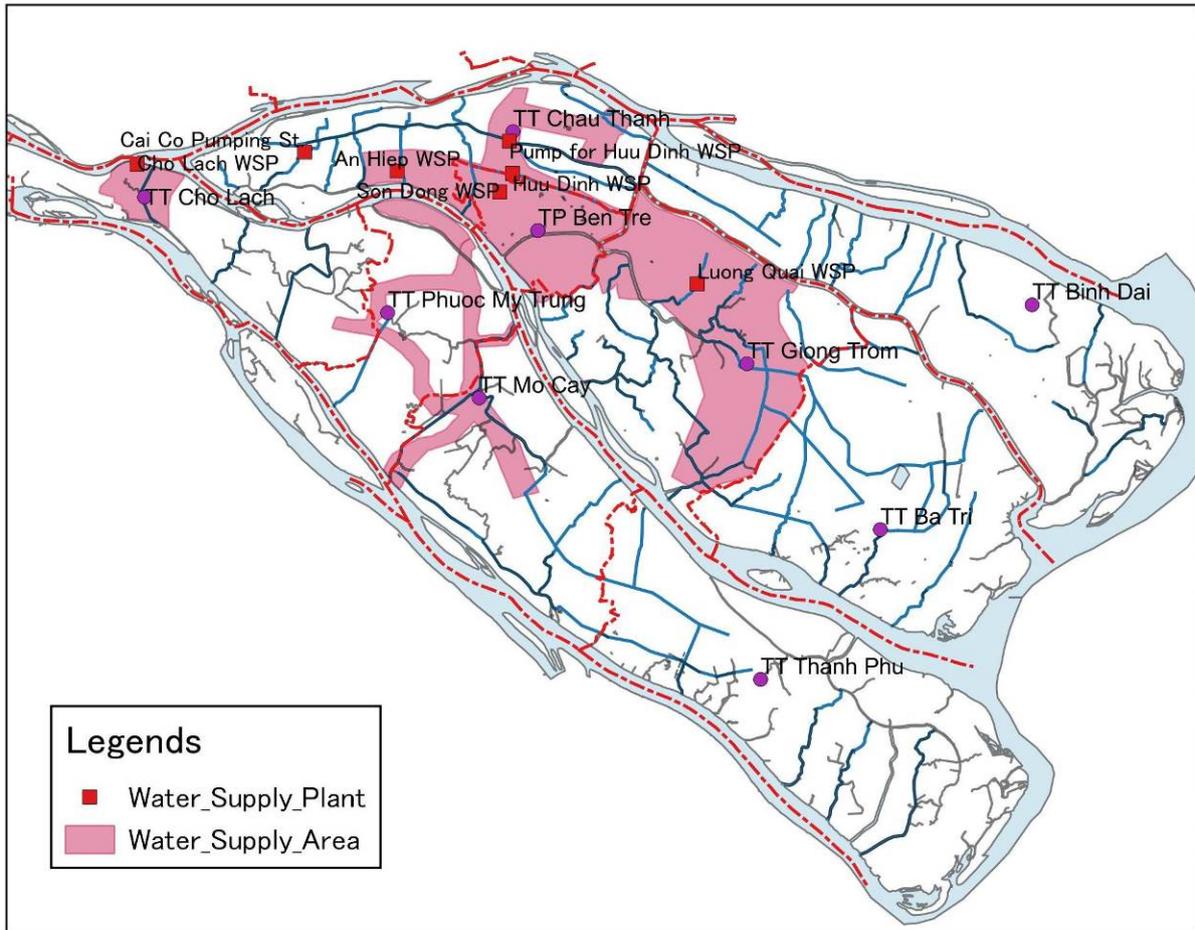


Figure 2.3.17 Location Map of Water Supply Plant and Water Supply Area in Ben Tre

Source: JICA survey team (2016)

There are different water prices categorized by purposes and areas as shown in the table below.

Table 2.3.8 Water Price in Ben Tre (unit: Dong/ m3)

No.	Purpose	Cho Lach and Giong Trom district (except the communes in sub-region IV of Giong Trom district)	Ben Tre city, Chau Thanh district, industrial zones and communes-belong to sub-region IV of Giong Trom district
1	Living of residential	7,000	8,000
2	Public purpose, business, and administrative offices	7,200	8,200
3	Material production activities	7,500	8,500
4	Business service activities	8,000	9,000

Source: Ben Tre Water Supply One-member Limited Liability Company

As for the water supply results from 2005 to September 2015, especially under contract, the number of customers has doubled from 22,015 to 59,684 as shown in Figure 2.3.18. This shows that most of the supply is for living purposes. As for the production of supplied water from 2005 to 2014, the total volume has doubled from 6.2 million m³ to 11.8 million m³, and not only the water supply for living, but also the water supply for produce and business and organization is increasing as shown in Figure 2.3.19.

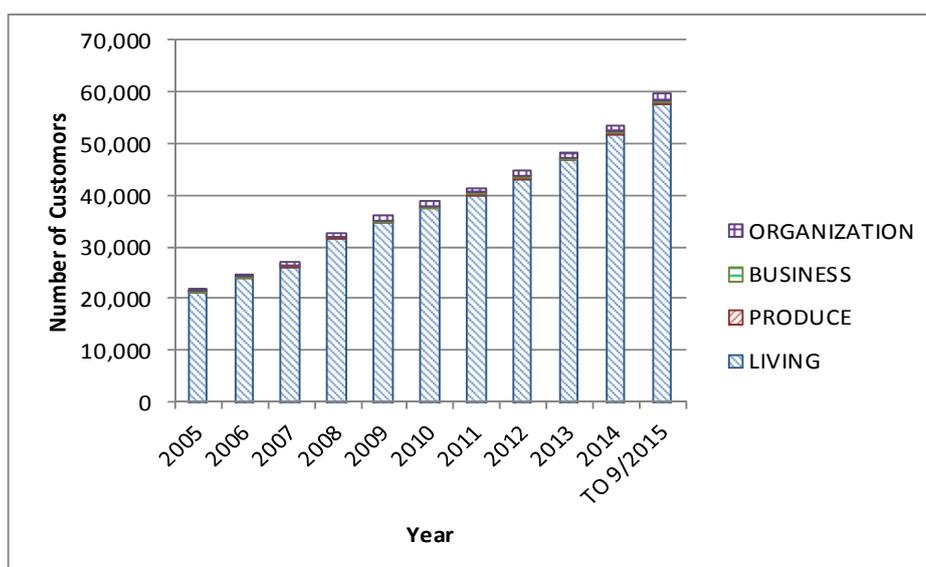


Figure 2.3.18 Change of Number of Customers of Water Supply Company by Users

Source: Ben Tre Water Supply One-member Limited Liability Company

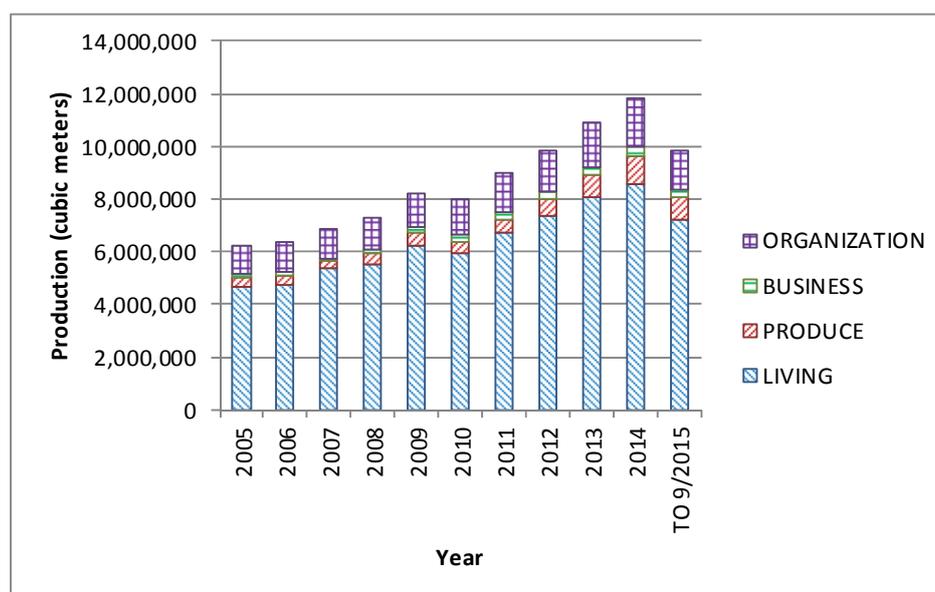


Figure 2.3.19 Change of Production of Water Supply Company by Users

Source: Ben Tre Water Supply One-member Limited Liability Company

3) Issues Caused by Saline water intrusion for Water Supply in Urban Area

Saline water intrusion into rivers has caused serious issues in the water supply for urban areas, canals, and boreholes/wells. In the Huu Dinh Water Supply Plant, the main water source, which was a borehole (as aforementioned in the groundwater section), salt water has entered into those boreholes resulting in being forced to stop taking water from those boreholes. Currently, the Ba Lai River is only one water resource to be treated and supplied. Consequently, although the designed water supply capacity is 10,500 m³/day, the actual water supply capacity stays at only 3,500 m³/day.

Moreover, in Luong Quoi, source water taken from a canal shows very high salinity concentration. Therefore, metal parts such as pipes and screens have been damaged and deteriorated by corrosion faster than the usual estimation for such.



Valve with corrosion

Pipe material is changed to corrosion resistant material

Figure 2.3.20 Damage to Water Supply Plant from Saline water intrusion

Source: JICA survey team (2016)

The water source of the Son Dong Water Supply Plant is the surface water of an adjacent canal. From March to May in the dry season, saline water intrusion into the canal results in water intake being stopped. Figure 2.3.21 shows a change of salinity of raw water (source water) at the Son Dong Water Supply Plant by year. It shows that the high saline content period in raw water as more than 300 mg/l continued for a long time, especially in 2004, 2005, 2010, 2011 and 2013.

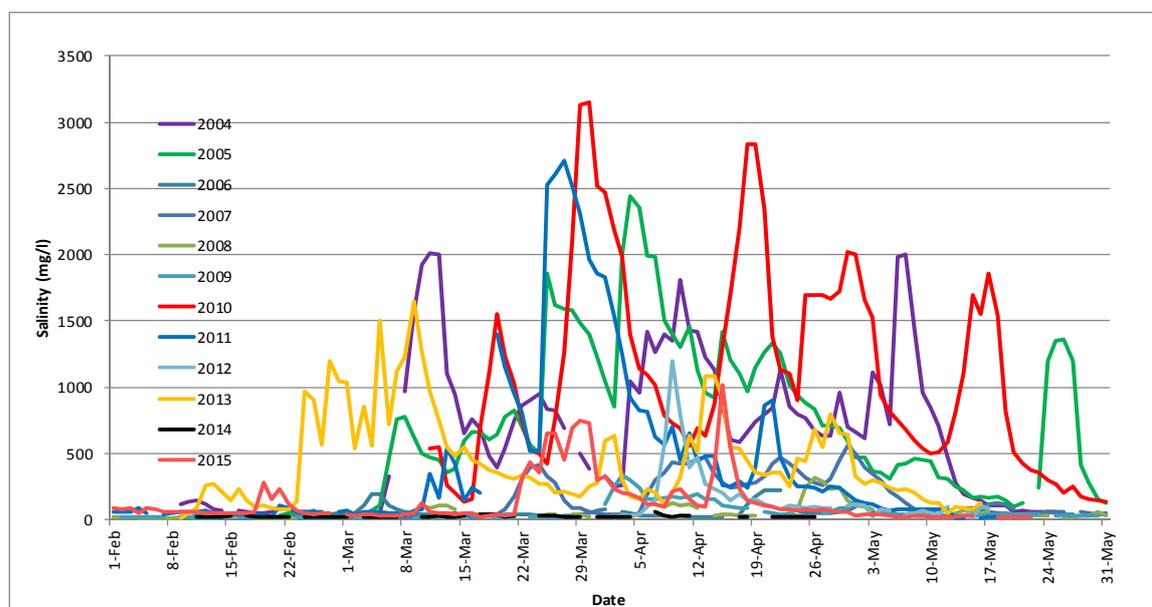


Figure 2.3.21 Salinity of Raw Water at the Son Dong Water Supply Plant

Source: Ben Tre Water Supply One-member Limited Liability Company

4) Countermeasures to Saline Water Intrusion

As a countermeasure to saline water intrusion, the Cai Co Pumping Station is planning to take 47,000m³/day of water from the Ben Ro Canal that connects to the Ham Luong River; this plan is now under implementation. It will be able to provide water in the amount of 15,000 m³/day to the An Hiep Water Supply Plant and 32,000 m³/day to the Son Dong Water Supply Plant. This construction work will finish, and the water supply plant will be in operation by early 2016.

On the other hand, for the determination of a new water source encountering saline water intrusion, WSC has started to measure salinity at upstream four (4) points, namely, the Ben Ro Canal, the Tan Phu Canal, the Tan Phu Ferry on the Tien River, and the Cho Lach Station on the Tien River from 2010. As a result, the salinity at the Ben Ro Canal has some high periods, around 250 mg/l, as shown in Figure 2.3.22. Therefore, if fresh water is taken at the Ben Ro Sluice gate, the gate should be

operated while monitoring salinity during the dry season.

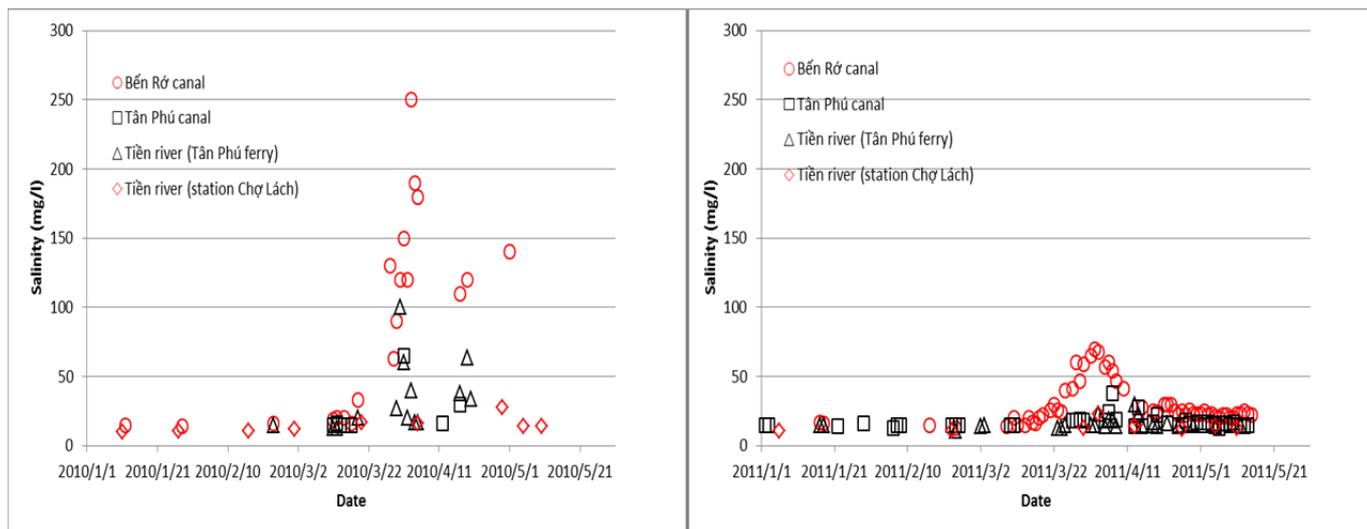


Figure 2.3.22 Salinity in the Upstream of Ben Tre during Dry Season (Left: 2010, Right: 2011)

Source: Ben Tre Water Supply One-member Limited Liability Company

5) Water Supply in Rural Area

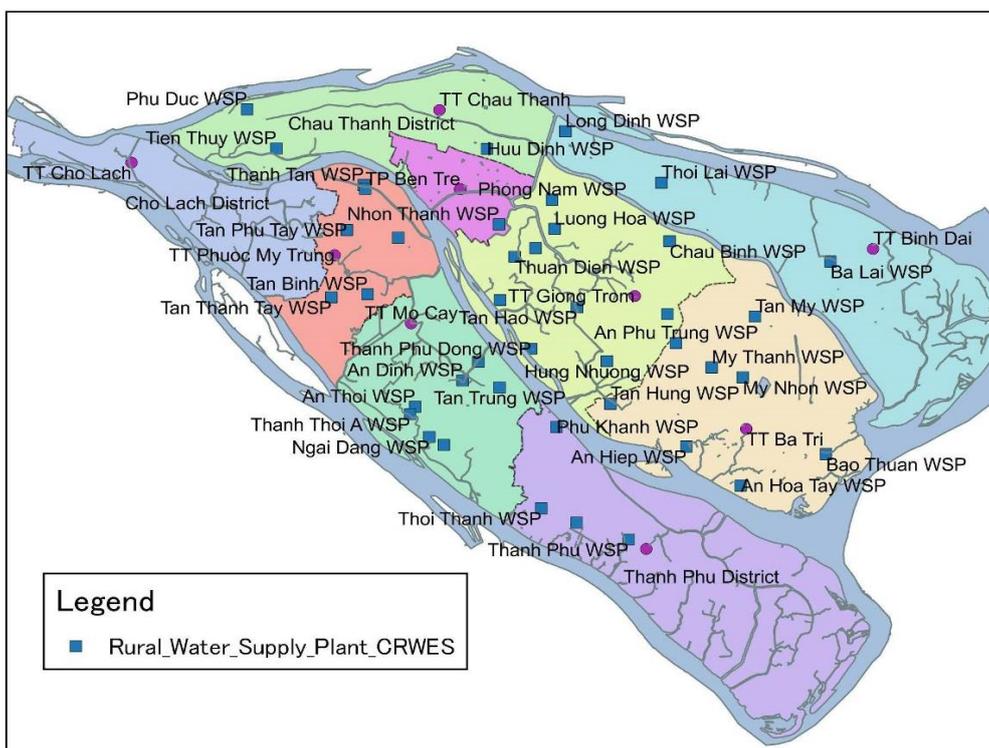


Figure 2.3.23 Location Map of Water Supply Plant in Rural Area by CRWES

Source: Prepared by JICA survey team based on the data from Center of Rural Water and Environment Sanitation Ben Tre Province

The Center of Rural Water and Environmental Sanitation under DARD is in charge of the water supply in the rural area of the Ben Tre Province. The Center is implementing a national campaign entitled, “Treated Water and Rural Environmental Sanitation” (NTP3), and it is in the stage of 2016-2020 of a short-term plan. The Center owns and operates forty-two (42) water supply plants and provides water in the amount of 1,583 m³/h to 51,383 households in a rural area as shown in Figure 2.3.23. Seventy-two (72) water supply plants supply the treated water to more than 80,000 rural households with a total capacity of 2,624 m³/h.

6) Saline Water Intrusion Problems in Rural Water Supply

In the Binh Dai District in North Ben Tre, the Ba Lai River is the main source of the rural water supply, but saline water intrusion into the Ba Lai River occurs during the dry season upstream from the Ba Lai Barrage. As a result, fresh water cannot be taken from the river. In the Chau Thanh District, fresh water cannot be taken from rivers and canals because of saline water intrusion during the dry season, too.

In South Ben Tre, the saline water intrusion area has been moving north. Currently, water is taken from water intake and supply plants in the middle of South Ben Tre and sent through pipes, but salt water has already reached to the intake point.

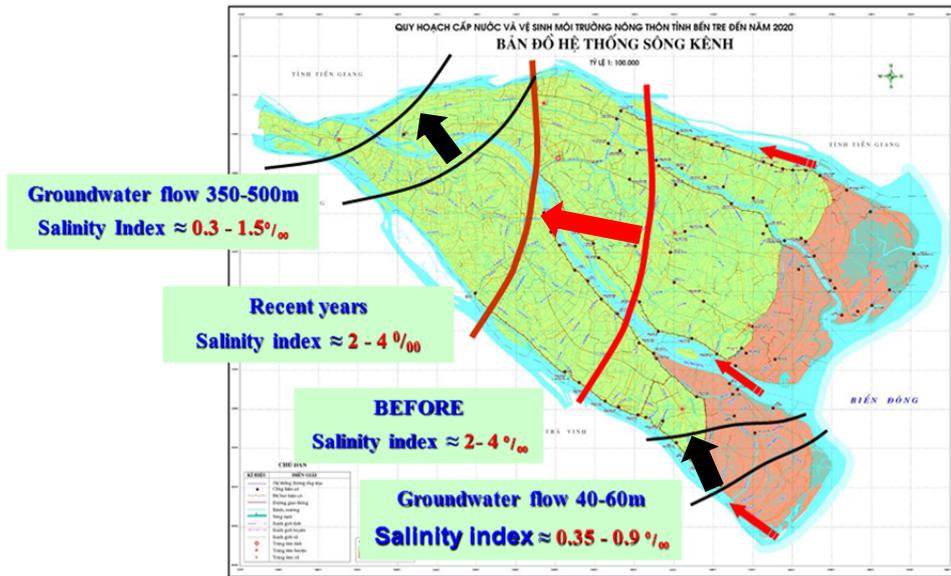
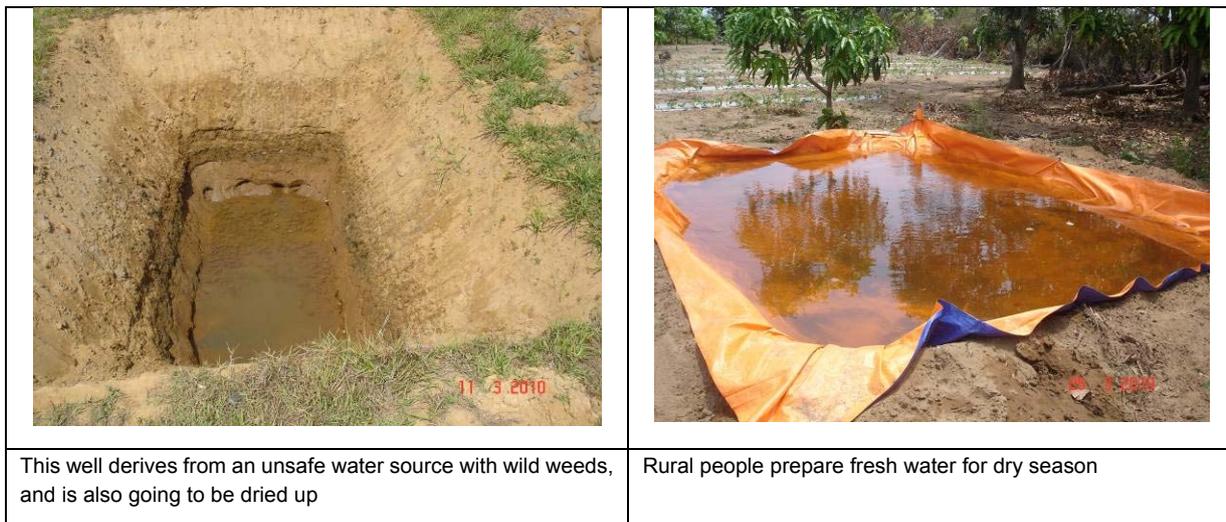


Figure 2.3.24 Change of Saline water intrusion Area in Ben Tre Province

Source: Prepared by JICA survey team based on the data from Center of Rural Water and Environment Sanitation Ben Tre Province

Groundwater use is not so dominant in the Ben Tre Province while surface water comprises the majority of the water resource. Fresh water available from surface water in the dry season is getting worse so that people’s selection of options will be quite limited, such as, surface water, groundwater, and stored rainwater during the rainy season.



This well derives from an unsafe water source with wild weeds, and is also going to be dried up

Rural people prepare fresh water for dry season

Figure 2.3.25 Water Shortage Situation in Dry Season in Ben Tre Province

Source: Center of Rural Water and Environment Sanitation Ben Tre Province

7) Countermeasures to Saline Water Intrusion

The Center supposes that the Vam Thom and Vam Nuoc Trong Sluice gates will stop saline water intrusion to their water intakes, but they are also considering that because salt water reaches north to the current intake points during the heavy saline water intrusion season, the intake point and pipeline should be extended to the north area as shown in Figure 2.3.26.

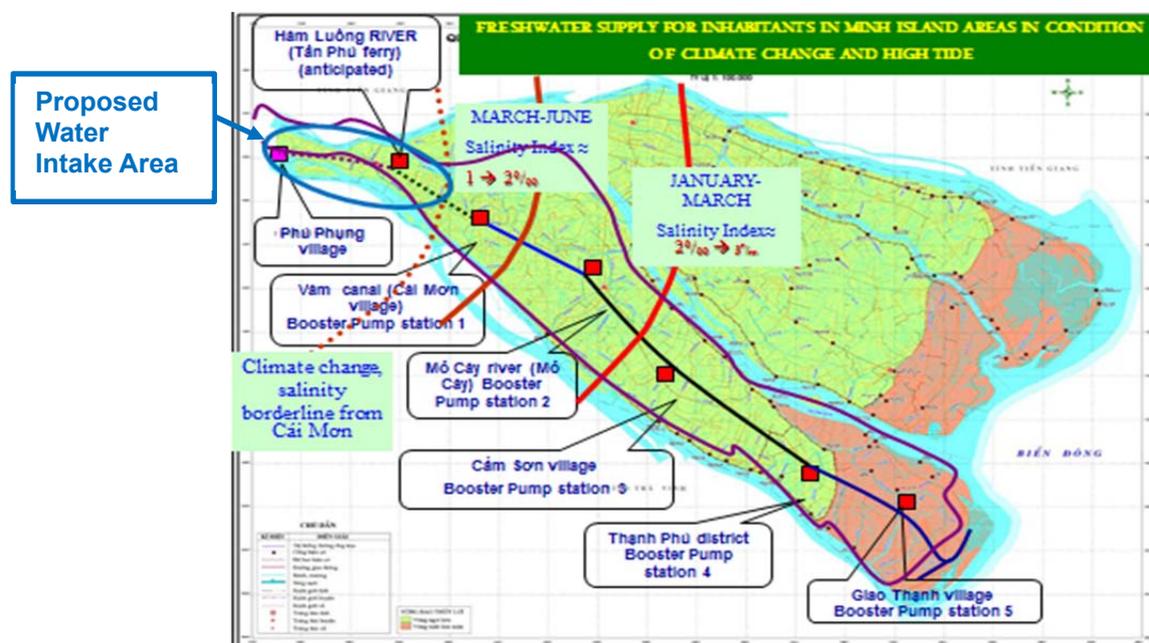


Figure 2.3.26 Extension Plan of Intake and Pipeline for Rural Water Supply in South Ben Tre

Source: Center of Rural Water and Environment Sanitation Ben Tre Province

8) Industrial Zone and Industrial Water Use

In the Ben Tre Province, seven (7) industrial zones were planned to be established at An Hiep, Giao Long, Giao Hoa, Thanh Tan, Phu Thuan, Phuoc Long, and Thanh Thoi as shown in Figure 2.3.27. However, only three industrial zones were actually opened and operated, namely, the An Hiep, Giao Long, and Giao Hoa Industrial Zones in the Chau Thanh District.

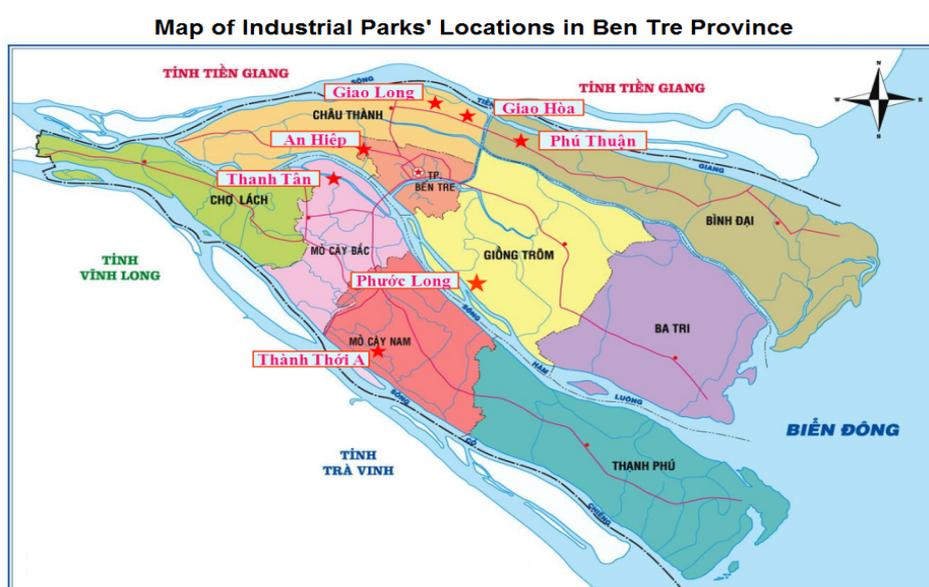


Figure 2.3.27 Location Map of Industrial Zone in Ben Tre Province

Source: Ben Tre Industrial Zone Authority

The An Hiep Industrial Zone contains nine (9) companies and uses 47,000 m³/day in total. There are still many vacant lots in this zone. Therefore, it is supposed that if those lots are occupied, the volume of water use will be increased. The Giao Long Industrial Zone contains twenty two (22) companies and uses more than 103,000 m³/day in total.

2.3.5 FLOOD AND FLOOD CONTROL SYSTEMS

1) Situation and Damage from Flood and High Tide

Based on the Natural Disaster Report prepared by the Steering Committee for Flood and Storm Prevention of the Ben Tre Province since 1993, the situation and damage from floods and high tide were analyzed. The highest damage cost by flood and high tide in the Ben Tre Province was VND 205 billion in 2000. And the average for 22 years, from 1993 to 2014, is VND 31 billion/year.

Table 2.3.9 Situation of Flood and High Tide Disaster

Year	Situation	District	Damage Cost (VND .Bill)	Inundated Area (ha)
1993	None			
1994	Heavy rain in the upstream caused earlier and longer flood than usual, and with high tide, long inundation was occurred. Damage in whole Mekong Delta was VND 2,399 Billion.	Cho Lach, Chau Thanh, Thanh Phu, Binh Dai Distric	1.000	
1995	Flood and high tide caused dyke collapse and inundation.	Thanh Phu District, Cho Lach District	0.200	
1996	Dyke collapse caused long inundation.	Cho Lach, Chau Thanh, Thanh Phu District	18.697	3,604.50
1997	Typhoon Linda (No. 26) caused flooding and high tide and damaged heavily.	Cho Lach, Ba Tri, Thanh Phu District		
1998	None			
1999	Rice, sugar cane, fruit tree were damaged and national roads and provincial roads were inundated.	Mo Cay, Thanh Phu, Ben Tre City, Binh Dai	8.926	4080.4
2000	Overflow and erosion of dyke caused large area inundation.		205.000	8490
2001	Overflow and erosion of dyke and erosion of sluice gate caused large area inundation.		109.369	28350
2002	Overflow and erosion of dyke and erosion of sluice gate caused large area inundation.		17.366	
2003	None			
2004	Tornado, storm and tropical depression caused house damage.	Mo Cay, Ba Tri, Binh Dai District	0.226	
2005	Heavy rain with tornado and heavy rain with high tide caused inundation.	Giong Tom, Ba Tri District	0.132	
2006	High tide in February and Typhoon No. 9 caused damage.		9.779	
2007	High tide caused damage.	Cho Lack, Chau Thanh	0.945	
2008	High tide caused damage.	Binh Dai, Thanh Phu, Ba Tri	0.700	
2009	High tide caused damage.	Mo Cay Bac, Cho Lach, Binh Dai, Ba Tri, Thanh Phu	1.463	
2010	Tropical depression, tornado and high tide caused damage.		69.520	
2011	Unseasonal heavy rain and high tide caused inundation.	Ba Tri, Binh Dai	87.672	
2012	High tide and tropical depression caused damage.		2.130	
2013	High tide and tropical depression caused damage.		15.906	
2014	High tide caused damage.		17.900	
Ave.			31.496	

Source: JICA survey team (2016)

2) Flood Control System

In the Ben Tre Province, there are three levels for storm and flood prevention management. At the provincial level, multi-sector/multi-department cooperation led to the establishment of a Steering Committee of Flood and Storm Prevention of the Province. In this steering committee, the Department

of Agriculture and Rural Development is supposed to have the main responsibility for storm and flood prevention. Then, the Department gave the main work to the Division of Irrigation and Storm-Flood Prevention. The secretariat of this committee was established in the Division of Irrigation and Storm and Flood Protection. The district and communal levels shared the same organizational structure.

The Division has four (4) subdivisions, namely, the Administration office, the Dike and Natural Disaster Prevention Management office, the Water and Irrigation System Management office, and the Sea Dike Management branch. They perform different tasks as assigned by DARD.

3) Meteorology, Hydrology, and Salinity Observation

In the Ben Tre Province, there is one (1) meteorological station, five (5) hydrological stations, and twenty-one (21) salinity stations. There are several organizations, which join the weather observing process. The observed data will be given to the district government to transfer to the people.

Table 2.3.10 Observation System in Ben Tre Province

Category	Item	Number of station	Recording	Data Transfer	Data Center	Organization	Purpose	Problems for Gate Operation
Meteorological	Rainfall and others	1	Automatic	Automatic	Regional Center of HMS in HCMC	Ben Tre Hydro-Meteorological Service, MONRE	Observation and alert	Lack of immediate data transfer
Hydrological	Water Level	5	Self-recording	Telephone	Regional Center of HMS in HCMC	Ben Tre Hydro-Meteorological Service, MONRE	Observation and alert	Lack of immediate data transfer
Water Quality	Salinity Concentration	5	Manual Daily in dry season	Telephone	Regional Center of HMS in HCMC	Ben Tre Hydro-Meteorological Service, MONRE	Observation and alert	Lack of immediate data transfer
Water Quality	Salinity Concentration	16	Manual Daily in dry season	Telephone	No	IWEC	Gate operation	----
Water Quality		54	Manual A few times/year	no	no	DONRE	Monitoring water pollution	Lack of immediate data transfer

Source: JICA survey team (2016)

4) Water Management Plan and Structural Measures

DARD has formulated a water management plan targeted for the year 2020; components of this plan include flood, high tide, drought, and seawater intrusion, especially as structural measures such as dykes, sluice gates, and canals. However, some information, such as construction status and size of structures, were already changed. The updated plan is shown in the following figure. In the figure, each black color dot indicates a sluice gate of construction completion while a red color shows a proposed sluice gate to be constructed. A blue color dot mainly along the Tien River means a sluice gate under construction. DARD plans to complete construction of all necessary sluice gates for saline water intrusion purpose before completion of the project.

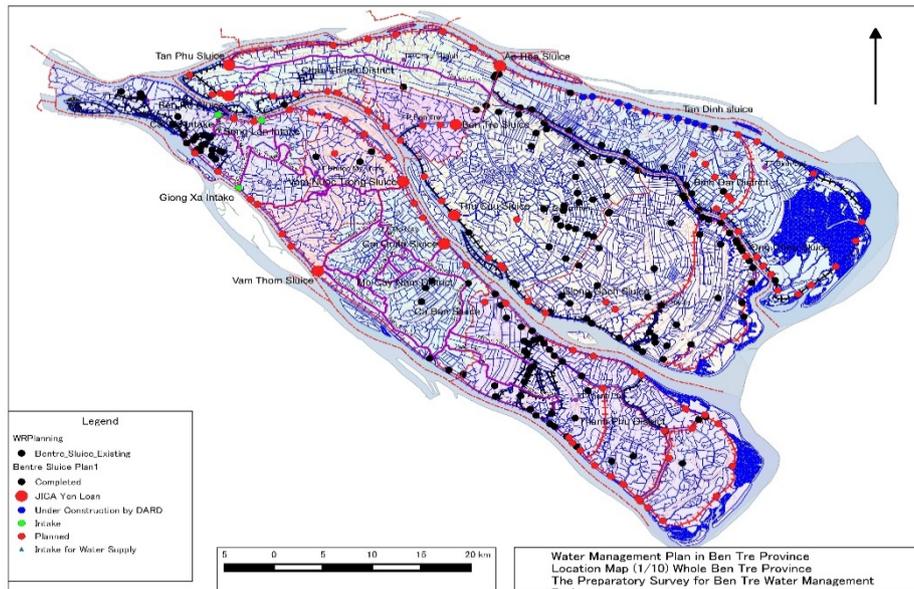


Figure 2.3.28 Draft Updating Ben Tre Province Water Management Plan

Source: JICA survey team (2016)

Water Management Structures in Vietnam are categorized into two; one is a dyke and the other is a flood control system. The dyke is composed of sea dyke, river dyke, and the inland waterway/canal dyke. The flood control system is composed of sluice gates and locks. Responsibilities of those structures in planning, construction, and operation and maintenance are summarized as follows.

Table 2.3.11 Role of Organizations Related to Water Management Structure

Structures location	Planning	Construction	Operation & Maintenance
Main tributaries of Mekong River	MARD/DARD	MARD/ DARD	DARD
1 st and 2 nd Level Canals	Irrigation Management Board of DARD	Irrigation Management Board of DARD	IWEC of PPC
3 rd Level and lower Canals	PPC/DARD	PPC/DARD	District and Commune Peoples' Committee
Sea dyke	MARD/DARD	MARD/ DARD	DARD

Source: JICA survey team (2016)

IWEC has the direct authority over every irrigation structure in the Ben Tre Province. The Division of Irrigation and Storm-Flood Prevention only has the authority over inspecting and managing some activities of this company. During the construction period, a joint management committee would usually be established at different governmental levels to control and manage construction works of irrigation facilities, for which the committee level in the government depends on the scale of construction volume and cost.

5) Budget and Expenditure

Investment and expenditure in irrigation purpose of the whole DARD from 2012 to 2014 were around VND 250-400 billion as shown in Figure 2.3.29.

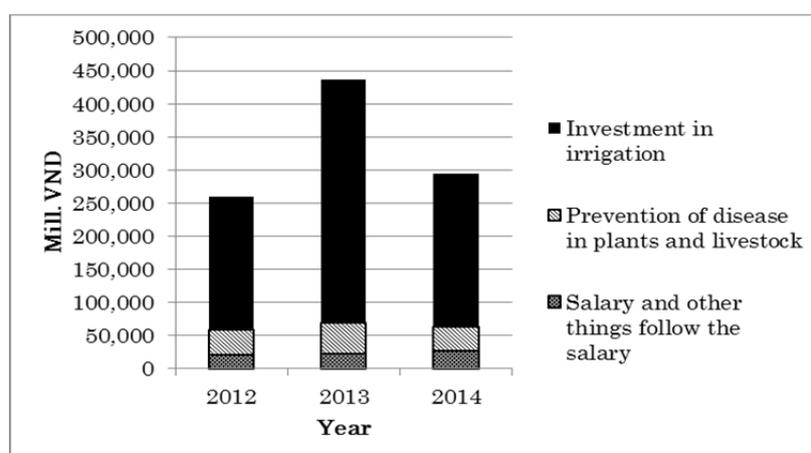


Figure 2.3.29 Expenditure of DARD from 2012 to 2014

Source: Ben Tre DARD

The IWEC conducts maintenance and operation works for water management structures, such as dredging and widening of canals and repairing embankments/dykes and sluice gates. In 2014, eleven (11) canals were dredged, six (6) embankments/dykes were repaired, and two (2) sluice gates were repaired; the costs allocated to those works were VND 11 Billion, VND 14 Billion, and VND 0.7 Billion respectively.

However, the budget for dredging and repair in the DARD is usually not enough, and it is difficult to expect which canal, dyke, or sluice gate will require repairing. Therefore, DARD cannot establish a detailed dredging and repair plan. There is a basic procedure for canal dredging, dyke repairing, and sluice gate rehabilitation where the commune at the site shall firstly send requests to the concerned district and DARD, and then DARD shall respond to the requests one by one. However, since the budget is usually not enough to fulfill all requests, some dredging and repairs may be postponed until the next year or later.

6) Non-structural Measures

Ben Tre Province takes non-structural measures against flood at the various levels; the levels and respective activities shown in the following table.

Table 2.3.12 Non-Structural Measures for Flood

Level	Actor/member	Action
Province	Chairperson of People's Committee and the head of concerned departments/ agencies	<ul style="list-style-type: none"> Steering Committee for Flood and Storm Prevention, Search and Rescue was established At the beginning of every rainy season, the committee is held in order to review the work in the last year and to build a program for the next year
Departments and districts/ communes	Permanent Office	<ul style="list-style-type: none"> On duty 24 hours/day during the storm/ rainy season (June 1 to November 30) for monitoring and providing direct and timely advice to the leaders
Residents	Border Guards	<ul style="list-style-type: none"> Propaganda campaigns to raise awareness of people about the damages of natural disasters
	Fishermen	<ul style="list-style-type: none"> Communication by the radio transmitters
NGO	Red Cross Society	<ul style="list-style-type: none"> Hold the training for quick response to search and rescue

Source: JICA survey team (2016)

2.3.6 ISSUES AND POTENTIALS FOR FUTURE DEVELOPMENT

1) Necessity of Navigation Lock

The number of vessels at the point of eight (8) planned sluice gates was not yet studied. The feasibility

study conducted by the Vietnamese side planned for navigation locks to be installed at the An Hoa, Ben Tre, Mo Cay Bac, and Mo Cay Nam Sluice gates, while the rest of them, the Thu Cuu, Tan Phu, Ben Ro, and Cai Quao Sluice gates were not planned to have installed navigation locks. The reason is that vessels can use detour canals even if these four (4) sluice gates cannot pass vessels.

However, if in the future, not only these eight (8) sluice gates, but also other sluice gates planned by the Vietnamese Government are constructed, there will be no detour canals. Therefore, considering such a future canal situation, the BWMP project shall consider the installation of navigation locks.

2) Prevention of Saltwater Intrusion Caused by Ship Traffic

When a ship passes through a lock, saline water intrudes into upstream (landside) from downstream (riverside). To prevent this, in the case of the Nagaragawa Estuary Barrage in Japan, desalination pumps were provided. While water is being let in to adjust the water level within the lock, the pumps are operated to reduce the salt concentration in the lock and prevent saltwater from intruding into the upstream.

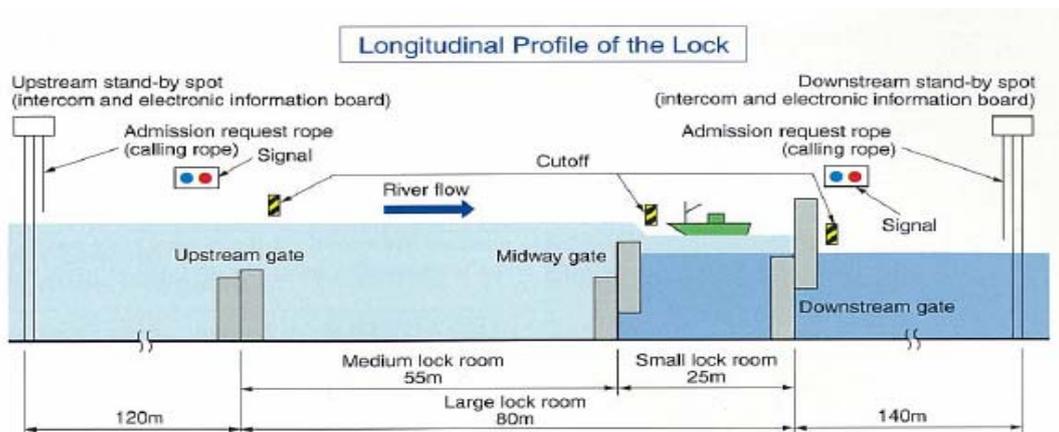


Figure 2.3.30 Example of Lock to Prevent Saltwater Intrusion

Source: Information of Nagaragawa Estuary Barrage, Japan Water Agency

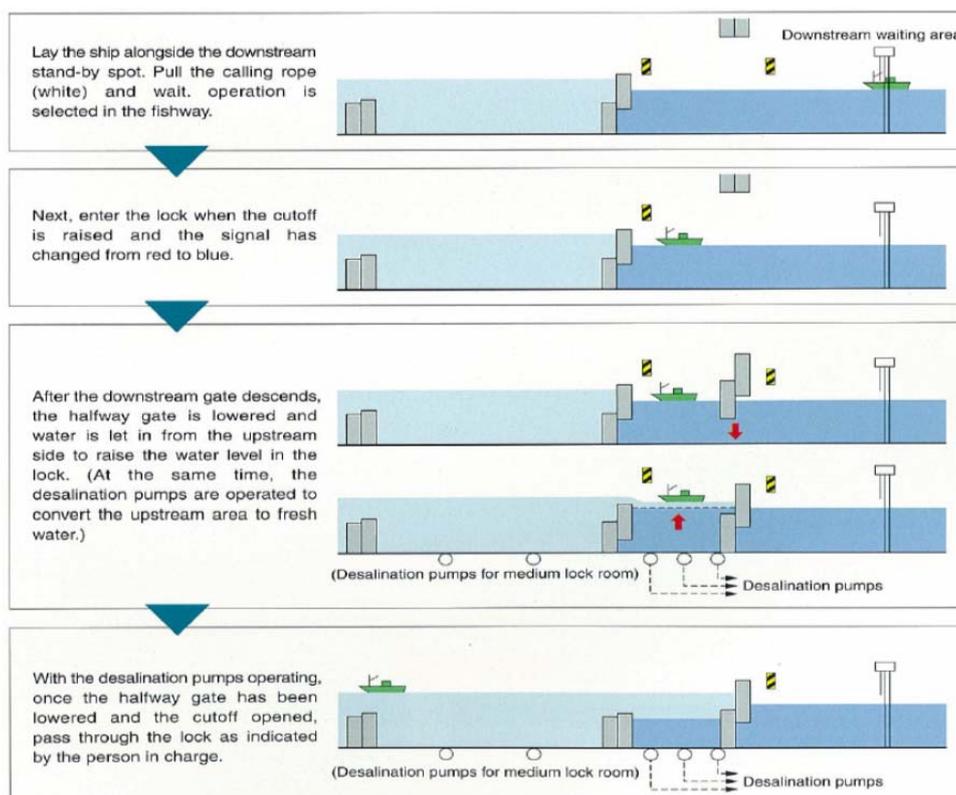


Figure 2.3.31 An Example of Lock Operation to Prevent Saltwater Intrusion

Source: Information of Nagaragawa Estuary Barrage, Japan Water Agency

3) Water Level and Salinity Observation

Different organizations have separately collected hydrological data including water level and saline content in Ben Tre. IWEC observes salinity at some sluice gates of two (2) sides, namely the riverside and the inland side. Hydro-Meteorological Service under MONRE observes water level and saline contents along the Mekong River. Ben Tre DONRE is the responsible organization for observation of meteorology, hydrology, and water quality; however, in actuality, they observe water quality only. Moreover, water quality is observed not continuously, but a few times a year at the same points.

As just described, three (3) organizations observe salinity and its related data, but they do not share the observed data with other organizations immediately. Therefore, for the sake of adequate and effective operation of the sluice gate, the current situation shall be revised and changed. Otherwise, the IWEC cannot obtain any useful data for gate operation immediately, which other organizations have observed.

2.4 FARM AND FARMERS ECONOMY

Agriculture in the Ben Tre Province is quite diversified by the strategic combinations of coconut tree, fruit trees, paddy, and aquaculture, depending on specific agro-ecological condition of each area. Especially, as the topography of the area is pronouncedly flat and the type of soil is generally alluvial sediment, the deciding factor of the agro-ecological condition is the availability of water in terms of the amount related to the occurrence of flooding during the rainy season, and salinity affected by saline intrusion especially during the dry season. Farmers strategically decide the farming system based on such a condition. One of those diversified farming systems is repeated production of paddy: two to three times of paddy productions a year. This sub-chapter discusses the agriculture in the Project area.

2.4.1 AGRICULTURAL AND AQUACULTURE LAND USE

1) Overview

In terms of land uses, there are four major types of crops/commodities in the Ben Tre Province: fruits, coconut, paddy, and brackish aquaculture (typically shrimp). In the upper stream side (northwestern) of the province, the following are prevalent: perennial plants, such as fruit trees, especially in and around Chau Thanh and Cho Lack districts; ornamental plants, especially in Cho Lack, and coconut trees in Giong Trom, Mo Cay Bac, and Mo Cay Nam as shown in Figure 2.4.1. In this upstream area, alluvial soil is prevailing, which is the best type of soil in Ben Tre for crop production. Thus, relatively high-value crops are cultivated in this area. In the mid-stream area, the soil type is saline alluvial soil coupled with some clay, which maintains relatively low fertility with poor drainage, thus coconut tree is popular.

On the other hand, paddy is predominant in downstream areas of Ba Tri and Thanh Phu districts where “saline alluvial soil” and “saline soil” are major soil types. As saline soil is a heavy soil with poor drainage, paddy is commonly cultivated in saline soil areas where freshwater is available, and shrimp (brackish aquaculture) is cultivated where brackish water is the main water source located outside of sea dikes.

Note that the above explains the general picture of the whole province and there are many small variations in reality. For example, coconut tree and fruit trees are planted together in the same land areas especially in the mid-stream areas. In addition, the paddy and shrimp rotation system is also seen in the Binh Dai and Thanh Phu districts.

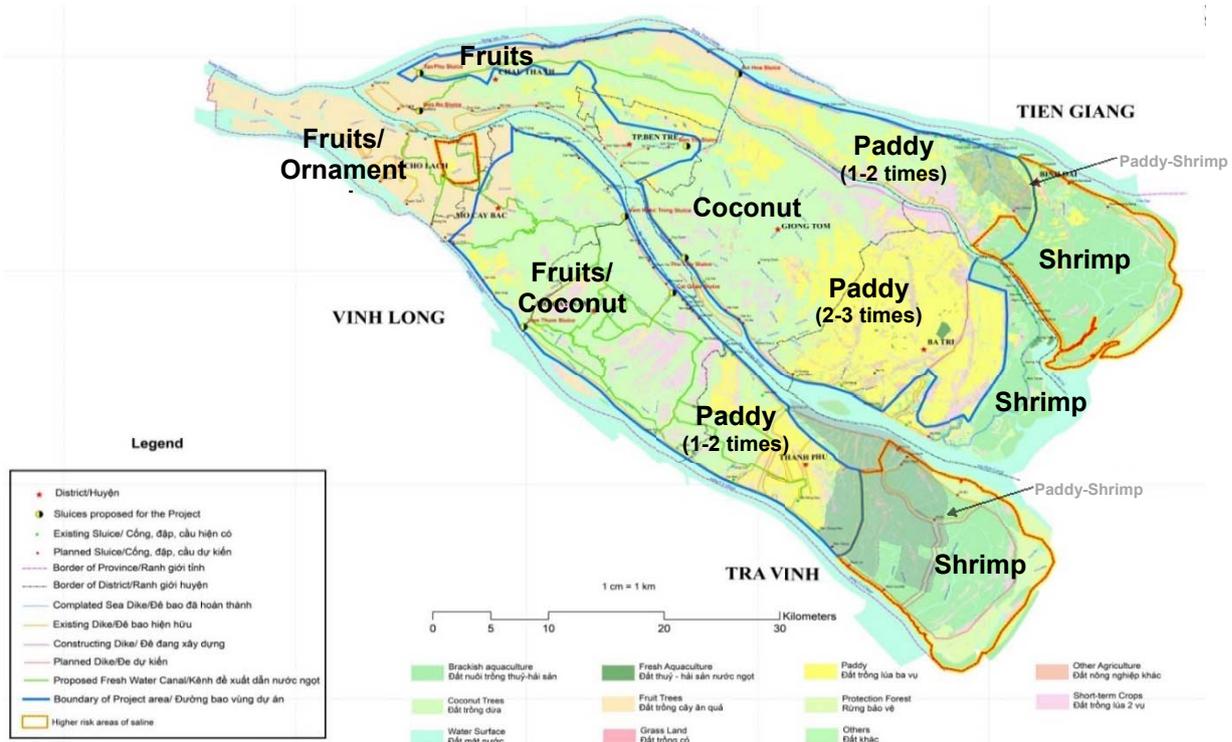


Figure 2.4.1 Current Land Use Map (2013)

Source: DONRE (Obtained in 2016) & JICA survey team (2016)

Note: Types of commodities in English shows the typical land uses of each area. “Shrimp” represents brackish aquaculture in general.

2) Planted Area of Major Commodities

Looking at the trend of planted areas as a proportion among the major categories: paddy, fruits, other crops, coconuts including cacao, and aquaculture, the “coconut and cacao” and “aquaculture” have an

increasing trend in the past five years from 2010 to 2014 (see Table 2.4.1 and Figure 2.4.2). Especially, the share of coconut and cacao has increased 5 percent points from 26% to 31%, while the share of the paddy area has decreased 6 percent points from 36% to 30%. Paddy is no longer the most popular crop in the province. In fact, planted areas of spring, autumn, and winter paddies have decreased 14%, 17% and 19% in the same period, respectively.

Instead, statistical data show that only the planted area of coconut has significantly increased (12,281 ha) in the past five years, while other crops have decreased, especially paddy (13,634 ha). It was also confirmed by field surveys that farmers in mid-stream areas tend to convert from paddy to coconut, attracted by the high market price of coconut these years and relatively high tolerance to saline water than paddy. In addition, labor intensity is also an important factor. It is higher in paddy production for land preparation, trans-planting, weeding in the water, and harvesting, as compared to coconut production which in general requires major labor works just in harvesting. Also, the scattered configuration of paddy fields makes it difficult for agricultural mechanization.

Table 2.4.1 Planted Area of Agriculture and Aquaculture

Type of Crop	2010	2011	2012	2013	2014	Change (2010-2014)	
Paddy	80,228	76,962	75,863	72,237	66,594	-13,634	-17%
Fruits	32,050	30,174	28,435	27,545	27,392	-4,658	-15%
Coconut and Cacao	57,893	63,348	66,684	68,211	70,174	12,281	21%
Other crops	10,772	8,543	8,059	11,212	13,204	2,432	23%
Crops Total	180,943	179,027	179,041	179,205	177,364	-3,579	-2%
Aquaculture	42,490	43,073	43,234	44,796	47,065	4,575	11%
Total	223,433	222,100	222,275	224,001	224,429	996	0%

Source: Statistical Yearbook, Ben Tre Statistical office (2014) | Unit: ha

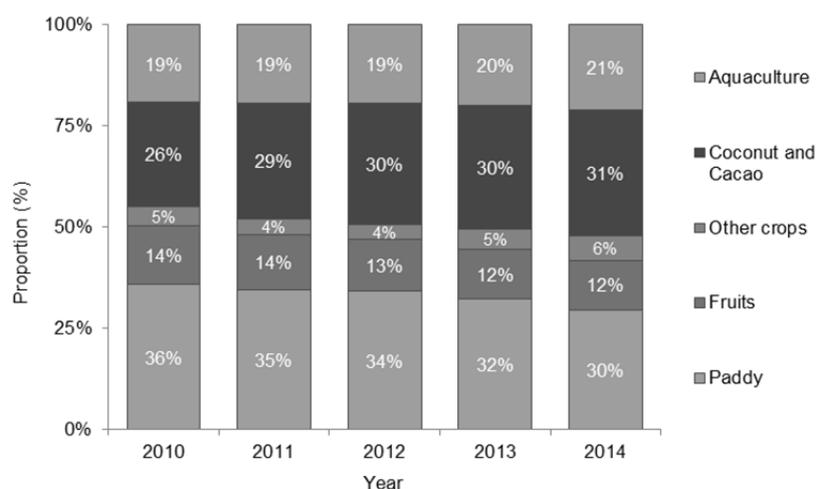


Figure 2.4.2 Trend of the Proportion in the Area of Agriculture and Aquaculture

Source: Statistical Yearbook, Ben Tre Statistical office (2014)
Unit: % to the total of crops and aquaculture indicated in Table 2.4.1

As there are several types of fruits and paddy, the planted area of these two crops is discussed hereunder.

Fruits

Figure 2.4.3 shows the trends of the planted area of major fruit crops in the Ben Tre Province from 2010 to 2014. In general, the total area of fruits planted has decreased in this period from a total of 32,050 ha to 27,392 ha (85% of the year 2010). Amongst the fruits crops, there are roughly three groups in terms of the trend: increased in the planted area (Rambutan, and Pomelo), decreased (Longan, and Mandarin Orange), and not much changed (others). As a result, the top three major fruit

crops have changed from Longan (19% of the total area planted), Orange (14%), and Pomelo (14%) in 2010 to Rambutan (20%), Pomelo (20%) and Longan (15%) as shown in Table 2.4.2 below.

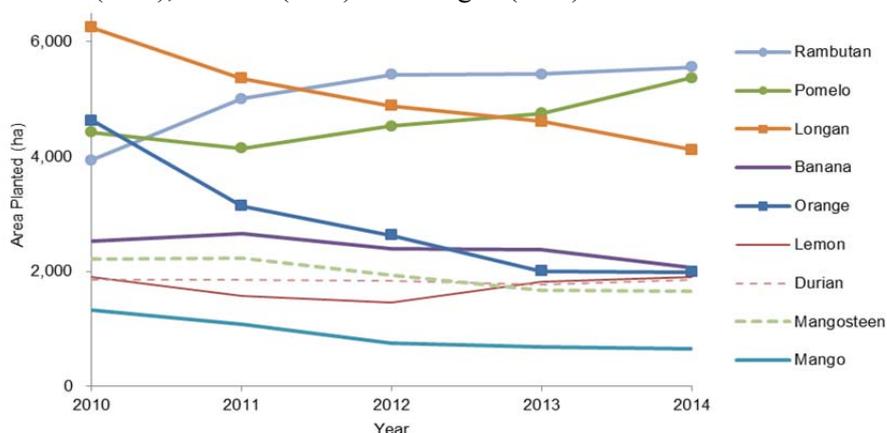


Figure 2.4.3 Trend of the Planted Area of Major Fruits

Source: Statistical Yearbook, Ben Tre Statistical office (2014)

Table 2.4.2 Planted Area of Fruits

Type of Fruits	2010		2011	2012	2013	2014		% to 2010
Rambutan	3,941	12%	5,010	5,428	5,437	5,557	20%	141%
Pomelo	4,422	14%	4,144	4,528	4,754	5,372	20%	121%
Longan	6,249	19%	5,360	4,884	4,609	4,123	15%	66%
Banana	2,527	8%	2,664	2,401	2,387	2,076	8%	82%
Orange	4,631	14%	3,141	2,634	2,007	1,993	7%	43%
Lemon	1,903	6%	1,572	1,459	1,828	1,897	7%	100%
Durian	1,860	6%	1,848	1,843	1,780	1,856	7%	100%
Mangosteen	2,219	7%	2,230	1,937	1,670	1,665	6%	75%
Mango	1,328	4%	1,077	761	687	650	2%	49%
Other Fruits	2,970	9%	3,128	2,560	2,386	2,203	8%	74%
Fruits	32,050	100%	30,174	28,435	27,545	27,392	100%	85%
Trend in %	100%		94%	89%	86%	85%		

Source: Statistical Yearbook, Ben Tre Statistical office (2014) | Unit: ha

Note: "Proportion (%)" is for the year 2014 and "% to 2010" is also for the planted area in 2014.

Major contributing factors to the decrease in the planted area of fruit trees are not clear. According to DARD, a decrease in the total planted area of fruit attributes to conversion from Longan to fresh-type Coconut trees. As discussed, fruit trees and coconut trees are planted widely in the alluvial soil zone in up- to mid-stream areas. Therefore, some kinds of fruit are converted to more attractive coconut. In terms of the change in the planted area of each fruit type, disease, and profitability are the major factors. Here is a summary:

Table 2.4.3 Major Factors of Change in Planted Area of Fruits

Type of Fruits	Decrease/ Increase	Major Factor of Increase/ Decrease in Planted Area
Rambutan	Increase	- International market is active
Pomelo	Increase	- International market is active; - Currently pomelo is very popular and expected to still increase
Longan	Decrease	- It depends heavily on the exportation to China; demand has decreased due to recession - Epidemic of severe disease - Converted to pomelo (pomelo boom)
Orange	Decrease	- Plunge of market price since 2010 - Epidemic of severe disease; it is still on the way to recover from disease - Farmers are still willing to continue, provided that saline concentration is well controlled.
Mangosteen	Decrease	- Rambutan, Durian, and Mangosteen are usually cultivated in the same area, having a trade-off relationship. As Rambutan is getting more popularity, then planted area of mangosteen has decreased. - Epidemic of disease (warm and fungi)
Mango	Decrease	- Disease (<i>Colletotrichum gloeosporioides</i> and <i>Plocaacderus ruficornis</i>)
Other Fruits		- Market factors and disease in general (Banana, Lemon, Durian, and others)

Source: Agriculture and Fishery Extension Center, DARD Ben Tre (2016)

Paddy

Table 2.4.4 and Figure 2.4.4 demonstrate the planted area of paddy by the cropping season in the past 10 years from 2005 to 2014. The total planted area of paddy has significantly decreased (21% in 10 years), for which spring, autumn and winter paddy all have decreased. Particularly, the decrease in winter paddy is significant: a total of 8,418 ha of decrease in the 10 years. This result implies two things: the cultivation area of paddy itself is decreased, and the cropping pattern has changed from three times per year to one to two times per year in certain size of areas. Once again, a large area of paddy area is now shifted to a coconut tree area as shown in Table 2.4.1. It is expected that this trend will still continue with the background of climate change and better profitability of coconut production.

Table 2.4.4 Planted Area of Paddy

Year	Spring	Autumn	Winter	Total
2005	21,844	23,996	37,664	83,504
2006	20,735	25,424	35,674	81,833
2007	20,675	24,232	34,825	79,732
2008	20,619	24,545	34,093	79,257
2009	21,130	24,159	35,765	81,054
2010	21,063	23,243	35,922	80,228
2011	20,245	23,138	33,579	76,962
2012	20,019	22,234	33,610	75,863
2013	18,973	20,118	33,146	72,237
2014	18,072	19,276	29,246	66,594
Average	20,338	23,037	34,352	77,726
Ratio	26%	30%	44%	100%
Change* (2005-2014)	-3,772 -18%	-4,720 -20%	-8,418 -23%	-16,910 -21%

Source: Statistical Yearbook, Ben Tre Statistical office (2014)

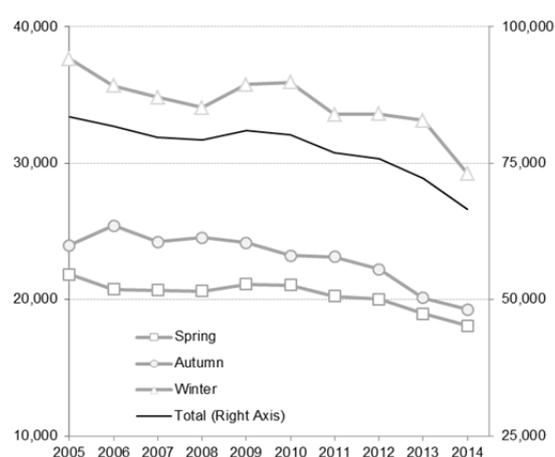


Figure 2.4.4 Trend in Planted Area of Paddy

Source: Statistical Yearbook, Ben Tre Statistical office (2014)
Unit: ha | Note: Minimum figure is not zero.

2.4.2 CROPPING PATTERNS AND FARMING SYSTEMS

Cropping patterns and farming systems in Ben Tre are quite diversified. Among all, major cropping patterns are illustrated as Table 2.4.5. As shown in the table, there are five major cropping patterns in Ben Tre Province, each one may also have some variations. The first cropping pattern is the intensive cropping of paddy, which is common in the midstream to downstream areas of Ben Tre, except for the coastal areas. Yet, three-times-per-year cropping is losing popularity due to the high risk of saline concentration. Thus, since 2016, it is recommended by DARD to shift this pattern to two-times-per-year cropping of paddy plus some short-term crops during the dry season, such as vegetable and grass for cattle raising.

The second pattern is two times of cropping of paddy, sometimes combined with freshwater aquaculture during the dry season, which is enabled by reserved freshwater during the rainy season. Two times of cropping of paddy is suitable, especially where irrigation systems are not well developed. This cropping pattern is popular in the Upper Than Phu and Upper Binh Dai districts.

The third cropping pattern is the combination of one-time cultivation of paddy and brackish aquaculture. In fact, this type of cropping pattern only appears in the area where brackish water comes in during dry season, with which farmers have substantially no choice but going into this pattern. As to practice this cropping pattern, leaching of salinity of the field is required for a certain period of time at the beginning of rainy season, which makes it difficult to control the cropping season. Also, productivity cannot be high as compared with three cropping of paddy. One variation is to cultivate freshwater fish in the same field with paddy, which can be managed with a local variety of paddy which is tolerant to disease and thus does not require much application of fertilizer and chemicals.

This pattern can be found in lower Than Phu and lower Binh Dai. Note that brackish aquaculture often starts at the end of the dry season as the cultivation of Autumn-Winter paddy with the local variety extending to the middle of the dry season.

The fourth pattern is brackish aquaculture in coastal areas, outside of dikes, of Binh Dai, Ba Tri and Thanh Phu districts. One pattern of this is to conduct two times of shrimp culture per year with white leg shrimp, which requires a relatively shorter growing period (3-4 months). Cultivation of Giant Tiger Shrimp is recommended to be managed only one time per year as to reduce the risk of disease.

The fifth pattern is the cultivation of perennial crops: fruit trees and coconut trees throughout the year. Fruit cultivation is popular upstream of Ben Tre, such as at Chau Tanh and Cho Lach whereas coconut cultivation is more in the midstream of Ben Tre. Yet, fruit trees and coconut trees are often mixed in the same agricultural fields for diversification.

Table 2.4.5 Major Cropping Pattern in Ben Tre Province

Cropping Pattern	Dry Season				Rainy Season						Dry Season		Major Area
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1 3 Cropping of Paddy	WS Paddy (90-100days) 5.5tha				SA Paddy (90-100days) 4.5tha						AW Paddy (90-100days) 4.5tha		Giong Trom, Ben Tre, Mo Cay, Chau Thanh, most of Ba Tri,
2 Cropping of Paddy + Vegetable/Grass	VegeGrass (short-term)				SA Paddy (90-100days)						AW Paddy (90-100days)		
2 2 Cropping of Paddy	Fresh Aqua (extensive)				SA Paddy (90-100days)						AW Paddy (120days)		Upper Thanh Phu, Upper Binh Dai
3 1 Cropping of Paddy/ Fresh Aqua + Brackish Aqua	AW Paddy (150-180days)				Brackish Aquaculture (White leg: 90 days Giant Tiger: 120-150days)						AW Paddy (150-180days)		Lower Thanh Phu, Lower Binh Dai
	Fresh Aqua				Brackish Aqua (White leg: 90 days Giant Tiger: 120-150days)						Fresh Aqua		
1 Cropping of Paddy + Brackish Aquaculture	AW Paddy (150-180days)				Brackish Aqua (White leg: 90 days Giant Tiger: 120-150days)						AW Paddy (150-180days)		
4 2 times of Shrimp					Brackish Aqua (White leg: 90 days)						Brackish Aqua (White leg: 90 days)		Coastal Area (Outside of dyke)
					Brackish Aquaculture (Giant Tiger: 120-150days)								Coastal Area (Outside of dyke)
5 Coconut/ Fruits	Coconut/Fruits												Upper to mid Ben Tre

Source: Agriculture and Fishery Extension Center, DARD Ben Tre (2016)

Note

- * For SA paddy, acid tolerance is preferred as it is cultivated at the beginning of rainy season when acidity tends to be slightly high.
- * For AW paddy, occurrence of warm is not severer than SA paddy; however, it is cloudy, thus, about same level of yield as SA paddy is expected.
- * The crop yield is based on dried paddy (15% in moisture)
- * For repeated cultivation of shrimp, at least one month of furrow period should be made.
- * Fresh water aquaculture can be managed with local variety of paddy, as it does not require so much application of fertilizer and pesticide.
- * Fresh water aquaculture can be managed even during dry season when saline concentration is high if enough amount of fresh water can be secured during rainy season.
- * Nowadays, two times of shrimp culture is gaining more popularity (roughly 80% of extensive brackish aquaculture).
- * In terms of brackish shrimp culture alone, 10,700 ha are intensive and semi-intensive (30%), 25,000 ha is extensive (70%) in 2015.

In terms of cropping patterns and farming systems in the area, two major features among all should be emphasized.

- *Diversified Farming:* diversified farming systems feature the agriculture, aquaculture, and livestock sectors of the Ben Tre Province. Except for the highly industrialized shrimp culture, farmer households mix various types of commodities, typically crop production and cattle raising, and/or crop production and aquaculture. Especially in mid- to down-stream areas of Ben Tre, each farmer household raises a few head of cattle, for which paddy straw is fed, and the cattle manure is used as fertilizer for paddy in return. Another outstanding system is the mixture of paddy and freshwater aquaculture in the same field, by which the limited resource of land is fully utilized. The combination of coconuts and fruits should also be noted, with which farmer households can diversify the income sources.

- *Frequent Change of Commodities:* farmers in the Ben Tre Province are business-oriented. Pursuing the market trend, they do not hesitate to change the land use or cropping pattern. For instance, sugarcane was quite popular during the early 2000s; however, once the market price had become depreciated, then, they changed sugarcane to other crops like coconut tree. As such, types of fruits are being frequently changed. Thus, it can be concluded that the Ben Tre farmers are quite motivated by business-oriented farming.

2.4.3 AQUACULTURE

The coastal areas of the Ben Tre Province are characterized by brackish aquaculture, especially shrimp (*Penaeus monodon*, or so-called Giant Tiger Shrimp) cultivation under the condition with abundant saline water. In fact, shrimp culture shares more than 80% of the aquaculture area (Ben Tre Statistical Yearbook 2015). In the areas, various types of cultivation systems are in operation, for example, the cultivation of mollusks such as clams (*Meretrix* spp) and blood cockles (*Anadara* sp) are also popular.

Brackish shrimp culture, which shares 80% of the aquaculture area, is divided into two major categories: intensive and extensive, and those may further be divided into four: intensive, semi-intensive, improved extensive, and extensive. In Ben Tre, extensive and improved extensive aquaculture shares 72%, intensive aquaculture shares about 27%, and semi-intensive shares less than 1% in terms of the area cultivated (same source).

As shown in Table 2.4.5, shrimp is cultivated one to two times per year. As for Giant Tiger Shrimp, which requires as long as five to six months for production, one time per year cultivation is recommended due to high risk of disease concurred by continued cultivation. On the other hand, White Leg Shrimp (*Litopenaeus vannamei*), which requires only about three months to grow, can be managed two times per year. Today, Giant Tiger Shrimp is given more popularity, fetching a better market price.

During 2012-2013, the brackish aquaculture sector had once experienced a hard-hit failure of the business due to the pandemic of the then unknown disease, which is now identified as “Early Mortality Syndrome (EMS) or Acute Hepatopancreatic Necrosis Syndrome (EMS/AHPNS). Due to that bad experience, brackish aquaculture is now seen as a “high-risk and high-return” commodity in the Mekong Delta.

In terms of water use in brackish aquaculture, as it is managed outside of a dike, brackish water is fully accessible throughout the year. On the other hand, to regulate the saline concentration of a shrimp pond, freshwater is also required. There are three possible options for that: reserve rainwater in a pond, acquire freshwater from a canal when available, and pump up groundwater. Today, use of groundwater is strictly prohibited due to the risk of land subsistence. In most cases, therefore, aquaculture households secure water from rain or from canal where available.

2.4.4 MARKETING

There are four major primary commodities in Ben Tre: fruits, coconut, paddy, and aquaculture products. This sub-section of the report briefly explains how these commodities are being distributed. Firstly, major destinations of each commodity are summarized in Table 2.4.6, which is followed by some background information of each commodity. In general, a large percentage of agricultural produce is exported to the international market, especially aquaculture products, coconuts and some particular types of fruits. On the other hand, paddy is consumed almost everywhere in the region notwithstanding the fact that Vietnam is one of major exporting countries of paddy.

Table 2.4.6 Marketing Destinations of Major Commodities

Commodity	Distribution		
	Local	Other Province	Export
Fruit			
Longan	5%	35%	60%
Rambutan	5%	45%	50%
Pomelo	5%	85%	10%
Mangostine	5%	95%	0%
Durian	5%	95%	0%
Coconut	10%	0%	90%
Paddy	100%	0%	0%
Aquaculture			
Fresh catfish	0%	0%	100%
Brackish Shrimp	10%	0%	90%
Clam	15%	0%	85%

Source: Ben Tre DARD (2016)

Note: It is a rough estimate by the officer at commercial division of DARD.

1) Fruits

There are five major fruits produced in the Ben Tre Province: longan, rambutan, pomelo, mangostine, and durian. In terms of the destination of these fruits, a high percentage of produce is exported as longan (60%) and rambutan (50%), while other fruits are sold mostly for other provinces: 85% for pomelo, 95% for mangostine, and 95% for Durian. In fact, the Ben Tre Province is given credit for its high quality fruits in the nation.

As for the marketing, there are no major wholesale markets in the province, but middlemen take charge of the roles of collection from individual farmers and transportation to bigger-scale middlemen and supermarkets. As the farmers are not very organized as a group, the middleman's function as a collector is important. In general, a large-scale wholesale market is not functioning much in the Mekong Delta area. For example, there used to be a wholesale fruit market in Caibe in the Tieng Gian province but was closed as it was not well functioning.

There are five big enterprises of pomelo marketing in Ba Tri and Mo Cay and two to three major enterprises for rambutan and longan in Cho Lach and Chau Thanh. The latter enterprises collect produce from middlemen and do packaging for exporting to China, with a lower standard, and also to Europe, Australia, and the USA, with a higher standard.

The most promising type of fruit is currently "daxanh", a variety of pomelo; it is currently the most profitable fruit among all. Vietnam is leading the international pomelo market with its high quality and its reputation in general. As the share of export to the international market is still 10%, the government sees pomelo as still having a high potential for marketing.

2) Coconut

The Ben Tre Province is referred to as the "kingdom of coconut" due to its large production area of coconuts. Coconut is marketed with about 20 kinds of products, such as candy, jerry, oil, milk, fiber, flesh, skin powder, wine, and whole coconut. Processing of coconut is practiced in the Ben Tre Province; more than 10 big processing companies are in operation. Although 525,813 tons of coconuts were produced in Ben Tre in 2014, Ben Tre still imports coconut from other provinces for processing. With this background, the planted area of coconut has increased from 51,560ha to 67,382ha in the past four years from 2010 to 2014. Now, the coconut sector is thriving, with a Thailand company invested in coconut production and processing in Ben Tre with which new processing technologies are introduced, for example.

In terms of marketing of coconut, about 90% are exported (Table 2.4.11). From exportation to other countries, including European countries and the USA, output value is estimated to reach about US

\$200 million/year. In fact, the destination of the exportation of coconut alone reaches about 75 countries and territories as compared to 105 countries and territories for all commodities exported from Vietnam. As for whole coconut exportation, the fresh type is mostly exported to Korea, the USA, and a little to Japan, and the dry type to China and Korea.

3) Paddy

In Ben Tre, the most popular variety is “OC10,” which is a desirable variety for making noodles. Accordingly, the exportation of paddy from the Ben Tre Province to other countries is virtually zero. However, there are two major exporting companies located in Ben Tre that purchase paddy from other provinces instead. Cultivated areas of paddy are experiencing a decreasing trend in the Ben Tre Province, from 80,228ha in 2010 to 66,594ha in 2014. Production is decreasing due to three major reasons: weather condition, low economic value, difficulty in farm mechanization due to small-scale paddy fields scattered about.

4) Aquaculture Products

In terms of aquaculture, freshwater catfish is marketed almost 100% for exportation to Europe and the USA. As for brackish-water shrimp, about 90% is exported and the remaining 10% is consumed locally. There are no major processing factories of shrimp in Ben Tre. Thus, fresh shrimp is transferred to other provinces like Bac Lieu, Soc Trang, and Can Tho for processing and exportation.

In addition, clam is now gaining high popularity in the international market because the Ben Tre Province obtained a quality control certificate of the Marine Stewardship Council (MSC); only the two provinces of Ben Tre and Tien Gian maintain the MSC certificate for clam. There are four processing companies of clam in Ben Tre, which even purchase clam from other provinces located in the northern part of Vietnam.

Like the marketing of fruits, marketing through the wholesale market does not exist in aquaculture products. In the past, there was one wholesale shrimp market in the Binh Dai district; however, it was closed, as it was not used so much.

5) Price Trend

As for the price of major commodities, data on the farm-gate price or local market price are not available. Thus, to gain some implications of the trend, international market prices are analyzed. Figure 2.4.6 shows the standardized price of coconut oil, shrimp, orange and rice: the average price of each commodity is zero and standard deviation one. As shown in the figure, the price of rice has a relatively stable trend, except for in 2008, the year of the food-supply crisis when the price had hiked up extremely due to harvest failure that happened internationally.

As for the coconut oil, the price has also been stable, within the range of -1 to 1 standard deviation, except for in 2011 when crop failure happened in Thailand, a major producing country, due to crop disease⁶. The orange crops, on the other hand, have seasonal fluctuation every year and also reflect the effect of bad weather, like in 2008. Shrimp producers had enjoyed a high-value season in the past few years (2013-2015) after a terrible outbreak in and around 2012. However, it seems to be the end of the honeymoon period; the standardized price has fallen at the end of 2015 once again.

⁶ <http://www.telegraph.co.uk/foodanddrink/8541371/Coconut-milk-crisis-as-supermarkets-run-dry.html>

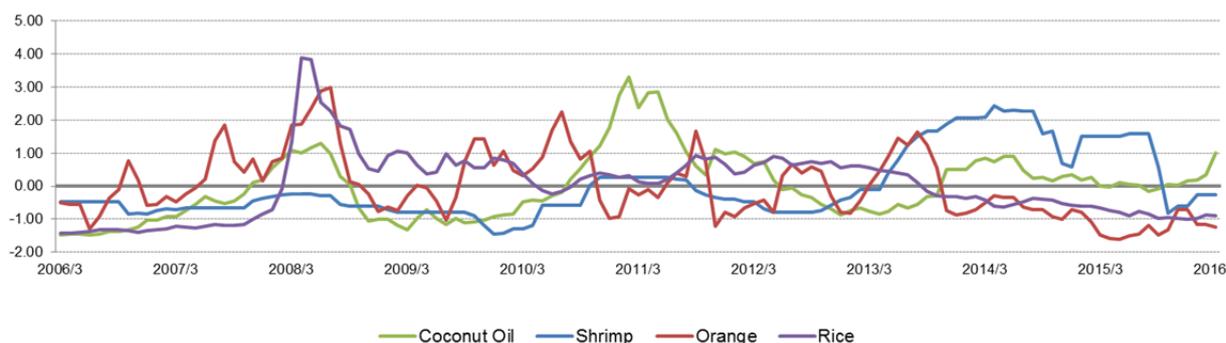


Figure 2.4.5 Trend in Standardized International Price of Major Commodities

Source: Prepared by JICA survey team (2016) based on information at <http://www.indexmundi.com/commodities/?commodity=coconut-oil&months=120&commodity=rice>

5) Way Forward

In essence, established markets are readily available for all of the major commodities produced in Ben Tre, which are connected to international markets. The high ratio of exportation may imply a relatively huge demand of these commodities. Making the best use of these opportunities, producers' concern then is how to stabilize the production of these commodities rather than penetrating the market.

2.4.5 FARM ECONOMY BY MAJOR CROPS

The farm economy of major crops became available through the household questionnaire survey conducted in the Master Plan Study in 2011. Thus, the available data has been converted to the 2015 current price using the inflation rate. The sample size of the questionnaire survey data was 118,100, and 281 households were for paddy, fruits, and shrimp respectively. These results were then compared with the standard farm budget that Ben Tre DARD maintains and then confirmed that net income of each commodity is at the same level with the Ben Tre standard today. The following explains the farm economy of major crops at 2015's current price.

1) Paddy

As shown in Table 2.4.7, the average size of the area harvested per season per farmer was 0.74 ha. The size of the paddy field does not change much by the cropping season (0.73ha to 0.76ha). In this size of the paddy field, an average of 4.86 ton/ha of paddy were harvested, in which the highest yield was marked during the Summer-Autumn season (5.39 ton/ha), while the lowest was during the Autumn-Winter season (4.27 ton/ha). The yield level is generally consistent with the latest data for the entire province, where the average yield of paddy was 4.79 ton/ha in 2014 (Statistical Yearbook 2014, Ben Tre Statistical Office 2015).

The estimated net income from paddy cultivation per season is also summarized in the table. With the gross cash incomes and the total cost of production, the net income per season per hectare is VND 10,679,000 (USD481) at a financial value of VND 16,030,000 (USD723) at an economic value. According to another reference, the net profit with the financial value was VND 7,661,070/ha in Autumn-Winter (AW) and VND 9,488,830/ha in Summer-Autumn (SA) at 2015's current price. This result was based on an average yield of 4.34 ton/ha and 4.70 ton/ha respectively, and thus the yield of the SA paddy in the Master Plan Study (5.39 ton/ha) may have been overestimated.

Table 2.4.7 Average Net Income of Paddy Cultivation per Hectare at 2015 Current Price

Cropping Season	Yield	Gross Cash Income (Financial)	Gross Cash Income (Economic)	Total Cost	Total Net Income (Financial)	Total Net Income (Economic)
	(ton/ha)	(VND/ha)	(VND/ha)	(VND/ha)	(VND/ha)	(VND/ha)
SA Paddy	5.39	35,591,000	39,973,000	21,820,000	13,771,000	18,153,000
AW Paddy	4.27	28,749,000	35,106,000	21,551,000	7198000	13,556,000
WS Paddy	4.79	31,835,000	37,318,000	21,298,000	10537000	16,020,000
Average	4.86	32,250,000	37,601,000	21,571,000	10,679,000	16,030,000
		US\$1,454	US\$1,695	US\$973	US\$481	US\$723
Exchange Rate as of Oct 2015 (VND/US\$)						22,180
Inflation Rate from 2011-2015						22.16%

Source: Questionnaire Household survey, JICA Study Team for the Master Plan Study (2011)
 Inflation rate (2011-2014); The World Bank (<http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>)
 Inflation rate (2015 estimate); Asian Development Bank (<http://www.adb.org/countries/viet-nam/economy>)
 Exchange rate: JICA (October 2015)

Note: Income was estimated as a weighted average, not by the horizontal calculation in the table.
 Date were adjusted to 2015 current price with
 SS (Spring-Summer) Paddy was excluded from the data as it has only one valid sample
 Total average was estimated based on the weighted average of all the valid data, not the average of above figures
 Financial: Based on the amounts that were sold out. Economic: Based on the amounts that were produced.

Table 2.4.8 Average Net Income of Paddy Cultivation per Household at 2015 Current Price

Category	Area Harvested	Gross Cash Income (Financial)	Gross Cash Income (Economic)	Total Cost	Total Net Income (Financial)	Total Net Income (Economic)
	(ha)	(VND/ha)	(VND/ha)	(VND/ha)	(VND/ha)	(VND/ha)
Per Hectare per Season	1.00	32,250,000	37,601,000	21,571,000	10,679,000	16,030,000
		US\$1,454	US\$1,695	US\$973	US\$481	US\$723
Per Household per Year (2.76 times)	2.04	65,790,000	76,706,000	44,005,000	21,785,000	32,701,000
		US\$2,966	US\$3,458	US\$1,984	US\$982	US\$1,474
Per Household per Year (3.00 times)	2.22	71,595,000	83,474,000	47,888,000	23,707,000	35,587,000
		US\$3,228	US\$3,763	US\$2,159	US\$1,069	US\$1,604
Per Household per Year (2.00 times)	1.48	47,730,000	55,649,000	31,925,000	15,805,000	23,724,000
		US\$2,152	US\$2,509	US\$1,439	US\$713	US\$1,070

Source: Questionnaire Household survey, JICA Study Team for the Master Plan Study (2011)
 Note: Based on the source, an average number of cropping is 2.76 times per year, thus 2.05 ha/ household/ year.
 For other conditions for the estimates, see the note in Table 2.4.7.

Table 2.4.8 estimates the net income from paddy cultivation per year per average farmer household engaged in paddy farming. As shown in the table where a typical average farmer cultivates a total area of 2.04ha by an average of 2.76 cultivations per year, the farmer generates net incomes of VND 21,785,000 (USD982) and VND 32,701,000 (USD1,474) in financial and economic terms respectively. This is the current situation of the area, if not significantly changed in the farming condition.

To be sure, if a farmer's household can manage three (3) times of paddy cropping per year, an estimated net income should be VND 23,707,000 (USD1,069) and VND 35,587,000 (USD1,604) in the same manner as above. It suggests that if freshwater is maintained and any other factors are satisfied, US\$130 per household can be secured. On the other hand, if farmers can manage only two (2) times per year, they will lose about USD400.

2) Fruits and Coconuts

In general, it is difficult to estimate the profitability of fruit production because of highly fluctuated market prices during the year or over the years. For example, the price of coconuts has fluctuated

within the range between VND 2,000/fruit recorded in June 2012 up to VND 12,000/ fruit recorded in October 2011, which is about six times the difference according to the Department of Finance (DOF) of the Ben Tre Province (2015). Thus, data on the profitability of fruit production must be treated as just a reference.

On that condition, the farm economy of fruits is discussed based on the household questionnaire survey conducted during the Master Plan Study. As per household, farmers can generate a net income of VND 33,169,000/household (USD1,495/household) from coconut production per year, and 16,070,000VND/household (USD725/household) from other fruits. This difference is caused mainly by the size of the area planted, which is 0.48 ha/household for coconuts and 0.23 ha/household for other fruits.

As per hectare, the net income is about VND 69,102,000/ha (USD3,116/ha) from coconut production per year and VND 69,871,000/ha (USD3,150/ha) from the production of other fruits. The profitability of both types of crops resulted in about the same level, but it is usually said that the net income of other fruits are usually higher than coconuts. It was probably caused by the high price of coconuts in 2011. To be sure, another reference shows that an average net profit in economic value ranges from VND 50 to 70 million/ha (2011), which is about VND 60-85 million/ha at 2015 current price. Thus, this result can be reliable enough.

Table 2.4.9 Average Net Income of Fruits Production at 2015 Current Price

Crop	Per Household (VND/Household)			Area per Household (ha)	Per Hectare (VND/ha)		
	Gross Income	Cost of Production	Net Income		Gross Income	Cost of Production	Net Income
Coconut	38,174,000	5,005,000	33,169,000	0.48	79,529,000	10,426,000	69,102,000
	US\$1,721	US\$226	US\$1,495		US\$3,586	US\$470	US\$3,116
Other fruits	20,428,000	4,357,000	16,070,000	0.23	88,815,000	18,946,000	69,871,000
	US\$921	US\$196	US\$725		US\$4,004	US\$854	US\$3,150
Exchange Rate as of Oct 2015 (VND/US\$)							22,180
Inflation Rate from 2011-2015							22.16%

Source: Questionnaire Household survey, JICA Study Team for the Master Plan Study (2011)

Note: For other conditions for the estimates, see the note in Table 2.4.7.

3) Shrimp

An estimation of the profitability in shrimp culture is also challenging as the production of shrimp is exposed to a high risk of disease in addition to the fluctuation of the price being largely affected by the international market trend. With this background, referable figures were availed by the household survey of the Master Plan Study. As per conversion to 2015's current price, the most profitable types of shrimp culture are semi-intensive cultures among four types of shrimp culture: extensive, extensive (shrimp-paddy system: SP), semi-extensive, and semi-intensive. During the study, a survey on intensive shrimp culture was not possible due to the need to respect the privacy of the business owners.

As per net income per household, the extensive culture (SP), VND 47,271,000/household, is much lower than the extensive culture, VND 137,360,000/household because of the limited size of the area under that system. Since shrimp culture needs to be prepared after the harvest of the paddy during the previous season in that system, farmers may not be able to manage such a large size of the area. On an average of all types of shrimp culture, the net income is estimated at about VND 89,610,000 /household, which is USD 4,040/household.

In terms of the net income per hectare, an average income is VND 44,860,000/ha (USD2,023/ha), which is composed of a minimum of VND 31,820,000/ha (USD1,435/ha) for extensive culture (SP) to

VND 63,561,000/ha (USD2,866/ha) for semi-intensive culture.

Table 2.4.10 Average Net Income of Shrimp Culture at 2015 Current Price

Category	Net Income per Household (VND/HH)			Area of Shrimp (ha/HH)	Net Income per Hectare (VND/ha)			
	Gross Income	Total Cost	Net Income		Gross Income	Total Cost	Net Income	
Extensive	228,509,000	91,149,000	137,360,000	3.8	59,797,000	23,852,000	35,946,000 US\$1,621	
Extensive (SP)	66,213,000	18,942,000	47,271,000	1.5	44,571,000	12,751,000	31,820,000 US\$1,435	
Semi Extensive	172,353,000	72,307,000	100,046,000	1.9	90,143,000	37,817,000	52,326,000 US\$2,359	
Semi Intensive	206,587,000	100,835,000	105,752,000	1.7	124,166,000	60,605,000	63,561,000 US\$2,866	
Average	158,537,000	68,927,000	89,610,000	2.0	79,365,000	34,505,000	44,860,000 US\$2,023	
	US\$7,148	US\$3,108	US\$4,040		US\$3,578	US\$1,556	US\$2,023	
Exchange Rate as of Oct 2015 (VND/US\$)							22,180	
Inflation Rate from 2011-2015							22.16%	

Source: Questionnaire Household survey, JICA Study Team for the Master Plan Study (2011)

Note: For other conditions for the estimates, see the note in Table 2.4.7.

2.4.6 FARMERS ECONOMY: INCOME AND ITS DISTRIBUTION

1) Trend of Poverty Rate

In the Ben Tre Province, the poverty rate has been reducing during the past decade as shown in Table 2.4.11; it has reduced from 20.02% in 2005 to 6.48% in 2014 (Table 2.4.11). The poverty rate of the rural area is nearly two (2) times higher than the urban area all the time, but both areas have reduced the same percentage of their poverty rate in the past 10 years, that is, about 30% of the year 2005. It generally supports the idea that the livelihood disparity between the urban area and the rural area has not been expanded, while both areas have performed positive economic development. One of the reasons that enabled this parallel development is that the industries sector is not much developed and, as a result, the income level in urban areas is still low as compared to the other areas (see Table 2.4.14)

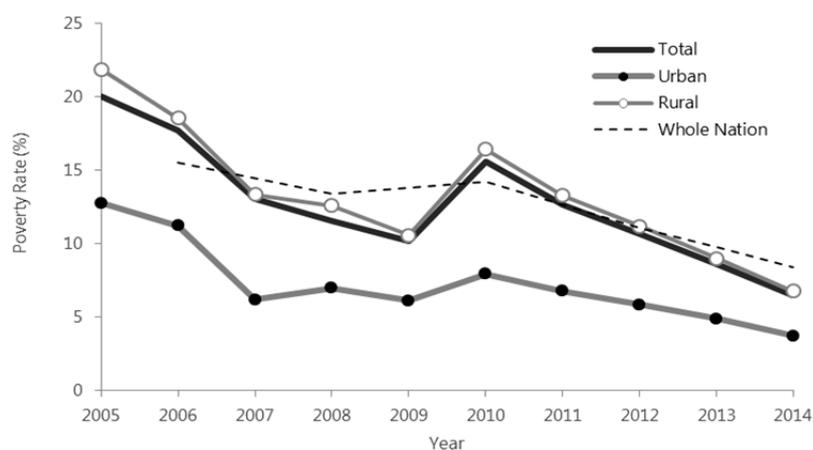


Figure 2.4.6 Trend of Poverty Rate in Ben Tre

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 2.4.11 Poverty Rate of Ben Tre Province by Urban and Rural

Year	Total		Urban		Rural		Rural/ Urban
	P. Rate	Trend	P. Rate	Trend	P. Rate	Trend	
2005	20.02	100%	12.75	100%	21.88	100%	1.72
2006	17.74	89%	11.23	88%	18.55	85%	1.65
2007	13.05	65%	6.20	49%	13.36	61%	2.15
2008	11.58	58%	6.97	55%	12.60	58%	1.81
2009	10.15	51%	6.12	48%	10.57	48%	1.73
2010	15.58	78%	7.93	62%	16.43	75%	2.07
2011	12.63	63%	6.78	53%	13.29	61%	1.96
2012	10.65	53%	5.86	46%	11.19	51%	1.91
2013	8.59	43%	4.88	38%	9.00	41%	1.84

Source : Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015) | Unit: %

Note: "Trend" shows the yearly trend from 2005 as 100%

The poverty rate of each district in 2014 is shown in Table 2.4.12. It ranges from 1.3% in Ben Tre City to 10.86% in the Thanh Phu district, resulting in an average of a 6.48% poverty rate in the whole province. Comparing the poverty rate of each district with the provincial average, there are four (4) districts which are found to have more than the provincial average: North Mo Cay (1.21 times larger), Binh Dai (1.15 times), Ba Tri (1.38 times), and Thanh Phu (1.60 times). The worst three (3) districts are coastal districts, which generally maintain aquaculture on the coastal part of the districts and paddy-oriented farming systems inland.

As shrimp culture has had good business in the past few years, a relatively negative poverty rate in these districts is likely to attribute some part to the suppressed production of paddy at the inland part of the districts due to saline water intrusion.

For example, the Thanh Phu district, which has shown the worst poverty rate, is located at the coastal area of South Ben Tre, characterized in its land uses by intensive and intermitted shrimp culture, paddy-shrimp system, and paddy. According to DARD Ben Tre, the Thanh Phu district faces a lack of freshwater in the middle part of the district due to the stagnation of water flow during the dry season caused by the angulation of the topography. As a result, farmers can choose only the paddy-shrimp system, which may not be so promising as they need to remove the salinity at the beginning of the paddy season every year.

In Ba Tri, for another example, the saline water intrusion problem has been a typical problem during the dry season from January to April. Also, in the Binh Dai district, approximately 2,000 ha of current paddy areas are expected to decrease by half for converting to coconut plantations and shrimp culture due to the high saline level for paddy cultivation. Binh Dai also has a large area of the shrimp-paddy system, which is not a promising system due to the rather complicated operation required.

Table 2.4.12 Poverty Rate of Ben Tre Province by District

District	Total	Urban	Rural	Compare to Province
Ben Tre City	1.30	0.84	1.85	0.27
Chau Thanh	4.02	2.10	4.07	0.60
Cho Lach	5.05	4.74	5.08	0.75
South Mo Cay	5.75	7.29	5.62	0.83
North Mo Cay	8.24	0.00	8.24	1.21
Giong Trom	5.92	6.24	5.90	0.87
Binh Dai	7.74	6.46	7.83	1.15
Ba Tri	9.23	6.42	9.40	1.38
Thanh Phu	10.86	10.99	10.85	1.60
Whole Province	6.48	3.72	6.79	1.00

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015) | Unit: %

On the other hand, North Mo Cay is the only district worse than the provincial average among the inland districts. North Mo Cay is widely characterized by the mixed cultivation of coconut trees and orchards in its land uses. According to the DARD office of North Mo Cay, it is difficult to conclude the reason behind this, but the higher poverty rate usually attributes to the higher ratio of the population engaged in farm labor.

2) Income Level

Table 2.4.13 summarizes the monthly average income per capita at current price by residence. In the past eight (8) years, from 2006 to 2014, the average per capita monthly income has more than tripled from VND 612,000/capita/month to VND 1,930,000/capita/month. Although the income level is about 50% higher in the urban area, both urban and rural areas have experienced similar increments of more than triple (326% of 2006 in the urban area and 315% in the rural area).

Yet, looking at the increase of income in the whole nation, it has increased more than four times in the same period from VND 636,000/capita/month to VND 2,640,000/capita/month. Thus, it is concluded that the increase of income is in a good trend but not to the level of whole nation. Probably, it may attribute to the difference of population structures between the province and the whole nation. While the ratio of urban population and rural population of the province is about 1:9, that of the whole nation is about 1:2. It is anticipated that the high dependency in the rural sector is a reason for the delay in economic development.

Table 2.4.13 Monthly Average Income per Capita at Current Prices by Residence

Year	Whole Province		By Residence				Whole Nation		Mekong Delta	
			Urban		Rural					
2006	612	100%	807	100%	591	100%	636	100%	628	100%
2008	872	142%	1,116	138%	845	143%	995	156%	940	150%
2010	1,200	196%	1,833	227%	1,127	191%	1,387	218%	1,247	199%
2012	1,580	258%	2,205	273%	1,517	257%	2,000	314%	1,797	286%
2014	1,930	315%	2,633	326%	1,859	315%	2,640	415%	2,326	370%

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015) | Unit: VND Thousand

Statistical Yearbook of Vietnam 2014, General Statistics Office (2015) | Unit: VND Thousand for whole nation and Mekong Delta

To make sure, Table 2.4.14 indicates the monthly average income per capita at the current price by income source and region. As shown in the table, the average income per capita in Ben Tre is lower than the average of the whole nation from all the income sources except for “agriculture, forestry and fishing,” which is 38% higher than the whole nation. Particularly, income from “salary, wage” is only 52% of the whole nation. From the fact that the ratio of the rural population is much higher in the Ben Tre Province, it can be said that a higher dependency on agriculture, forestry, and fishing is a contributing factor to lower income as compared to the average of the whole nation.

Table 2.4.14 Monthly Average Income per Capita by Income Source and Region (2014)

Income Source	Whole Nation	Mekong Delta	Ben Tre
Salary, wage	1,238	778	644
	100%	63%	52%
Agriculture forestry and fishing	484	682	670
	100%	141%	138%
Non-agriculture forestry and fishing	591	527	410
	100%	89%	69%
Others	327	339	206
	100%	104%	63%
Total	2,640	2,326	1,930
	100%	88%	73%

Source: Statistical Yearbook of Vietnam 2014, General Statistics Office (2015) | Unit: VND Thousand

Note: percentage shows the significance of the income as compared to the whole nation, which is taken as 100%

As a conclusion of this subsection, the Ben Tre Province is developing but behind the pace of the

whole nation. Since this province depends heavily on agriculture and aquaculture, improvement of these sectors is a key strategy for further development against forthcoming climate change.

2.4.7 ISSUES AND POTENTIAL FOR FUTURE DEVELOPMENT

1) Issues

In Ben Tre, the first and foremost issue in agriculture and in the aquaculture sector is foreseeable saline intrusion. In 2016, severer drought occurred and thus saline intrusion became worse in the Mekong Delta.⁷ Likewise, saline intrusion is the central issue today. Acid Sulfate Soil (ASS) is also a common issue in the Mekong Delta; however, it is an issue mainly in the upstream provinces of the Mekong Delta. Flood or inundation is also an issue particularly very upstream of the province where excessive water comes and thus drainage of water becomes difficult, causing inundation in the farming areas.

Pest and disease are the classic but considerable issues in agriculture and aquaculture. The pandemic of shrimp disease once caused a disastrous damage in the shrimp culture sector, and it is always an issue for fruit cultivation as fruits are susceptible agricultural commodities. Associated with all these issues, lower productivity of agricultural produce is the resulted issue. In fact, the yield of paddy in the Ben Tre Province (4.72 t/ha in the past five years from 2010 to 2014) has been only about 80% of that of Tien Giang (5.65 t/ha in the same period)⁸, a neighboring province to the north.

In addition, fluctuation of market price is quite influential as the agricultural production in Ben Tre is more for selling than home consumption, which even extends to oversea exportation.

Table 2.4.15 Major Issues in Agriculture and Aquaculture

Issue	Remarks
Saline intrusion	It affects a large area of farmland and is expected to get worse due to sea level rise in the future.
Acid Sulfate Soil (ASS)	Acid Sulfate Soil (ASS) (pH < 4.5) is a major problem in and around upper Mekong River delta, such as Kieng Gian, and Can Tho, which is estimated about 1,600,000 ha. In Ben Tre, an estimated land area categorized as ASS soil is 3,134 ha (1.3% of total land area). ASS area is quite limited but found in lower area where it is difficult to drain water such as: An Phước (Châu Thành); Phú Long (Bình Đại); Minh Đức (Mỏ Cày); Tân Xuân, Bảo Thạnh (Ba Tri); Châu Bình, Châu Hòa (Giồng Trôm); and Bình Thạnh (Thạnh Phú). Although some part of province is categorized as ASS area, such areas have been renovated quite well and as a result varieties of high-value crops such as citrus and other fruit trees are already being cultivated (Source: Agriculture and Fishery Extension Center, DARD Ben Tre 2016).
Flood/ inundation	During rainy season, flooded water comes into the inland area of very upstream areas of Ben Tre Province, which cause some damages on crop production coupled with excessive water from rain. But the area affected is quite small.
Pest and disease	Shrimp culture is always associated with high risk of disease. Also, fruits cultivation is exposed to particular types of diseases by fruit type. In the former case, all the shrimps in the affected pond need to be killed, resulting in a huge amount of economic loss. In the latter case, farmers sometimes need to change the type of fruit. High cost of pesticides and fungicides is also an issue associated with pest and disease.
Market price	Fluctuation of market price is, first of all, big as most of agricultural commodities are for exportation. As the land area for such commodities are large in Ben Tre, then, impact of that fluctuation is large.

Source: JICA survey team (2016)

2) Potential

In terms of potential in agriculture and aquaculture development in Ben Tre, the following should be noted. As shown in Table 2.4.16, business-oriented farmers themselves are the first and foremost feature of the Ben Tre Province. As discussed in 2.4.2, farmers in the area easily change their crops,

⁷ <http://english.vietnamnet.vn/fms/environment/152955/drought--saline-encroachment-continue-in-mekong-delta--mekong-river-commission.html>

<http://english.vietnamnet.vn/fms/business/154155/vn-s-rice-supply-may-decrease-due-to-drought-and-saline-intrusion.html>

⁸ Statistical Yearbook 2014 of Ben Tre and Tien Gian (2015) respectively.

pursuing higher market prices; thus higher flexibility can be expected. Also, integrated farming/diversified farming is a key feature of the agriculture and aquaculture in the area. Diversification of income source makes the economic activities more stable.

Furthermore, the type of shrimp culture is relatively eco-friendly. The majority (70%) of shrimp culture in the Ben Tre Province is an extensive culture, which is regarded as having less environmental impact. Therefore, even shrimp culture can be a sustainable measure, in a relative term. Lastly, limited risk of flood enables farmers or any stakeholders to focus on disaster management during the dry season, which can lead to drought and saline intrusion.

Table 2.4.16 Remarkable Potential in Agriculture and Aquaculture

Potential	Remarks
Business-oriented farmers:	Farmers in Ben Tre Province are highly oriented to business in agriculture and aquaculture. By pursuing the chance of high profit, they can easily change the type of fruits or type of commodity. It implies flexibility of changing cropping pattern with regard to market potential as well as production risk.
Integrated farming systems	Many farmer households, especially in the downstream part of Ben Tre Province, conduct an integrated farming, composed of paddy cultivation, fish culture, and cattle raising, which enable farmers to do income diversification and eco-cycling. For example, residual products of paddy cultivation, rice straw, can be used as cattle feed. Potential of this model is seen high as more demand on meat is expected along with the urbanization.
Ecologically preferable shrimp culture:	Roughly 70% of the cultivation system of shrimp in Ben Tre is extensive culture. Environmental impact of extensive culture is much lower than intensive culture. Thus, shrimp culture model in Ben Tre as a whole is not a typical "high-risk-high-return" kind of business model.
Limited risk of flood:	Although there are some areas that are exposed to some risk of flood or inundation during rainy season, majority of the province is free from the risk of flood. It suggests that, as the disaster management, stakeholders can focus almost only on saline intrusion and a lack of water during dry season.

Source: JICA survey team (2016)

2.5 ACTIVITIES OF INTERNATIONAL DONORS/NGOS AND VIETNAM GOVERNMENT

In light of Climate Change (CC) and Sea Level Rise, the central and local agencies of the Government of the Socialist Republic of Viet Nam (GOV) are implementing various projects in the Ben Tre Province, in order to protect or improve on people's livelihood in their changing environment. There are several donors and non-governmental organizations (NGOs) supporting and complementing such government efforts by providing financial and technical support.

2.5.1 INTERNATIONAL DONORS AND NGOS

The two (2) projects to respond to CC are currently under implementation in the Ben Tre Province with support from IFAD and Oxfam, an international non-governmental organization, with financing from New Zealand's Government, respectively⁹. Meanwhile, the World Bank (WB) has been preparing another project, which will cover Ben Tre Province, once it comes under implementation. The WB project is awaiting the approval by its Board of Directors, planned for June 10, 2016.

The existence of on-going or forthcoming projects that may undermine effect and impact of the Ben Tre Water Management Project, thus far, is not confirmed. To the contrary, each of the three projects mentioned above and the Ben Tre Water Management Project may complement each other and create a synergy for the agricultural development and an improvement on living standards of the residents of the province. However, there is a possibility of overlapping among these projects, including the Ben Tre Water Management Project, and therefore it is important for the Ben Tre Water Management Project to keep exchanging regularly any progress and updates with these projects. Figure 2.5.1 below shows the locations of project sites in the Ben Tre Province of the projects to respond to CC under the

⁹ The projects implemented in Ben Tre Province with support from DANIDA and ICUN, which the Interim Report issued in December 2015 refers, have been already concluded and therefore they are not mentioned in this Draft Final Report.

implementation with support from donors and NGOs. In the following, more details of each of the three projects are explained, while the outline of each project is compiled in Table 2.5.1.

1) Project supported by IFAD

The project with support from IFAD, “Adaptation to Climate Change in the Mekong Delta in Ben Tre and Tra Vinh Provinces” (AMD) has the establishment and operationalization of the automated monitoring system of water quality under one of its components, just as the Ben Tre Water Management Project does. To avoid unnecessary overlapping and to seek a complementarity, the information exchange between the AMD Ben Tre team and the B-SWAMP team has taken place in several occasions, and it was confirmed that the willingness of the AMD Ben Tre in working closely with the Ben Tre Water Management Project to ensure the coordination between the two (2) projects.

As of May 2016, the AMD Ben Tre is about to start defining details of this sub-component, while the recommendations by the B-SWAMP for the water level and quality monitoring system for the Ben Tre Water Management Project have been already consolidated through consultation with primary stakeholders. In terms of the designing and planning, the Ben Tre Water Management Project is going ahead, however, it seems that AMD Ben Tre will install and start to operate its monitoring system earlier than the Ben Tre Water Management Project does.

In order to facilitate the creation of complementarity and coordination between the two (2) projects, the B-SWAMP has developed a draft memorandum on the installation, operation and maintenance of the water monitoring systems between the AMD Ben Tre and the Ben Tre Water Management Project as proposal. The proposal was shared with both the projects for their consideration, modification and finalization.

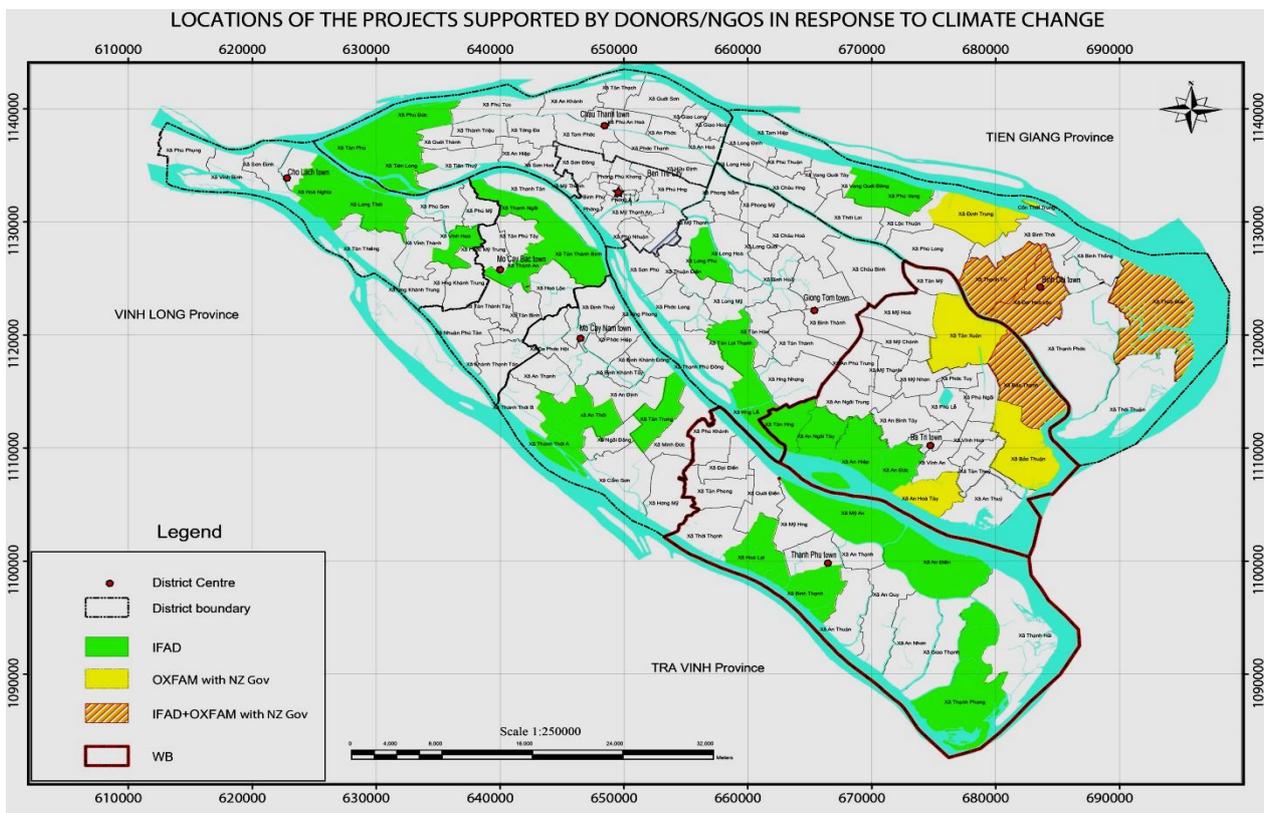


Figure 2.5.1 Locations of Support from Donors and NGOs in Ben Tre Province

Source: JICA survey team (2016)

Under another component, the AMD Ben Tre has supported the thirty (30) selected communes in the

Ben Tre Province in the development of the Socio-Economic Development Plan (SEDP) for the next 5 years (2016-2020) for their own communes. Subsequently, the construction of a small-scale infrastructure for Climate Change Adaptation will get started in those communes, drawing from the developed SEDP 2016-2020. There is a possibility that some communes will select those works that could benefit from the availability of freshwater through the year as an effect of the Ben Tre Water Management Project, such as the upgrading or rehabilitation of the existing irrigation systems at the commune field level. Thus, there is a possibility for both projects to create synergy for the lives of the Ben Tre people.

2) Project Supported by Oxfam

The Response and Adaptation to Disasters and Climate Change (RADCC) that has been supported by Oxfam with financing from the New Zealand Government has been supporting the residents of the selected fifteen (15) communes in the coastal three (3) districts in the Ben Tre Province. The project has facilitated the residents to develop and implement the Socio-Economic Development Plan for the period 2016-2020 in their communes, and to improve their livelihoods by providing necessary equipment, agricultural inputs (including goats and cows), water tanks, and connection to the water plant. Almost half of the 15 communes fall into the coverage areas of the Ben Tre Water Management Project and may directly benefit from the effect of the construction and operation of sluice gates: availability of freshwater through the year. In addition, the information on the salinity of water and the recommendations for land-use and agricultural practices, which will be made available to the residents through the Technical Assistance components, may also contribute to improvement on the livelihoods of the RADCC participants.

3) Project to be Supported by World Bank

The Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project has been under the preparation by the WB in conjunction with the GoV at the central (MARD, MONRE and Ministry of Planning and Investment: MPI) and provincial levels. It is also important for the JICA3 Project to keep exchanging information with this project to ensure that both the projects can complement each other by avoiding unnecessary overlapping, especially for the surface water level and quality monitoring system.

Just like the AMD supported by IFAD, this project also has a plan to establish regional automatic monitoring systems of surface water, groundwater and river and shoreline erosion. In addition, the project plans to establish a national data center of Mekong Delta Region with integrated database on natural resources and environment, including the monitoring data of water flow, volume and salinity. However, since this project is still at the appraisal stage, and further details will be determined only when the project actually get started.

The project also considers the implementation of two (2) sub-projects for Ba Tri and Thanh Phu Districts of Ben Tre Province have been proposed, and the actual preparation for the Ba Tri sub-project is underway prior to that for the Thanh Phu Sub-projects.

According to the proposal submitted to the WB, the objective of this sub-project is to “complete the Ba Tri sea dyke to prevent saltwater intrusion caused by the tides, creating favorable infrastructure for stable production and sustainable socio-economic development, environmental protection of the coastal ecosystem, adapt to rising sea levels and adverse impacts of climate change.” As for the component of structure works, the construction of nine (9) sluice gates through the sea dike is proposed, and as for the non-structural component, mangrove replantation, promotion of the importance of natural disaster preparedness, and coastal environmental protection are proposed. It is possible that some part of Ba Tri can benefit not only from this project but also from the operation of the sluice gates installed by the JICA3 Project, and thus, there is a possibility of synergy effect.

Meanwhile, the Thanh Phu sub-project has the following three (3) objectives:

- Invest into some structure works for water regulation to serve agricultural production and domestic use in Cu Lao Minh.
- Develop the trees and livestock as mono cropping, especially species of high economic value that are suitable with ecological condition of each sub-zone in the project area.
- Build capacity and technical skills for the farmers in agricultural production to better cope with risks in case of force majeure.

To contribute to the achievement of the first objective, the dredging of irrigation canals system for freshwater from Cho Lach to Thanh Phu was included into the proposal. If this work is carried out, it will improve the effect of the sluice gates to be constructed by the Ben Tre Water Management Project in South Ben Tre.

Table 2.5.1 Summary of the On-going & Forthcoming Projects with Support from donors and NGOs

DONOR/ NGO	PROJECT NAME	OBJECTIVE	MAJOR COMPONENTS	IMPLEMENTING AGENCY	PERIOD	COSTS FUNDED BY DONOR/NGO (USD million)	PROJECT SITES OR TARGETS IN BEN TRE
IFAD	Adaptation to Climate Change in the Mekong Delta in Ben Tre and Tra Vinh Provinces (AMD)	The strengthened adaptive capacities of target communities and institutions to better contend with climate change and increase income through participation in adaptive economic activities.	<p>Component 1: Building Adaptive Capacity</p> <p>1.1. Climate Change Knowledge Enhancement</p> <p>1.2. Climate Informed Planning</p> <p>Component 2: Investing in Sustainable Livelihoods</p> <p>2.1. Rural Finance for Resilient Livelihoods</p> <p>2.2. Investing in Climate Change Adaptation</p>	<ul style="list-style-type: none"> ▼ Ben Tre and Tra Vinh Provincial People's Committees ▼ Project Steering Committees at the provincial level ▼ Project Coordination Units at the provincial level ▼ Climate Change Coordination Office and Provincial Climate Change Steering Committee 	2014-2020 (6 years)	34	30 selected communities in the Province
Oxfam + New Zealand Government	Response and Adaptation to Disasters and Climate Change (RADCC)	To increase the resilience and adaptive capacity of poor people and local authorities to disaster and climate risks in coastal communities in the Mekong Delta	<ul style="list-style-type: none"> ▼ to strengthen the capacity and resources to local officials and the community in disaster risk reduction and adaptation to climate change ▼ to improve production and incomes for the poor through livelihood models to adapt to climate change and vocational training ▼ to improve the quality of drinking water and sanitation for the poor. 	Department of Agriculture and Rural Development of Ben Tre Province (DARD)	2012-2017 (5 years)	4	15 selected communes in Binh Dai, Ba Tri and Thanh Phu Districts

DONOR/ NGO	PROJECT NAME	OBJECTIVE	MAJOR COMPONENTS	IMPLEMENTING AGENCY	PERIOD	COSTS FUNDED BY DONOR/NGO (USD million)	PROJECT SITES OR TARGETS IN BEN TRE
<p>WB (at the appraisal stage)</p>	<p>Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project</p>	<p>To enhance tools for climate-smart planning and improve climate resilience of land and water management practices in selected provinces of the Mekong Delta in Vietnam.</p>	<p>Component 1: Enhancing Monitoring, Analytics, and Information Systems Including the establishment of the surface water monitoring system in Mekong Delta Region and the construction and operation of the data center for the region Estimated Costs for the component: USD 61.3 million Component 2: Managing Floods in the Upper Delta Component 3: Adapting to Salinity Transitions in the Delta Estuar Including the sub-projects proposed for Ba Tri and Thanh Phu Districts of Ben Tre Province Estimated Costs for the component: USD 109.1 million Component 4: Protecting Coastal Areas in the Delta Peninsula Component 5: Project Management and Implementation Supporty</p>	<p>E/A: MARD in close collaboration with MONRE and MPI Project Steering Committee: comprised of representatives from MONRE, MARD (including its technical departments), MOF, MPI, OOG, SBV and PPCs, and chaired by a MARD Vice Minister</p>	<p>2016 -</p>	<p>Total Estimated Costs: 387 (GOV: 77, WB: 310)</p>	<p>The sub-projects under the Component 3 are under the preparation to be implemented in Thanh Phu and Ba Tri Districts, Ben Tre Province</p>

Source: JICA survey team (2016)

2.5.2 VIETNAM GOVERNMENT AND LOCAL NGOS

At the central level, MARD, as part of its mandate, is in charge of the implementation of rural infrastructure programs, including hydraulic works, assigned by the Government. There are different ministerial apparatuses (Directorates, Departments, Offices and Boards), which play their own roles for MARD to fulfill such mandates.

The Hydraulic Project Investment and Construction Management Board No. 10 (ICMB 10) is one of the 10 ICMBs under MARD spread over the country, as agencies for the management of the preparation and implementation of hydraulic projects. The ICMB 10 locates in Can Tho City, has a branch office in Vinh Long City, Vinh Long Province. Its jurisdiction consists of the following 13 provinces in the Mekong Delta: Long An, Tien Giang, Dong Thap, An Giang, Kien Giang, Hau Giang, Vinh Long, Ben Tre, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau Provinces and Can Tho City.

The ICMB 10 has been the Project Owner (PO) for the North Ben Tre Irrigation Project – Stage 1, which has the following 4 different objectives:

- to complete a closed system of a dyke along Tien River and Ham Luong River together with Ba Tre, Binh Dai Sea Dyke in order to prevent saline water,
 - to retain freshwater for 139,000 ha of natural land area in North Ben Tre,
 - to actively take freshwater to wash alum for 100,000 hectare of agriculture land area, and
 - to control salinity for 20,100 hectare of aquaculture in Binh Dai and Ba Tri province.
- In order to achieve these objectives, several sluice gates are being constructed, and the total amount of budget managed by ICMB 10 is VND 1,006 billion.

At the provincial level, the Department of Agriculture and Rural Development (DARD) is in charge of the development of rural infrastructure, including the hydraulic works. The Construction Management Division (CMD-DARD) has the mandate to supervise and appraise the preparation and implementation of such projects, and the Program Management Board for Agriculture and Rural Development (PMB) takes care of the procurement and contract management of consultants and contractors. Figure 2.5.2 shows the organizational structure of DARD. DARD spent VND 200 billion in 2012, VND 367 billion in 2013, and VND 230 billion in 2014 to invest in the irrigation system in the Province.

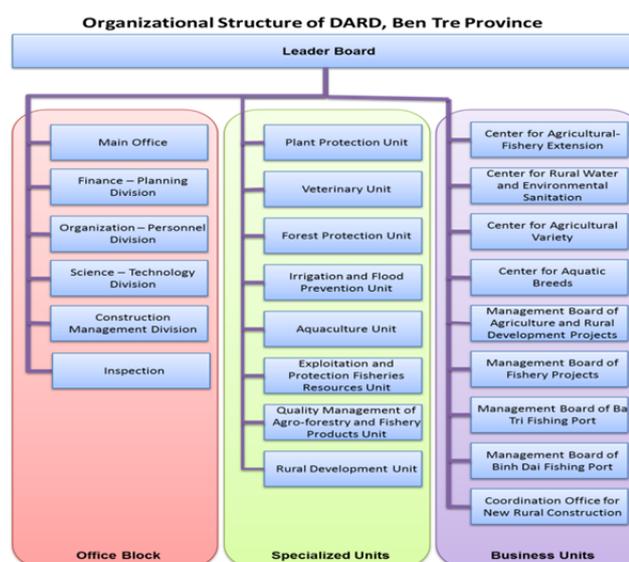


Figure 2.5.2 Organizational Structure of DARD

Source: JICA survey team (2015)

IWEC, according to its mandate, will be the agency, which is responsible for the Operation and Maintenance (O&M) of all eight (8) sluice gates to be constructed under the BWMP. The company is in charge of the O&M and the upgrading and rehabilitation of the 1st and 2nd level canals in the Ben Tre Province and is responsible for the operation of all the existing sluice gates in the Province.

Since the abolishment of the irrigation user's fee in 2008, the company has remained without its own revenue, and the budget allocated by the PPC has been the only funding source for the company to cover all its expenditure in investment, activities and administration. Twenty (20) dredging and repairing works were undertaken by the IWEC in 2014. The total cost of the works was nearly VND 26 billion, and the amounts of allocated and executed capital budget during the last three (3) years (in 2012, 2013 and 2014) have remained at the same level. It is understandable that the IWEC has the capacity to manage the implementation of a similar number and scale of works per year.

Except for the Ben Tre Town, the remaining eight (8) districts in the province have the Departments of Agriculture and Rural Development (D-DARD), responsible for construction works, agricultural extension works, training for farmers, research, etc. under the District People's Committee (DPC). The amount of capital and activity budget vary from District to District; however, the last three (3) years have seen an increase in their annual budget in most of the D-DARDs. They have been engaged in improving upon the irrigation facilities at the commune level under NTP-NRD 2010-2015; the central government allocates an earmarked budget for those activities. The local NGOs, especially associations at the commune level have been actively participating in those projects, which are under preparation or implementation in their communes.

2.5.3 LESSONS FROM THE PAST PROJECTS

In order to attain the ultimate objective of the Ben Tre Water Management Project, "achieving the agricultural development and improvement of the people's livelihood in the Ben Tre Province", the B-SWAMP team recommends implementing the Ben Tre Water Management Project in tandem with a technical cooperation project. (For a detailed explanation of the technical cooperation project, see section 3.5 below.)

In this section, lessons learnt from the already implemented related projects, which may be relevant to the design and implementation of the Ben Tre Water Management Project and technical cooperation projects, are consolidated. Lessons were drawn from the documents of various projects, and actually they are a mixture of lessons learned earlier and reflected into the design of the reference projects, and lessons actually learnt through the implementation of the reference projects.

Table 2.5.2 shows the list of projects and studies whose documents were reviewed to draw lessons and further information on each of the projects. The lessons drawn were classified in to three (3) categories: lessons relevant only to construction project (Ben Tre Water Management Project), those relevant only to technical cooperation projects, and those relevant to both. Table 2.5.3 illustrate those classified lessons. Those lessons for the planning stage have been taken into account by B-SWAMP members to write up this report and it is expected that other lessons for the preparation, implementation and monitoring stages will be also reflected.

Table 2.5.2 Sources of lessons learnt

DPs/NGOs	Programs, Projects or Studies whose reports or documents are consulted
ADB	<ul style="list-style-type: none"> ▶ Phuoc Hoa Water Resources Project ▶ Preparing the Greater Mekong Sub region Flood and Drought Risk Management and Mitigation Project Rural Infrastructure Sector Project ▶ Strengthening Water Management and Irrigation System Rehabilitation Project
Aus AID	▶ North Vam Nao Flood Control Project in An Giang Province
DANIDA	▶ Climate Change Adaptation Pilots in Quang Nam and Ben Tre Provinces

DPs/NGOs	Programs, Projects or Studies whose reports or documents are consulted
GIZ	<ul style="list-style-type: none"> ▶ Integrated Coastal Management Programme ▶ Transboundary water management with the Mekong River Commission – Component: Supporting measures for adaptation to climate change in the Mekong region
IFAD	<ul style="list-style-type: none"> ▶ Adaptation to Climate Change in the Mekong Delta in Ben Tre and Tra Vinh Provinces ▶ Environmental and Climate Change Assessment
IUCN	<ul style="list-style-type: none"> ▶ Building Resilience to Climate Change Impacts – Coastal Southeast Asia ▶ Mangroves for the future phase III ▶ Short term interventions, Long term impact: Results and lessons learned from Small Grant Facility (2011-2013) ▶ Vulnerability and capacity assessment in Thanh Hai and Thanh Phong Communes, Thanh Phu District, Ben Tre Province
WB	<ul style="list-style-type: none"> ▶ Mekong Integrated Water Resources Management Project ▶ Mekong Delta Water Resources Management for Rural Development Project ▶ Natural Disaster Risk Management Project ▶ Mekong Water Resources Project ▶ Reaching across the waters: facing the risks of cooperation in international waters

Source: JICA survey team (2016)

Table 2.5.3 Lessons learnt by previous related projects relevant to construction projects and technical cooperation projects

Category	Relevant lessons
Common	<ul style="list-style-type: none"> ▶ When projects fit into larger policies or plans, their impact, effectiveness and sustainability can be enhanced. ▶ Effective project management and communications among stakeholders will be a key for success. ▶ Loudspeaker system can work effectively as one of the means to convey messages to a majority of residents at commune level. ▶ Through existing mass organizations, such as Vietnam Farmers' Union and Vietnam Women's' Union, it is easy to organize community mobilization or collective actions. ▶ The areas and frequency of the utilization of external consultancies may be carefully studied: it has both positive (rapid implementation) and negative results (lower capacity for officers in charge). ▶ The sustainability of a project, largely, depends on the funding ability of the PPC to cover costs for Operation and Maintenance (O&M).
Construction works (Ben Tre Water Management Project)	<ul style="list-style-type: none"> ▶ Water resource infrastructure development at a large scale in Mekong Delta needs to take place, taking into account upstream water developments, future effects of climate change, and ecological and social impacts on the entire region. A certain degree of flexibility should be included in the design or in the operation to respond to emerging changes. ▶ In some previous projects, the delay in the compensation for resettlement resulted in a delay in the entire projects and/or an additional funding due to the soaring land and material prices (Vietnam recently experienced double-digit inflation twice, in 2007-2008 and 2010-2011.). It is important for the central government and the PPC to allocate and disburse the budget for this purpose as planned. ▶ There was a case where ineligible expenditures were made due to a misunderstanding of the borrower. It is important to explain and confirm with the borrower the regulations of a loan at an early stage, since details of the regulations may vary from DP to DP. ▶ There were cases where the procurement procedure from abroad took more time than scheduled and the closure date of the project had to be extended. The procurement plan should be realistic and feasible. ▶ Advanced activities are recommended be carried out prior to the signing of the L/A to facilitate the start-up of the project. ▶ The construction work can contribute to an improvement of livelihoods of residents, especially the poor in the affected communes, by offering short-term labor jobs. ▶ It is necessary for contractors to take necessary measures to reduce dust, noise, air, and water pollution through the construction period. The contractor should also provide sanitary facilities for (female and male) workers on the construction sites. ▶ There should be a designated place for the dredged sludge in order to properly manage and treat wastewater drained from the sludge disposal site against alum. ▶ The dredging work should be scheduled and implemented during the recession of tide in order that turbid water will not enter into fields.
Technical Cooperation Projects	<ul style="list-style-type: none"> ▶ To align, consult and communicate with all levels of authorities to increase agricultural production and improve living standards of residents. ▶ It is also important to obtain active participation of affected residents in activities and more importantly in decision making in water resource management. ▶ For effective O&M, good organization involving beneficiaries, realistic and well-planned budget, sound financial and reporting mechanism can be prepared in advance. ▶ It would be effective to organize water user groups in order to advocate for the importance of increasing efficiency in water and to build consensus about water use patterns, as well as to get members involved in the O&M of tertiary and in-field canals. ▶ It is necessary to clarify and agree the distribution of roles among participating actors, including local

Category	Relevant lessons
	<p>government officers and beneficiary residents. Capacity development for such officers and residents in accordance with the roles assigned would be important.</p> <ul style="list-style-type: none"> ▶ During the construction works, it is necessary to keep posting the affected communities and residents the information on schedules and progress of works. ▶ Community people can also supervise progress and quality of construction works, if there is a mechanism to listen to their voices (feedback) in place. ▶ A peer education or knowledge sharing from one resident to another, especially the “Farmer to Farmer” approach can work at the commune and village levels. ▶ Knowledge of climate change processes, impacts and adaptation measures needs to be strengthened by on-the-job training at local levels. ▶ Private sector could play an important role in agricultural development. To establish a win-win relationship between private sector and smallholders would be the key. Smallholders could buy products or service from the private sector, meanwhile, the private sector could provide smallholders with technology, knowledge, skills, market information, and supply/value chains. ▶ There is the possibility of increased water pollution with chemical elements due to enhanced agricultural production: appropriate mitigation measures should be considered and taken.

Source: JICA survey team (2016)

CHAPTER 3 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

3.1 OVERVIEWS OF PROJECT COMPONENTS RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

3.1.1 BACKGROUND OF THE SURVEY

Ben Tre Province is located at the east side of the Mekong Delta; the total area is 2,360 km²; with a total population of 1.26 million; and thus, the population density is 532 persons/ km². The population density of Ben Tre Province is the fifth highest in the Mekong Delta. The Ben Tre area is of polder area bordered by three (3) big Mekong tributaries namely Tien, Ham Luong and Co Chien. The residents access these tributaries for domestic use and irrigation. This area is one of the most affected areas by saline water intrusion in Vietnam. Ben Tre Province is expected to be affected by high level of saline water that could affect not only paddy production, but also fruit production. In fact, the damage cost was estimated as the highest among seven (7) coastal provinces based on the salinity introduction simulation.

3.1.2 RELEVANT TO THE MASTER PLAN

This Project was prepared based on the Master Plan of “The project for climate change adaptation for sustainable agriculture and rural development in the coastal Mekong Delta in Vietnam”, which was completed in April 2013.

In addition, this Project was selected and proposed as an optimal option which combines structural and non-structural measures, mainly due to a lesser option for resettlement and land acquisition based on the comparison with other options.

3.1.3 OBJECTIVES OF THE SURVEY

This preparatory survey (hereinafter referred to as “the survey”) aims at formulating a project plan for the Japanese ODA loan. The survey examines the objective, outline, costs, implementation organization, O&M organization, environmental and social considerations, and others.

This project aims at contributing to an improvement on the livelihoods of the people of Ben Tre Province in Southern Vietnam where severe loss in agriculture caused by saline intrusion has been recorded. To do so, the project will construct structures and facilities to control saline intrusion, which allow the Ben Tre people to provide water with lower salinity to their farming plots, hence, an improvement on the productivity of their produce. With such improved productivity, the Ben Tre people could better adapt to Climate Change impacts and enhance rural and regional development. This objective will be achieved by the construction of sluice gates at eight (8) sites (Northern Ben Tre: five (5) sites, and Southern Ben Tre: three (3) sites) and procurement of the monitoring equipment.

3.1.4 TARGET AREA OF THE SURVEY

The survey area is in Ben Tre Province. In addition, other provinces (Tien Giang, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau, and Kien Giang) are also included within the scope of the survey in case of the review on the current status of implementing the agriculture development plan according to the impact of climate change.

In the Project, the construction of sluice gates is planned at eight (8) sites in Ben Tre Province (refer to Table 3.1.1). In the northern part of Ben Tre, fresh water is to be diverted from the gates at Tan Phu and Ben Ro. Other gates (An Hoa, Ben Tre, and Thu Cuu) are closed during the dry season to prevent saline water intrusion. The dredging of canals has been already completed for the portion from Tan Phu and Ben Ro; thus, these canals provide enough capacity to deliver the water right after the construction of the sluice gates.

Table 3.1.1 Details of Sluice Gates in the Target Area

No.	Name	Polder Area	Length (m)	Depth(m)	Remarks
1	Tan Phu	Northern Ben Tre	20.0	-4.0	The fresh water will be secured from Tan Phu and Ben Ro and closed other gate to protect saline water intrusion. Dredging is complied.
2	Ben Ro	Northern Ben Tre	20.0	-4.0	
3	An Hoa	Northern Ben Tre	120.0	-6.0	
4	Ben Tre	Northern Ben Tre	70.0	-5.5	
5	Thu Cuu	Northern Ben Tre	60.0	-5.0	
6	Vam Nuoc Trong	Southern Ben Tre	90.0	-6.0	Open canals along the Co Chien/Ham Long Rivers are utilized as fresh water intakes. All sluice gates to be constructed aim to prevent saline water intrusion.
7	Vam Thom	Southern Ben Tre	70.0	-5.5	
8	Cai Quao	Southern Ben Tre	60.0	-5.0	

Source : JICA survey team from F/S of Vietnam

1) Rising Sea Level by Climate Change

There are water level stations in the East Sea at Vung Tau, West Sea at Rach Gia, and the inland areas at Can Tho. The record period is from 1982 to 2011 for Vung Tau, Rach Gia, and Can Tho, covering a period of about 30 years. The three (3) stations show a continuous increasing trend. The sea level rise at Can Tho station arrives at an average of approximately 4 cm over the record period of about 30 years.

On the other hand, the sea level rise at Vung Tau and Rach Gia stations had an average of approximately 15 cm over the same period. This means that the sea levels for both the eastern and western seas have been increasing with an average sea level rise of approximately 5 cm per decade.

2) Production Loss by Saline Water Intrusion

As for the forecasted agricultural production loss to be caused by temperature rise and other factors as of the year 2050, the expected loss in fruit production is the most significant, although the loss of shrimp culture was not concerned in the source (JICA 2012). According to JICA study (2012), it was difficult to estimate the loss of shrimp culture in the dry season because of the following reasons: 1) Shrimp farmer start their own business when their capital is ready regardless of the government's plan, 2) Salinity content for shrimp is higher than agricultural products, 3) Shrimp farmers access ground water individually, 4) The type of shrimp culture/cropping pattern (areas, variety and others) is changing dramatically due to occurrence of virus diseases and market price of shrimp and others.

On the other hand, water salinity levels play an important role in shrimp culture. The best-fit range for black tiger shrimp is 18-25 PPT. It is affected when salinity content changes through the contamination of either high saline water more than that level or freshwater.

Regarding what is called non-structural measures, it has been studied since the M/P stage which preceded this Study. In light of the result, the possibility of non-structural measures was studied in examining the alternatives of this Study. Having discussed SHM and so on, it was studied how to proceed with the non-structural measures including its implementation mechanism.

3.2 CURRENT ENVIRONMENTAL AND SOCIAL SITUATIONS RELEVANT TO THE PROJECT

3.2.1 ENVIRONMENTAL SITUATIONS

1) Meteorology

The Mekong Delta Region, including the survey Area of Ben Tre Province, belongs to the tropical monsoon climate, which does not vary in temperature and is hot and humid throughout the year.

Air temperature in Ben Tre Province is relatively high, as compared to other parts of Vietnam. The

highest monthly average air temperature is 29.2°C in May, 2014, and the lowest monthly average air temperature is 24.1°C in January, 2014.

Table 3.2.1 shows monthly average rainfall in Ben Tre Province in recent years.

Table 3.2.1 Monthly Rainfall in Ben Tre Province (year 2005 to year 2014) (unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2005	-	-	0.4	3.9	85.1	94.8	299.2	216.0	209.4	366.2	366.2	156.0
2006	0.5	0.0	21.3	105.5	190.8	275.4	160.3	249.2	456.9	151.1	151.1	69.5
2007	7.3	0.0	0.0	13.6	380.4	192.7	154.8	207.8	231.3	144.1	144.1	0.2
2008	2.4	4.5	20.6	160.8	171.6	134.8	179.4	272.8	339.4	284.3	284.3	25.1
2009	0.0	4.8	1.4	52.9	236.2	99.2	203.3	173.6	250.2	215.3	215.3	0.8
2010	53.9	-	0.0	8.8	49.1	183.7	333.5	301.5	301.5	388.9	388.9	33.1
2011	3.8	-	61.6	27.5	231.1	310.6	119.0	100.8	217.9	177.9	177.9	2.3
2012	0.0	7.3	41.4	76.6	205.1	170.6	249.8	102.8	417.4	171.6	171.6	10.1
2013	80.8	1.5	0.0	51.4	159.5	159.3	78.7	193.7	183.0	290.0	290.0	8.7
2014	5.6	-	0.0	36.7	77.1	292.4	226.4	279.0	259.8	98.8	89.6	94.4

Source : Hydrological and Meteorological Center in Ben Tre Province

The climate of Ben Tre Province is divided into two distinct seasons corresponding to the two forms of the monsoon: the rainy season from May to November and the dry season from December to April. During the rainy season, rainfall accounts for 80 to 85% of the annual rainfall, while during the dry season, rainfall accounts for about 15 to 20% only. The total yearly rainfall volume varied in recent years: from 1,430 mm to 2,041mm.

The average humidity is 82.0% during the rainy season and 79.2% during the dry season. The wettest month is August with the averaged humidity of 82.5%; while the driest months are March and April with 74.1% as the average. In terms of evaporation, the maximum evapotranspiration is recorded from December to April as 3.3 mm per day. For the remaining months, while the humidity is still high, the evapotranspiration is approximately 2.3 mm per day.

Through the year, there are also two wind seasons. During the winter monsoon season from December to April, the wind direction is mainly east - northeast. The averaged wind speed is from 2.4 m per second to 4.5 m per second. The summer wind occurs from May to November in the direction of west – southwest. The averaged wind speed is approximately from 2.2 m per second to 4.2 m per second.

2) River System

Ben Tre Province is located in the lower Mekong Basin, bordering the East Sea. Ben Tre has a vast river network with a total length of 6,000 km, of which the Co Chien River is 82km, the Ham Luong River is 71 km, the Ba Lai River is 59 km, and the My Tho River is 83 km, in addition to other rivers.

The river system creates favorable waterways, rich aquatic resources and watering for crops. However, it interferes with the water supply in the dry season, when the tide from the East Sea puts salt deep into the canals during the wind season. Also, Ben Tre has a network of rivers, streams, and canals connecting local together, which is forming a communication network and convenient irrigation system. On average along the main river, about 1 to 2 km is a canal. Ben Tre has hundreds of rivers and canals, while there are more than 60 rivers and canals which widths are more than 50 m wide.

The water levels downstream are affected by tidal variation much more than upstream, although the water levels in the rivers or canals in Ben Tre Province as well as in the whole Mekong River differ point by point in general. The water level variation of the downstream is twice or more than twice of the upstream ones.

Transportation volume by the water transportation in the Mekong River Delta region, including Ben Tre Province is much bigger than the volume in the other region. Originally, the Mekong Delta region had developed through the water transportation by natural streams or rivers. Following that, the French government, with initiatives from the Vietnamese government, has promoted the development. Then, the water transportation is still a dominant form of cargo transportation at the present time. Recently, tourism vessels of medium volume class are navigating in wider river-width rivers or canals.

3) Water Quality

According to the Environmental Monitoring Report of Ben Tre Province, during the second period, 2014 prepared by DONRE, the Water Quality Index (WQI) showed a general bad situation in the dry season, with 54% water samples being heavily contaminated, which are classified as level 5 (Polluted water, necessary measures to be needed) of the WQI. 2% of the samples are classified as level 4 of WQI (can be used for waterway transportation and equivalent purposes); 14% water samples are classified as level 3 of WQI (can be used for irrigation and equivalent purposes). Only the remaining 30% water samples area classified as level 1 and 2 of WQI (can be used for daily life activities) (refer to Figure 3.2.1).

The WQI is calculated by using a simple statistical analysis which compares various water quality parameters with the standard value. The WQI is a comprehensive water quality indicator, which is used in worldwide, including Europe countries.

In Vietnam, the WQI is categorized by five levels based on the value of BOD₅, COD, N-NH₄, P-PO₄, Turbidity, TSS, and Total Coliform (refer to Table 3.2.2).

Table 3.2.2 Water Quality Index(WQI) based on Each Water Quality Parameter

Level		WQI Value						
		BOD ₅ (mg/l)	COD (mg/l)	N-NH ₄ (mg/l)	P-PO ₄ (mg/l)	Turbidity (NTU)	TSS (mg/l)	Total Coliform (MPN/100ml)
1	100	less than 4	less than 10	less than 0.1	less than 0.1	less than 5	less than 20	2500
2	75	6	15	0.2	0.2	20	30	5000
3	50	15	30	0.5	0.3	30	50	7500
4	25	25	50	0.1	0.5	70	100	10,000
5	1	more than 50	more than 80	more than 5	more than 6	more than 100	more than 100	more than 10,000

Source : "Decision No.879/QD-IDU, Vietnam, 2011"

DONRE conducts the water quality sampling of Ben Tre Province regularly at rivers and canals from upstream to downstream. In general, deterioration of the water quality in the rainy season is not significant as compared to the one in the dry season.

On the other hand, in the dry season, some water quality items such as ammonia and coliform exceeded the permissible level of the quality standards of the surface water in Vietnam. The recent deterioration of the water quality may be caused by the absence of centralized wastewater treatment facility in the Ben Tre Province, and recent rapid population growth in the residential areas, and the recent increase in livestock activities such as pig breeding.

4) River Bank Erosion

Ben Tre Province is located at the eastside of the Mekong Delta. The total area of this province is 236,199.0 ha. in 2015. This province is located in a polder area bordered by three big tributaries of Mekong, which are, Tien, Ham Luong and Co Chien. Total length of rivers and canals in Ben Tre Province is approximately 6000 km. Erosion and sedimentation are common phenomenon along rivers and canals in Ben Tre, which are causing significant changes in the total land area of the province through the years (refer to Table 3.2.3)

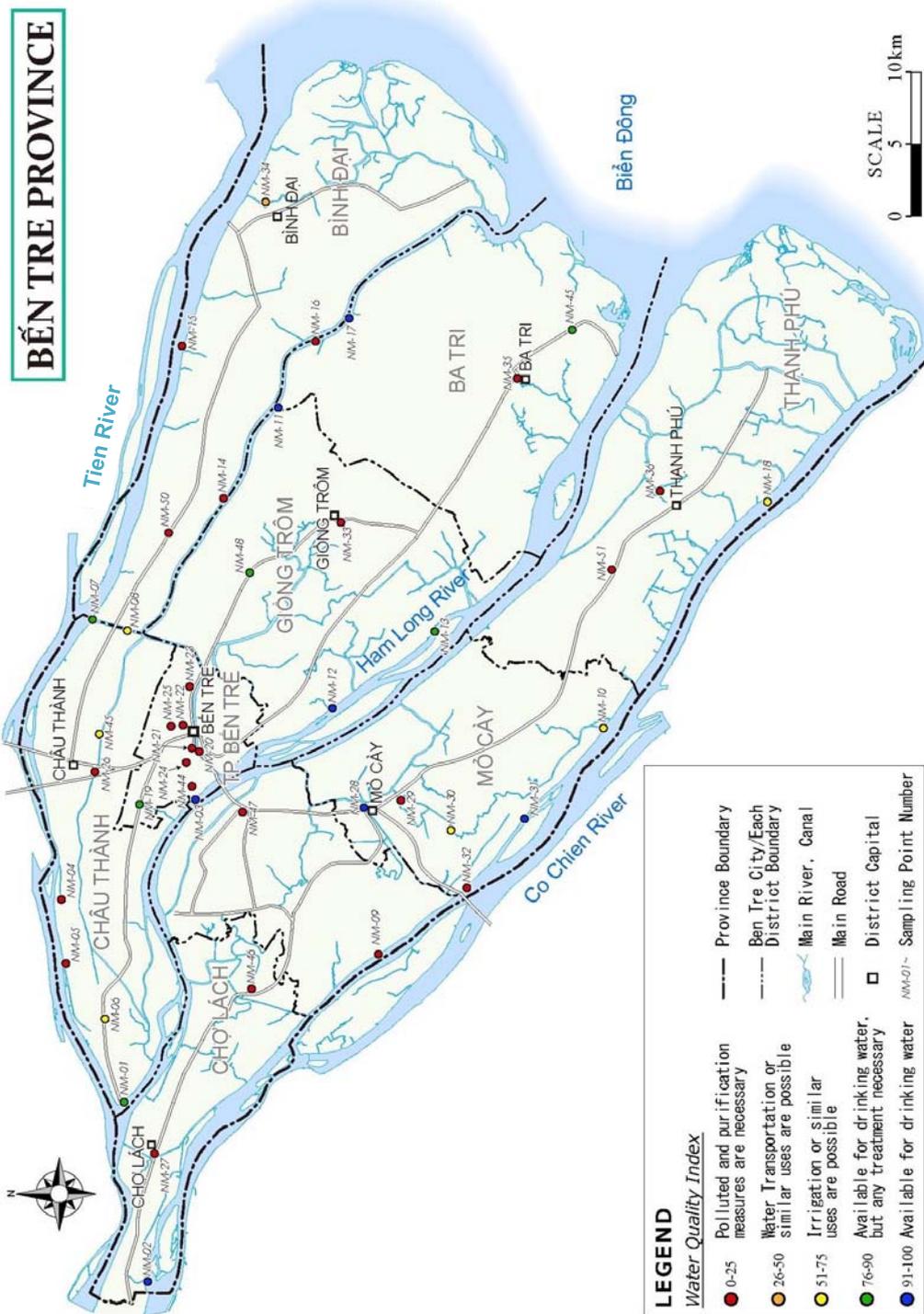


Figure 3.2.1 Water Quality Situations in Ben Tre Province of Dry Season in 2014

Source : Environmental Monitoring Report of Ben Tre Province, second period, 2014 by DONRE

Table 3.2.3 Recent Total Land Changes of Ben Tre Province

Year	2006	2007	2008	2011	2012	2013
Total Land Area (ha)	236,019.7	236,020.0	236,020.0	236,062.0	235,766.0	235,981.0

Source : Environmental Status Report of Ben Tre Province 2011-2015, Environmental Monitoring Center

According to hearings with governmental officials of the Rural Development Division of DARD and field reconnaissance in August 2015, severe riverbank erosion was addressed in some riverbanks, including at the proposed eight (8) sluice gate sites installed along the rivers and canals in Ben Tre Province. Of the eight (8) sluice gate points, severe erosion points were identified at four sites including An Hoa, Mo Cay Bac, Mo Cay Nam, and Cai Quao sites.

Figure 3.2.2 shows the progress of the recent riverbank erosion in Ben Tre Province reported in “Main Report of Resident Resettlement Plan of Ben Tre Province for Natural Disaster, period 2011 to 2015 and to 2020” prepared by the Rural Development Division of DARD in 2011. According to the report, riverbank erosion is progressing with the eroded area of more than 7 m per year in many river sites in Ben Tre Province.

Furthermore, in Ben Tre Province, more than 10 ha of residential areas including the gardens had been lost due to the bank erosion and a total of 1,122 households had to be resettled due to the riverbank erosions between 1990 and 2011. Also, more than 8,928 households will be affected by the bank erosion until 2010.

5) Soil Contamination

According to the Environmental Monitoring Report of Ben Tre Province prepared by DONRE in 2011, the soils in Ben Tre Province has sampled at total of 11 points to assess the current condition of soil contamination during the first period (rainy season) and second period (dry season) in 2011.

The sampled data indicated that pH values are low and it may influence plant growth. On the other hand, the Cl⁻ concentrations of the soils are within the tolerable range for the plants growth, even though the concentrations varies between the dry season and the rainy season. Therefore, it was concluded that the salinity levels would not cause significant adverse impacts to the plants in this year. The sampled soils contain heavy metal such as Fe, Cu, Pb, Zn, however the concentration values of these heavy metals do not exceed the values stipulated in Vietnamese standards. Therefore, it was also concluded that the heavy metal concentrations would not cause any adverse impacts on the human health.

6) Natural Protected Areas

Within Ben Tre Province, there are three natural protected areas. The characteristics and the location so f each protected area are shown in Figure 3.2.2 and Figure 3.2.3, respectively.

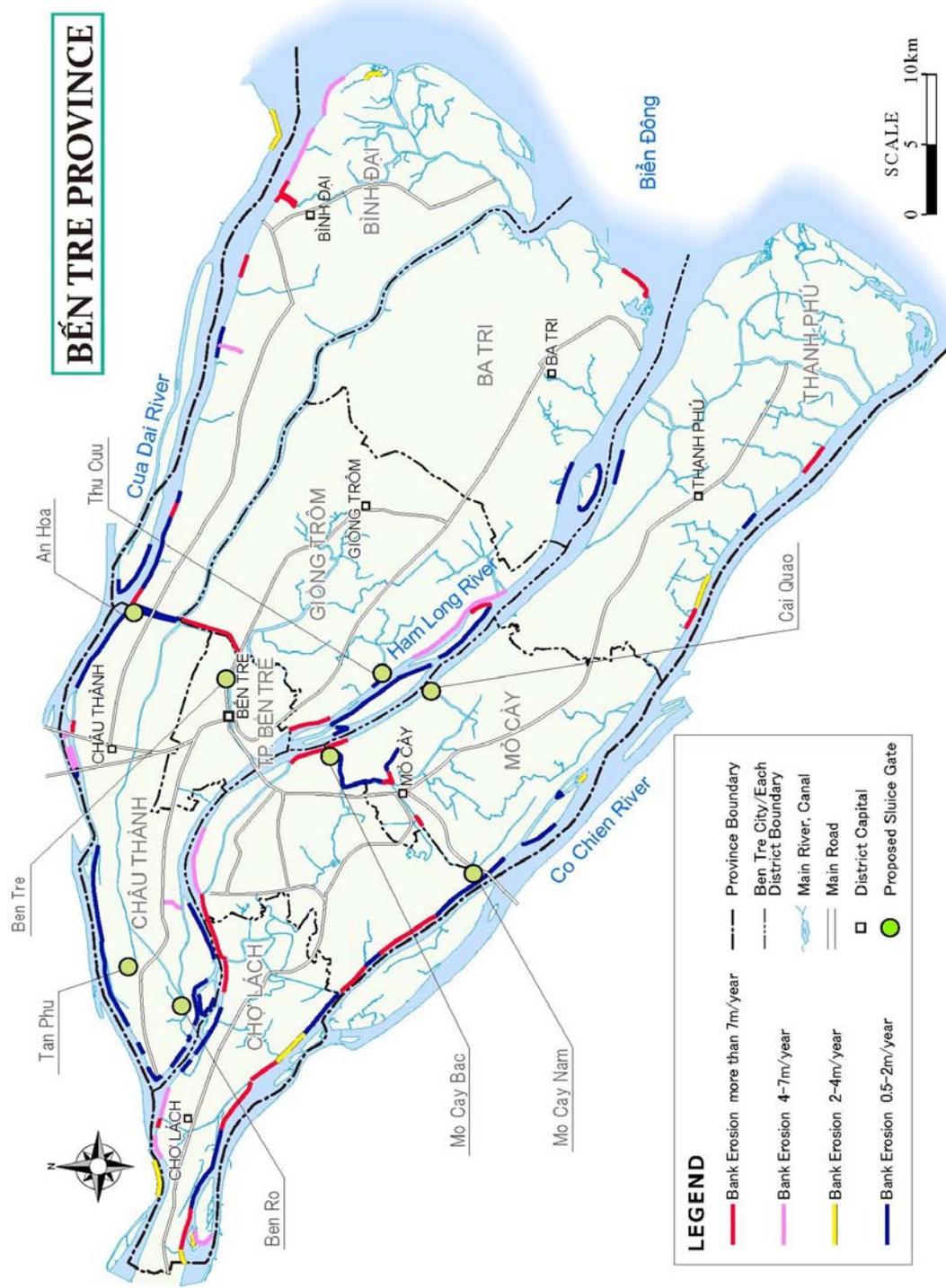


Figure 3.2.2 Recent River Bank Erosion Situations in Ben Tre Province

Source : Main Report of Resident Resettlement Plan of Ben Tre Province for Natural Disaster, period 2011 to 2015 and to 2020 by DARD

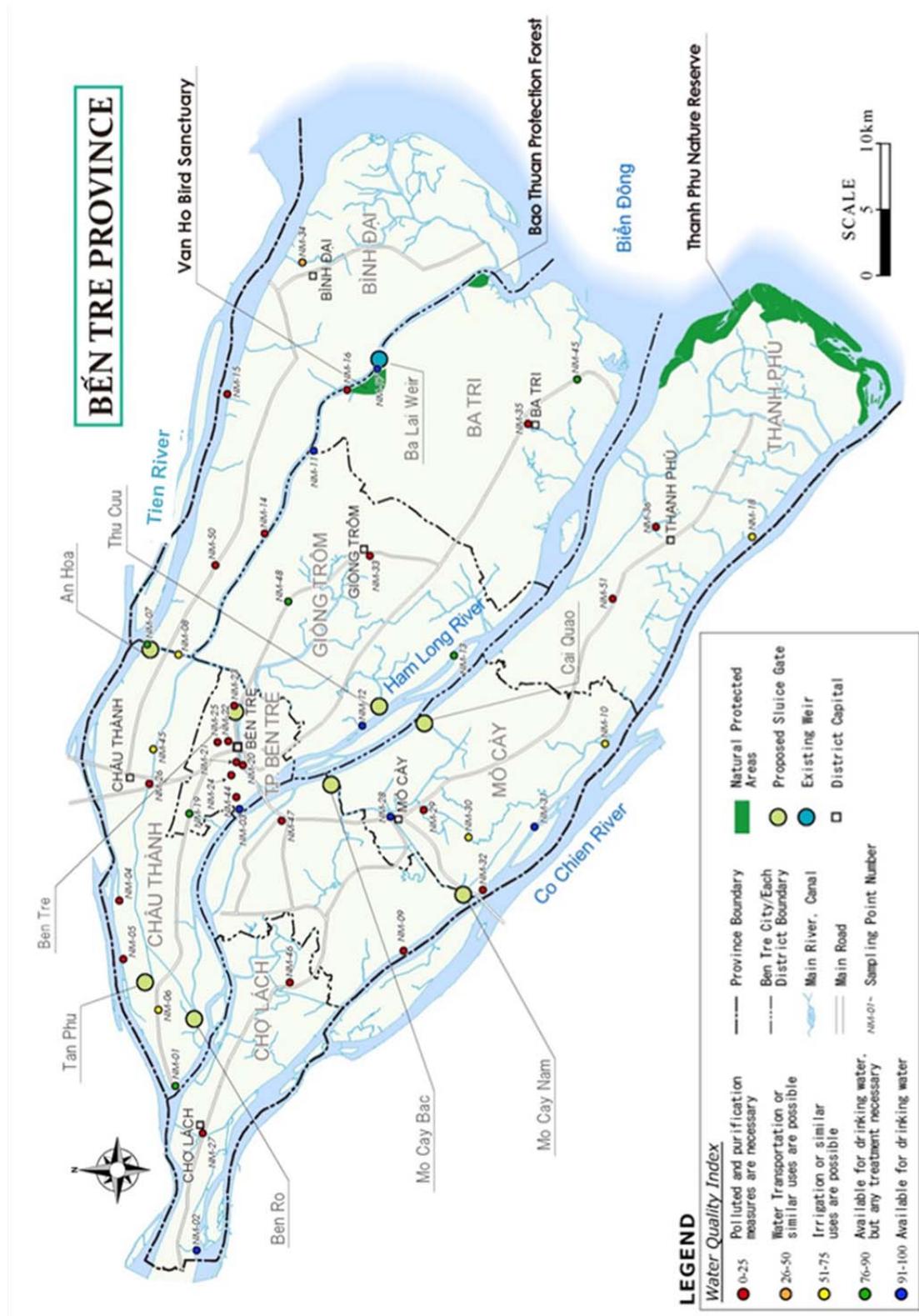


Figure 3.2.3 Nature Reserves within Ben Tre Province

Source : Forestry Division of DARD

Table 3.2.4 Natural Protected Areas in Ben Tre Province

Name of Natural Protected Area Designation Authority	Characteristics	Location/Areas
Than Phu Nature Reserve Ben Tre Province People's Committee of Thanh Phu District	<ul style="list-style-type: none"> - Mangrove forest (<i>Rhizophora apiculate is dominant</i>) and vast tidal flats area. - The area includes aquaculture areas. - The only forest protection area which is officially authorized within in Ben Tre Province. 	<ul style="list-style-type: none"> - Located in Thanh Phu District (more than 25 km from the closest proposed sluice gate site) - Total area is 6,276 ha (core zone: 2,584 ha, buffer zone: 3,692 ha). - Designated in order to preserve the biodiversity of wetland ecosystem,
Van Ho Bird Sanctuary Ben Tre Province People's Committee of Ba Tri District	<ul style="list-style-type: none"> - Many birds (<i>Egretta gazretta</i>, <i>Nycticorax nycticorax</i>) live on the trees such as acacia. - The habitat of various mammals such as Bat (<i>Pteropisvanpyrus</i>), civer (<i>Viverra indica</i>), squired (<i>Callosciurus pygerythrus</i>). - At present, the area is managed by Tan My Commune. 	<ul style="list-style-type: none"> - Located in Ba Tri District (more than 35 km from the closest proposed sluice gate site) - Total area is 65 ha. - The area was once a tourist destination until year 2005, but for the protection of the birds and ecosystem, the tourists are prohibited from entering.. - Designated in order to protect inhabitation of birds.
Bao Thuan Protection Forest Ben Tre Province People's Committee of Ba Tri District	<ul style="list-style-type: none"> - Mangrove forest (<i>Rhizophora apiculate is dominant</i>) and tidal flats area. - It is presumed that diverse fish species live in, but specific species have not yet been identified. 	<ul style="list-style-type: none"> - Located in Ba Tri District (more than 35 km from the closest proposed sluice gate site). - Mangroves densely grow as windbreak. - Designated in order to formulate a green belt of coastal conservation forests

Source : JICA survey team (2016)

7) Ecosystems

Within Ben Tre Province, including the survey Area, the following species could be addressed as a feature of the present ecosystems

a) Mangroves

In this report, based on the definition of a biology dictionary, “mangrove species” means a base unit of biological classification such as *Nipa Palm*, Mangrove Apple and etc. “Mangrove forest” means a collective term of trees comprising forests along river mouths and sea shores in salinity waters and brackish waters (intertidal zones) in the tropical and subtropical zones. In case of “mangrove”, it means a vegetation including mangrove species and others.

Sixteen mangrove species were confirmed within Ben Tre Province. Almost all types of the mangrove species densely grow in the coastal areas only. On the other hand, there are two types of mangrove species, which grow less dense and patch-wisely with other vegetation, covering the area within 1 to 2 m width banks of the main rivers. These rivers include the Cau Gai River, the Ba Lai River, the Ham Luong River, and the Co Chien River, and their tributaries in northern and middle areas of Ben Tre Province, where the survey was conducted (refer to Figure 3.2.4).

It is considered that mangrove species with vegetation could prevent the riverbank from the worsening of the erosion in the rivers and canals within the targeted survey Area. The aforementioned two types of mangrove species are *Nipa Palm* (*Nipa fruticans*) and Mangrove Apple (*Sonneratia caseolaris*), which grow broadly in Southeast Asia and the Pacific island regions. These species are not protected species, and they are not registered in the International Union for Conservation of Nature (IUCN) Red List. Therefore, within Ben Tre Province, there is no area where mangroves should be protected. In addition, no laws or regulations in Vietnam that prohibits the cutting of mangroves.

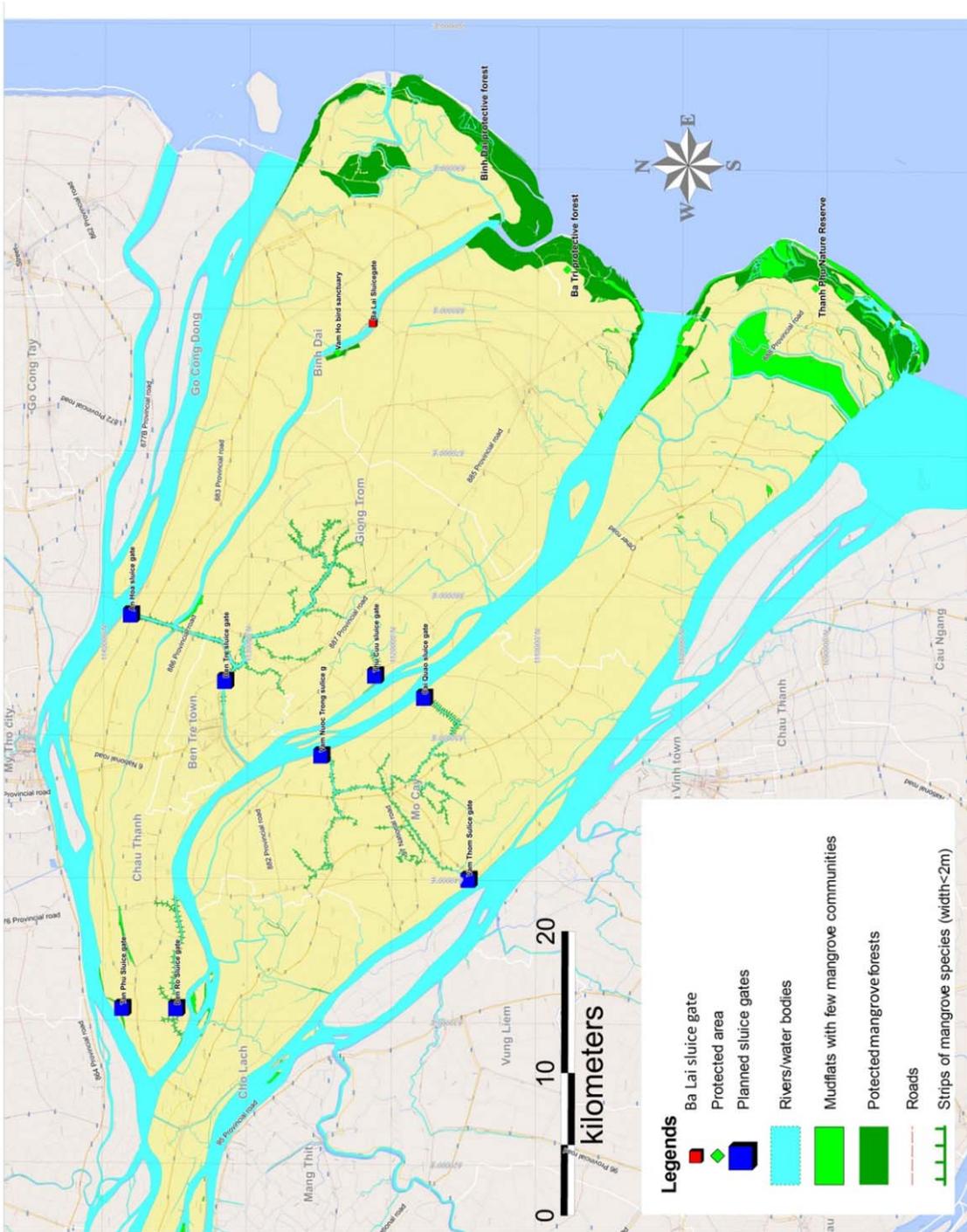


Figure 3.2.4 Mangrove Distribution Areas within Ben Tre Province

Source : Forestry Division of DARD

b) Fishes

The Mekong River within the Mekong Delta has rich and unique fish diversity. It is reported that there are fish species which live in fresh water, brackish water, and seawater under a certain range of the salinity, and also migratory fish species which live in fresh water, brackish water, and seawater in the Mekong Delta. The former fish (freshwater fish, brackish water fish, and sea fish) lives in each spawning area throughout their lifetime; therefore, it is considered that the population of these kinds of fish will not be affected by the operation of the sluice gates which will be constructed by this project.

On the other hand, it is reported that the migratory fish species may enter the waterway and spawn in the dry season when the gates are closed. Among the fish species which migrate from the Mekong River to freshwater in the survey area, some of them are registered as rare species in the latest IUCN Red List published in 2011. It is also reported that the migration of these fish species may have triggered by the water level rising in the Mekong River at the beginning of the rainy season.

c) Birds

As described in the previous section, the Van Ho Bird Sanctuary protects birds and other species near Ba Lai weir in the survey area.

It has a unique ecosystem consisting of birds, fish species, reptiles, and insects, mangrove species etc. However, the numbers of the species have been reduced to approximately 30 species. The main bird species are egret and heron, which are not registered as protected species in the Vietnam's Red Data Book as well as IUCN's Red List and nest on acacia trees and prey within the protected areas and its surrounding areas.

8) Air Quality

Table 3.2.5 shows the recent air quality conditions in Ben Tre Province. Figure 3.2.5 shows the location of the air quality sampling points. According to the data collected in the dry season of 2014 by DONRE, almost all the air quality parameters such as CO, NO₂, dust, and PM₁₀ meet each latest Vietnamese Standard (QCVN 05:2013/BTNMT).

As for the parameters which exceed the standard, the most exceed slightly and the parameters are Dust (average 24 hour) and PM₁₀. The sampling point where those parameters exceed substantially is only the southern part of Ben Tre city (KK-09).

Table 3.2.5 Recent Air Quality Conditions in Ben Tre Province

Sapling Point	Total Dust (mg/m ³)	PM10 (mg/m ³)	CO (mg/m ³)	NO ₂ (mg/m ³)	Nearest sampling point from the Proposed Sluice Gate	Distance to nearest Sluice Gate (km)
KK-01	0.24	0.15	6.24	0.102		
KK-02	0.27	0.17	7.35	0.118		
KK-03	0.21	0.11	3.42	0.062		
KK-05	0.23	0.14	5.04	0.072		
KK-06	0.26	0.14	5.34	0.096		
KK-09	0.41	0.21	4.65	0.068	Ben Tre	0.17
KK-11	0.21	0.10	2.57	0.043		
KK-12	0.17	0.09	2.74	0.032		
KK-15	0.19	0.06	2.16	0.052	Thu Cuu	10.65
KK-16	0.25	0.12	3.56	0.078		
KK-17	0.23	0.14	3.32	0.075		
KK-18	0.18	0.08	2.04	0.041		
KK-19	0.15	0.04	1.74	0.045	Tan Phu	9.36
KK-20	0.20	0.07	2.93	0.057	Vam Nuoc Trong	8.47
KK-21	0.28	0.15	4.34	0.095	Cai Quao	5.61
KK-22	0.17	0.06	1.85	0.042		
KK-24	0.21	0.09	2.44	0.067	Ben Ro	9.73
KK-26	0.23	0.12	4.36	0.103	An Hoa	6.29
KK-28	0.14	0.03	0.42	0.030	Vam Thom	2.99
KK-31	0.28	0.16	6.25	0.108		
<i>Vietnamese Standard (Average 1 hour)</i>	0.30	-	30.00	0.200		
<i>Vietnamese Standard (Average 24 hour)</i>	0.20	0.15	-	0.100		

Source : Environmental Monitoring Report of Ben Tre Province, second period, 2014 by DONRE

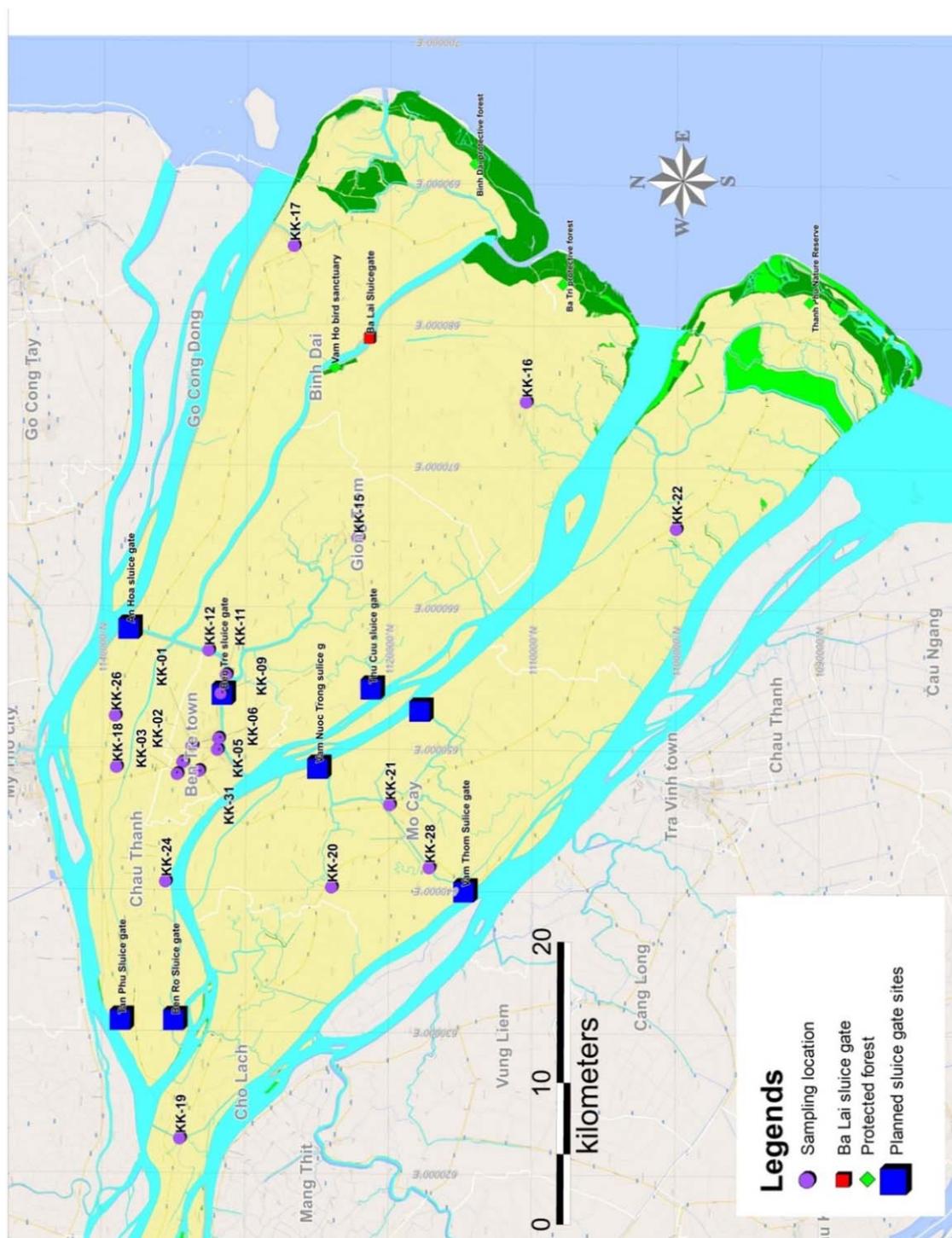


Figure 3.2.5 Air Quality Sampling Points in Ben Tre Province of Dry Season in 2014

Source : Environmental Monitoring Report of Ben Tre Province, second period, 2014 by DONRE

3.2.2 SOCIAL SITUATIONS

1) Administrative Areas and Population

The Ben Tre Province consists of 8 districts and 164 communes. Table 3.2.6 shows the surface areas, populations, and density of the districts belonging to Ben Tre Province.

Table 3.2.6 Surface areas and populations of districts/city of Ben Tre Province

No.	District/city	Surface area (km ²)	Population in 2014 (pers.)	Population density (pers./km ²)
1	Ben Tre City	71.1	120,749	1,698
2	Chau Thanh	225.1	164,037	729
3	Cho Lach	167.6	109,387	653
4	Mo Cay Nam	222.1	145,966	657
5	Mo Cay Bac	158.2	109,151	690
6	Giong Trom	313.2	167,203	534
7	Binh Dai	421.5	130,998	311
8	Ba Tri	358.4	187,161	522
9	Thanh Phu	422.7	127,553	302
	Total	2,359.9	1,262,205	535

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

2) Ethnic People

Majority of residents in Ben Tre Province are Kinh people. However, there are minority groups including Chinese, Muong, Tay, Khmer, and Cham ethnic people living in Giong Trom District (Thach Phu Dong Commune), Chau Thanh District (Phu Duc Commune, Tien Long Commune), and Binh Dai District (Long Dinh Commune). The people of the minority groups are living together with Kinh people, and use Vietnamese language in daily life. Significant difference in custom is not observed between the majority group and the minority groups.

3) Land Use Situation

Table 3.2.7 shows current land use situation of Ben Tre Province. Agriculture land occupies a large portion of total land (about 61%). Among them, a large part of land is used for cultivating fruit trees. Only a relatively small part of land is used for paddy.

Table 3.2.7 Current land use situation (as of Jun 1, 2014) (unit: ha)

No.	District/city	Agriculture land	Forest land	Land for special use	Residential land
1	Ben Tre City	5,082	-	649	507
2	Chau Thanh	16,444	-	934	1,072
3	Cho Lach	10,563	-	366	653
4	Mo Cay Nam	16,865	-	735	1,046
5	Mo Cay Bac	12,988	-	428	751
6	Giong Trom	24,617	-	1,268	1,130
7	Binh Dai	15,308	2,854	1,936	849
8	Ba Tri	21,515	1,531	2,728	1,006
9	Thanh Phu	20,599	2,670	1,583	715
	Total	143,981	7,055	10,627	7,729

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

4) Agricultural Products

Among agricultural products of the Ben Tre Province, fruits (such as coconut, orange, longan, grapefruit, durian, and rambutan), cacao and sugarcane are widely known. Coconut trees are widely

cultivated in Ben Tre Province because of their ability to recover from the damage by seawater. A large part of land in the northern part of the province is used for cultivating orange, longan, and grapefruit, etc. since there is relatively rich freshwater during all seasons

Table 3.2.8 and Table 3.2.9 show the change in cultivated land area and fruit production in the province during the period from 2010 to 2014. The land area and production of orange, mango, longan, and cacao are gradually decreasing, while those of grapefruit, rambutan, and coconut trees are likely to increase continuously.

Table 3.2.8 Change in Land Area of Fruit Tree Cultivation by Years (unit: ha)

Fruit Name	2010	2011	2012	2013	2014
Orange	4,631	3,142	2,634	2,007	1,993
Lemon	1,903	1,572	1,459	1,828	1,897
Grapefruit	4,422	4,144	4,528	4,754	5,372
Banana	2,527	2,664	2,401	2,387	2,076
Mango	1,328	1,077	761	687	650
Longan	6,249	5,360	4,884	4,609	4,123
Rambutan	3,941	5,010	5,428	5,437	5,557
Coconut	51,560	55,870	58,441	63,000	67,382
Cacao (grown in coconut garden)	6,333	7,478	8,243	5,211	2,792

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 3.2.9 Change in Fruit Production by Years (unit: ton)

Fruit Name	2010	2011	2012	2013	2014
Orange	35,568	22,929	20,171	14,907	15,463
Lemon	20,959	16,314	14,444	16,499	19,325
Grapefruit	33,921	35,997	38,650	35,312	41,051
Banana	36,879	41,568	38,189	40,283	33,618
Mango	10,186	8,557	6,228	5,527	5,526
Longan	62,032	50,523	39,999	42,612	39,459
Rambutan	67,602	84,322	85,640	96,919	109,800
Coconut	420,172	427,862	470,342	493,205	525,813
Cacao (grown in coconut garden)	21,636	26,939	29,987	20,631	14,964

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

On the other hand, there is a downward tendency in paddy cultivation. As shown in Table 3.2.10 and Table 3.2.11, paddy production is decreasing year by year.

Table 3.2.10 Tendency of paddy production (unit: ton)

Year/crop	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Winter-spring	96,436	104,178	112,609	118,262	124,170	121,194	105,646	115,601	96,257	105,000
Summer-autumn	90,272	86,447	97,089	103,409	96,320	90,977	107,659	105,209	87,864	82,484
Autumn-winter	154,683	141,839	95,085	139,446	142,200	154,639	148,863	154,192	147,368	131,415
Total	343,396	334,470	306,790	363,125	364,699	368,820	364,179	377,014	333,502	320,913

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 3.2.11 Tendency of Paddy Field Area (unit: ha)

No.	District/city	2010	2011	2012	2013	2014
1	Ben Tre City	1,286	1,099	975	817	653
2	Chau Thanh	4,255	4,058	3,396	2,586	1,877
3	Cho Lach	36	26	19	14	6
4	Mo Cay Nam	568	515	410	308	267
5	Mo Cay Bac	1,416	1,163	981	689	363
6	Giong Trom	11,980	11,692	11,550	10,643	9,225
7	Binh Dai	6,180	5,816	5,345	4,521	4,212
8	Ba Tri	39,332	37,703	39,292	39,178	37,998
9	Thanh Phu	15,175	14,890	13,895	13,481	11,993
	Total	80,228	76,962	75,863	72,237	66,594

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

5) Fishery

Fishery production is constantly increasing since 2005. Particularly, in 2010 and 2011, there was significant increase of 51% in fishery production (see Table 3.2.12)

Table 3.2.12 Tendency of fishery production (Unit: million ton)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Capture fishery	994	1,060	1,172	1,398	1,795	3,502	5,261	7,492	7,496	7,429
Aquaculture	2,169	2,687	3,179	3,724	3,963	5,199	7,889	7,991	9,818	11,163
Total	3,163	3,747	4,351	5,122	5,758	8,701	13,150	15,483	17,314	18,592
Ratio	-	18%	16%	18%	12%	51%	51%	18%	12%	7%

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 3.2.13 shows the change in land area for fish/shrimp aquaculture production in Ben Tre Province since 2010. A large part of the coastal area in the east of the province is being used for shrimp aquaculture with saline water. There was a boom in shrimp aquaculture since 2000. Many farmers have stopped paddy cultivation and changed their paddy fields into shrimp ponds. If the breeding goes well, shrimp aquaculture can provide farmers with high profit.

However, investment cost for shrimp aquaculture is high, and it is usually accompanied with high risks of shrimp disease. There are many reports about the farmers having heavy debt due to the unsuccessful shrimp aquaculture because the shrimp dies under the water polluted caused by the extensive use of industrial foods and chemicals. Recently, in order to avoid this high risk, the farmers attempt to cultivate paddy in combination with shrimp aquaculture. With this cultivation model, a lot of land may be used in rotation for paddy cultivation in the rainy season, and for extensive shrimp cultivation with saline water in the dry season.

Table 3.2.13 Change in Area for Fishery Production by Years (unit: ha)

	2010	2011	2012	2013	2014
Shrimp cultivation land	33,231	33,565	33,153	36,337	38,891
Fish cultivation land	4,083	4,243	4,686	4,059	4,081
Other cultivation lands	5,176	5,265	5,396	4,400	4,094
Total	42,490	43,073	43,235	44,796	47,066

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 3.2.14 shows the area change in several fishery aquaculture methods in the recent years. The area for intensive aquaculture was significantly extended from 6,332 ha in 2012 to 10,521 ha in 2013. On the other hand, as shown in Table 3.2.15, there was not significant change in the areas for freshwater aquaculture and saline water aquaculture, but the areas for brackish water aquaculture were significantly extended since 2013.

Table 3.2.14 Change in Area of Several Aquaculture Methods (unit: ha)

	2010	2011	2012	2013	2014
Area for intensive aquaculture	6,648	6,918	6,332	10,521	12,681
Area for semi-intensive aquaculture		450	236	345	271
Area for extensive aquaculture and improved aquaculture	35,842	35,705	36,666	33,930	34,113
Total	42,490	43,073	43,234	44,796	47,065

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

Table 3.2.15 Change in Area for Freshwater, Brackish Water, and Saline Water Aquaculture (unit: ha)

	2010	2011	2012	2013	2014
Area for freshwater aquaculture	6,524	6,103	6,500	5,374	5,568
Area for brackish water aquaculture	31,893	32,833	32,398	35,583	37,884
Area for saline water aquaculture	4,072	4,137	4,337	3,839	3,613
Total	42,489	43,073	43,235	44,796	47,065

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

As shown in Table 3.2.16, there was a significant increase in shrimp production in the three coastal provinces of Binh Dai, Ba Tri, and Thanh Phu during 2013. The high price of shrimp in the market and the successfully implemented measures to prevent shrimp disease are considered as the main factors leading to this increase in shrimp production in this year.

Table 3.2.16 Change in Shrimp Production in the Districts by Year (unit: ton)

		2010	2011	2012	2013	2014
1	Ben Tre City	16	25	30	46	24
2	Chau Thanh	129	123	120	102	114
3	Cho Lach	3	3	2	-	-
4	Mo Cay Nam	367	275	249	97	224
5	Mo Cay Bac	179	190	110	35	53
6	Giong Trom	216	254	172	427	925
7	Binh Dai	16,410	21,894	19,234	30,454	26,068
8	Ba Tri	5,251	8,080	8,759	12,022	10,428
9	Thanh Phu	6,636	7,493	7,120	10,406	18,110
	Total	29,207	38,337	35,796	53,589	55,946

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

6) Number of employees by main business entities/administrative agencies

Table 3.2.17 shows the change in number of employees by main business entities/administrative agencies in Ben Tre Province.

Table 3.2.17 Change in number of employees by main enterprises/agencies

(Unit: pers)

Business activities	2009	2010	2011	2012	2013
Agriculture, forestry, and fishery	6,048	3,756	4,543	4,454	4,362
Mining, quarrying	69	78	142	143	85
Manufacturing	17,421	18,228	26,828	30,926	37,899
Electricity, gas, steam and air conditioning supply	215	216	986	956	191
Water supply, sewerage, waste management and remediation activities	437	455	450	481	543
Construction	3,898	4,234	4,983	5,384	5,669
Wholesale and retail trade, repair of motore vehicles and motorcyles	5,489	5,795	6,372	6,335	5,887
Transportation and storage	935	823	727	786	492
Accomodation	174	159	292	434	461
Food and beverage service activities	241	293	220	268	250
Telecommunication	8	8	608	538	722
Financial, banking and insurance activities	121	115	170	204	211

Business activities	2009	2010	2011	2012	2013
Real estate activities	12	15	73	62	73
Professional, scientific and technical activities	407	446	579	615	676
Administrative and support service activities	758	807	717	709	778
Education	13	10	8	6	35
Human health and social work activities	20	21	137	160	170
Art, entertainment and recreation	118	111	82	124	150
Other service activities	5	30	17	23	27
Total	36,389	35,600	47,934	52,608	58,681

Source: Statistical Year Book Ben Tre 2014, Ben Tre Statistical Office (2015)

7) Literacy Rate and Basic Education Facilities

According to website of the General Statistics Office of Vietnam, the literacy rate among people with more than 15-year old in Ben Tre Province in the first months of 2014 is 95.1%. It slightly exceeds the national average literacy rate (94.7%). However, according to website of Ben Tre Province People Committee, this rate is 99.3% for people with age of 15~35, and 98.3% for people with age of higher than 36.

The number of basic educational facilities in the province are as followings: 174 kindergartens (schooling rates: 8.7% for children with age of 0~2, 75.1% for children with age of 3~5); 190 elementary schools (schooling rate: 100% for children with age of 6); 133 junior high schools (schooling rate: 96.3%) (source: <http://www.bentre.gov.vn/>)

8) Waterborne Diseases

Table 3.2.18 shows the number of registered waterborne diseases in Ben Tre Province. Number of diarrhea cases (which is considered as a typical water-related disease) is still considerable high.

Table 3.2.18 Number of registered cases of waterborne diseases in Ben Tre Province

Waterborne diseases	2012	2013	2014
Cholera	0	0	0
Typhoid fever	15	16	5
Dysntery syndrome	22	-	-
Shigellosis	222	165	276
Amebiasis	57	136	15
Diarrhea	14,028	13,535	12,029
Dengue	879	711	685

Source: Ben Tre Preventive Healthcare Center

3.3 LEGAL AND INSTITUTIONAL FRAMEWORK IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

3.3.1 LEGAL AND INSTITUTIONAL FRAMEWORK IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

1) Legal Framework in Vietnam Relevant to EIA

Table 3.3.1 lists the main laws and regulations on environmental protection in Vietnam.

Table 3.3.1 Main Laws and Regulations on Environmental Protection in Vietnam

Date of Issue	Code/Number	Title
2000/08/08	Circular No. 10/2000/TT-BXD	Guiding the formulation of EIA report for a construction project
2002/06/26	Decision No. 82/2002/QD-TTg	Establishment, Mandate and Operations of the Vietnam Environment Protection Fund
2002/07/16	Decision No. 53/2002/QD- BKHCNMT	Promulgating the Organization and Operation Charter of Vietnam Environmental Protection Fund (expired)

Date of Issue	Code/Number	Title
2002/08/09	Decision No. 62/2002/QD-BKHCMNT	Promulgating the Regulation on the Protection of the Environment in Industrial Parks
2002/11/11	Decree No. 91/2002/ND-CP	Prescribing the Functions, Tasks, Powers and Organizational Structure of the Ministry of Natural Resources and Environment
2003/04/02	Decision No. 45/QD-TTg	Establishment of provincial Department of Natural Resources and Environment.
2003/05/08	Decision No. 600/2003/QD-BTNMT	Specifying mandates, responsibilities; powers and organizational structure of the Department of Water Resources Management
2003/06/23	Decision No. 782/2003/QD-BTNMT	Promulgating the Charter on organization and operation of Vietnam Environment Protection Fund
2005/12/12	Order No. 29/2005/L-CTN	Law on Environmental Protection
2005/12/12	Decision No. 328/2005/QD-TTg	Approving the state plan on environmental pollution control till 2010
2006/06/23	Decree No. 65/2006/ND-CP	Organization and Operation of the Natural Resources and Environment Inspectorate
2006/08/09	Decree No. 80/2006/ND-CP	Providing detailed guidelines for Implementation of a Number of Articles of the Law on Environmental Protection
2006/08/09	Decree No. 81/2006/ND-CP	Sanctioning of Administrative Violation in the Domain of Environmental Protection
2006/09/08	Circular No. 13/2006/TT-BTNMT	Stipulation of organizations and operation of the assessment board for reports on Strategic Environmental Assessment (SEA) and EIA
2006/09/09	Circular No. 08/2006/TT-BTNMT	Guiding the preparation of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment
2006/11/22	Decree No. 140/2006/ND-CP	Providing for the Environmental Protection at Stages of Elaboration, Evaluation, Approval and Implementation of Development Strategies, Planning, Plans, Programs and Projects
2007/08/27	Circular No. 06/TT-BKH	On environmental protection in appraising and approving programs and projects
2007/08/27	Decision No. 1281/QD-BTNMT	Authorizing directors of departments to review and approve the EIA reports
2007/11/26	Decision No. 19/2007/QD-BTNMT	Promulgating the Regulation on the conditions for and provision of the service of appraising environmental impact assessment reports
2008/02/28	Decree No. 21/2008/ND-CP	Amending and supplementing a number of articles of the Government's Decree No. 80/2006/ND-CP of August 9, 2006, detailing and guiding the implementation of a number of articles of the Law on Environmental Protection (Note *)
2008/07/15	Circular No. 03/2008/TTLT-BTNMT-BNV	Guiding the functions, tasks, powers and organizations of the natural resources and environment related specialized units under the people's committees at all levels
2008/09/15	Decree No. 102/2008/ND-CP	On the collection, management, exploitation and use of natural resources and environmental data
2008/09/18	Circular No. 04/2008/TT-BTNMT	Guiding the formulation and approval or certification of environmental protection schemes and the examination and inspection of implementation of environmental protection schemes
2008/09/30	Decision No. 132/2008/QD-TTg	On function, tasks, responsibilities, and organization structure of Vietnam Environmental Protection Administration under MONRE
2008/12/08	Circular No. 05/2008/TT-BTNMT	Replace Circular 08/2006/TT-BTNMT on Guiding the preparation of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment
2009/11/16	Circular No. 25/2009/TT-BTNMT	On the promulgation of National Technical Regulations on Environment.
	Circular No. 39/2010/TT-BTNMT	National Technical Regulations on Environment.
	Circular No. 09/2010/TT-BTNMT	On environmental protection in developing transport infrastructure
2010/03/18	Circular No. 08/2010/TT-BTNMT	Stipulation on the preparation of national environmental report, sectorial environmental situation report, and provincial environmental status report
2010/04/06	Circular No. 09/2010/TT-BGTVT	Stipulation on environmental protection for transportation infrastructure development projects
2011/04/14	Circular No. 12/2011/TT-BTNMT	On management codes of harmful wastes

Date of Issue	Code/Number	Title
2011/04/18	Decree No. 29/2011/ND-CP	Stipulation on strategic environmental assessment (SEA), environmental impact assessment (EIA), and environmental protection commitment (EPC) (Replaced by Decree 18/2015/ND-CP)
2011/07/18	Circular No. 26/2011/TT-BTNMT	Guiding in detail numbers of articles of Decree No. 29/2011/ND-CP dated 18 April 2011 on strategic environmental assessment (SEA), environmental impact assessment (EIA) and environment protection commitment (EPC).
2012/03/16	Circular No. 01/2012/TT-BTNMT Replaces Circular No. 04/2008/TT-BTNMT	Regulation on setting-up, assessment, approval, inspection and certification of the implementation of detailed environmental protection project; setting-up and registration of simple environmental protection project
2013/11/14	Decree No. 179/2013/ND-CP	Decree on the sanction of administrative violations in the domain of environmental protection
2014/03/25	Decision No.25/2014/QD-TTg	Stipulation on function, responsibility, right, and organization structure of Vietnam Environmental Administration (VEA)
2014/04/29	Decree No. 35/2014/ND-CP (came into effect on 15 June 2014)	Amending and supplementing a number of articles of the Government's Decree No. 29/2011/ND-CP of stipulation on strategic environmental assessment (SEA), environmental impact assessment (EIA), and environmental protection commitment (EPC). (Replaced by Decree 18/2015/ND-CP))
2014/05/05	Circular No. 22/2014/TT-BTNMT	Providing regulations and guidelines on the implementation of Decree No. 35/2014/ND-CP dated 29 April 2014 amending and supplementing a number of articles of Decree No.29/2011/ND-CP dated 18 April 2011 providing for the strategic environmental assessments, environmental impact assessments and environmental protection commitments
2014/06/23	Law No.55/2014/QH13	Law on Environmental Protection (2nd revision) (Note*)
2014/08/28	Circular No.50/2014/TTLT-BTNMT-BNV	On function, responsibility, right, and organization structure of agency in charge of natural resources and environment in provinces, cities, districts.
2015/01/06	Decree No.03/2015/ND-CP	Stipulations on confirmation of damages to environment
2015/02/14	Decree No.18/2015/ND-CP	Stipulations on environmental protection master plan, strategic environmental assessment, environmental impact assessment, and environmental protection plan. (Note *)
2015/02/14	Decree No.19/2015/ND-CP	Stipulations on the implementation of several articles of Environmental Protection Law. (Note *)
2015/05/29	Circular No.27/2015/TT-BTNMT	Providing guidance on a number of articles of Law on Environmental Protection 2014 and Decree 18/2015/ND-CP on strategic environmental assessment, environmental impact assessment, and environmental protection plan. (Note *)

Source: MONRE, Vietnam

Note *: Law or regulation which should be especially considered for the EIA of the Project.

In addition, the Vietnamese government has signed 32 international environmental conventions/agreements/ treaties up to date, and additional six (6) international environmental conventions/agreements/ treaties are under review (refer to the document “Register of International Treaties and Other Agreements in the Field of the Environment”, published by UNEP in 2005, and the website of the Vietnam Environmental Protection Agency). Table 3.3.2 lists the main international conventions/agreements/ treaties related to environmental protection, which Vietnamese government has signed.

Table 3.3.2 List of International Environmental Conventions/ Agreements/ Treaties signed by Vietnam

No.	Name	Effective Date in Vietnam	Management Body
1.	Cartagena Protocol on Biosafety	2004Ac	VEPA, MONRE
2.	Kyoto Protocol on Climate Change	2002R	GDMH, MONRE
3.	Stockholm Convention on Persistent Organic Pollutants (POPs)	05/2001R	VEPA, MONRE
4.	UN's International Declaration on Cleaner Production	22/9/1999	MPI
5.	UN Convention to Combat Desertification	23/11/1998Ac	MARD

No.	Name	Effective Date in Vietnam	Management Body
6.	Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal	13/03/1995Ac	VEPA, MONRE
7.	Agreement on Cooperation for the Sustainable Development of the Mekong River Basin	1995S	MFA
8.	United Nations Convention on the Law of the Sea (UNCLOS)	25/07/1994R	MFA
9.	Vienna convention for the protection of the ozone layer including the Montreal Protocol on Substances that Deplete the Ozone Layer	26/01/94Ac	GDMH
10.	United Nations framework Convention on Climate Change	16/11/1994R	MONRE
11.	Convention on Biological Diversity (CBD)	16/11/1994R	VEPA, MONRE
12.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	20/01/1994R	MARD
13.	MARPOL International Convention for the Prevention of Pollution from Ships	29/08/1991S	VNMB, MOT
14.	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)	20/9/1988	MONRE, MARD
15.	Convention Concerning the Protection of the World Cultural and Natural Heritage	10/10/1987At	MOCI
16.	Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Under discussion	
17.	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction	1998R	NP
18.	Agreement on the Network of Aquaculture Centers in Asia and the Pacific	1989	MONRE
19.	Agreement for the Establishment of the Asia-Pacific Fishery Commission	1995At	MOF
20.	Agreement on the Conservation of Nature and Natural Resources	Under discussion	

Source: MONRE, Vietnam

Note: DMH: General Department of Meteorology and Hydrology, MOF: Ministry of Fisheries, VNMB: Vietnam Marine Bureau, MFA: Ministry of Foreign Affairs, MOT: Ministry of Trade, MONRE: Ministry of Natural Resources and Environment, MARD: Ministry of Agriculture and Rural Development, MPI: Ministry of Planning and Investment, MOH: Ministry of Health, MOST: Ministry of Sciences and Technologies, MOT: Ministry of Transportation, MOCI: Ministry of Culture and Information (now the Ministry of Culture, Sport and Tourism), NP: National President.;

S: Signed, R: Ratified, At: Accepted, Ap: Approved, Ac: Accession

2) Law on Environmental Protection

In Vietnam, the Law on Environmental Protection (LEP) is the over-arching law as well as the most comprehensive legal base in terms of environmental protection. Its first version was approved in 1993, and it was first amended in 2005, and then in 2014. The Law on Environmental Protection amended in 2014 (hereinafter referred to as “LEP amended in 2014”) was passed on 23 June 2014 by the XIIIth National Assembly (with law code 55/2014/QH13), and became effective on 1 January 2015.

In addition, the Vietnamese government has also issued Decree No. 18/2015/ND-CP and then Decree No. 19/2015/ND-CP to provide instruction and guidance for the implementation of the LEP.

On 29 May 2015, MONRE issued Circular No. 27/2015/TT-BTNMT to provide the detailed guidance for the implementation of the new Law on Environmental Protection (Point c, Clause 1, Article 32); and Decree No. 18/2015/ND-CP (Clause 5 of Article 8, Clause 7 of Article 12, Clause 4 and Clause 6 of Article 14, Clause 2 of Article 16, Clause 4 of Article 17, Clause 5 of Article 19 and Clause 4 of Article 21).

Circular No. 27/2015/TT-BTNMT has the following contents::

Chapter I	GENERAL PROVISIONS
Article 1.	Scope
Article 2.	Regulated entities
Chapter II	STRATEGIC ENVIRONMENTAL ASSESSMENT
Article 3.	Implementation of SEA
Article 4.	SEA report appraisal
Article 5.	Receiving opinions of appraisal, and reporting result of appraisal of SEA report
Chapter III	ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
Article 6.	Application for appraisal of the EIA report
Article 7.	Consultation during the implementation of EIA
Article 8.	Appraisal of the EIA report
Article 9.	Approval for the EIA report
Article 10.	Responsibility of the project owner after obtaining the approval of the EIA report
Article 11.	Authorizing the management board of the industrial parks to assess and approve the EIA report
Chapter IV	INSPECTION AND CERTIFICATION OF ENVIRONMENTAL PROTECTION WORKS SERVING THE OPERATION PHASE
Article 12.	Report on performance of the environmental protection works serving the operation phase
Article 13.	Inspection of the environmental protection works serving the operation phase
Article 14.	Working rules of the inspectorate
Article 15.	Responsibility and entitlement of inspectorate members
Article 16.	Contents and format of the record of inspection result of the environmental protection works serving the operation phase
Article 17.	Issuance of the certificate of completion of the environmental protection works.
Chapter V	SEA REPORT APPRAISAL COUNCIL AND EIA REPORT APPRAISAL COUNCIL
Article 18.	Composition and working rules of the SEA report appraisal council and EIA report appraisal council
Article 19.	Conditions and criteria for titles of the appraisal council
Article 20.	Responsibility of the appraisal council member
Article 21.	Entitlement of the appraisal council member
Article 22.	Responsibility and entitlement of the chairman, the vice chairman and the critic members of the appraisal council
Article 23.	Responsibility and entitlement of Secretary
Article 24.	Responsibility and entitlement of the council member who is the representative of Department of Natural Resources and Environment in the appraisal council established by ministries or ministerial-level agencies
Article 25.	Responsibility of the standing appraisal agency
Article 26.	Conditions for holding the official meeting of the appraisal council
Article 27.	Consultation with Department of Natural Resources and Environment in case of absence of its representative in the appraisal council established by ministries or ministerial-level agencies
Article 28.	Delegates attending meetings of the appraisal council
Article 29.	Contents and procedures for the official meeting of the appraisal council
Article 30.	Contents of the conclusion of the appraisal council
Article 31.	Format and contents of the minutes of the official meeting of the appraisal council
Chapter VI	THE ENVIRONMENT PROTECTION PLAN
Article 32.	Responsibility for certification of registration of the environment protection plan
Article 33.	Dossier on registration of the environment protection plan
Article 34.	Certification of registration of the environment protection plan
Article 35.	Implementation of the environment protection plan

Chapter VII	AGENCIES OBLIGATORY TO IMPLEMENTATION
Article 36.	Transitional provision
Article 37.	Agencies obligatory to the implementation of the circular
Article 38.	Effect

Source: MONRE, Vietnam

It is expected that MONRE will issue other circulars to provide further guidance on the implementation of LEP and Decree 18/2015/ND-CP. However, the procedure to prepare, apply, appraise, and approve EIA reports may not be different from the current procedure as shown in Figure 3.3.1

For this Project, the EIA was re-prepared because of the change of the Project scope. As a result of the confirmation with related local institutions, the EIA of this Project is going to be revised by a local project implementing institution referring to the result of the environmental and social consideration survey of this JICA preparatory study.

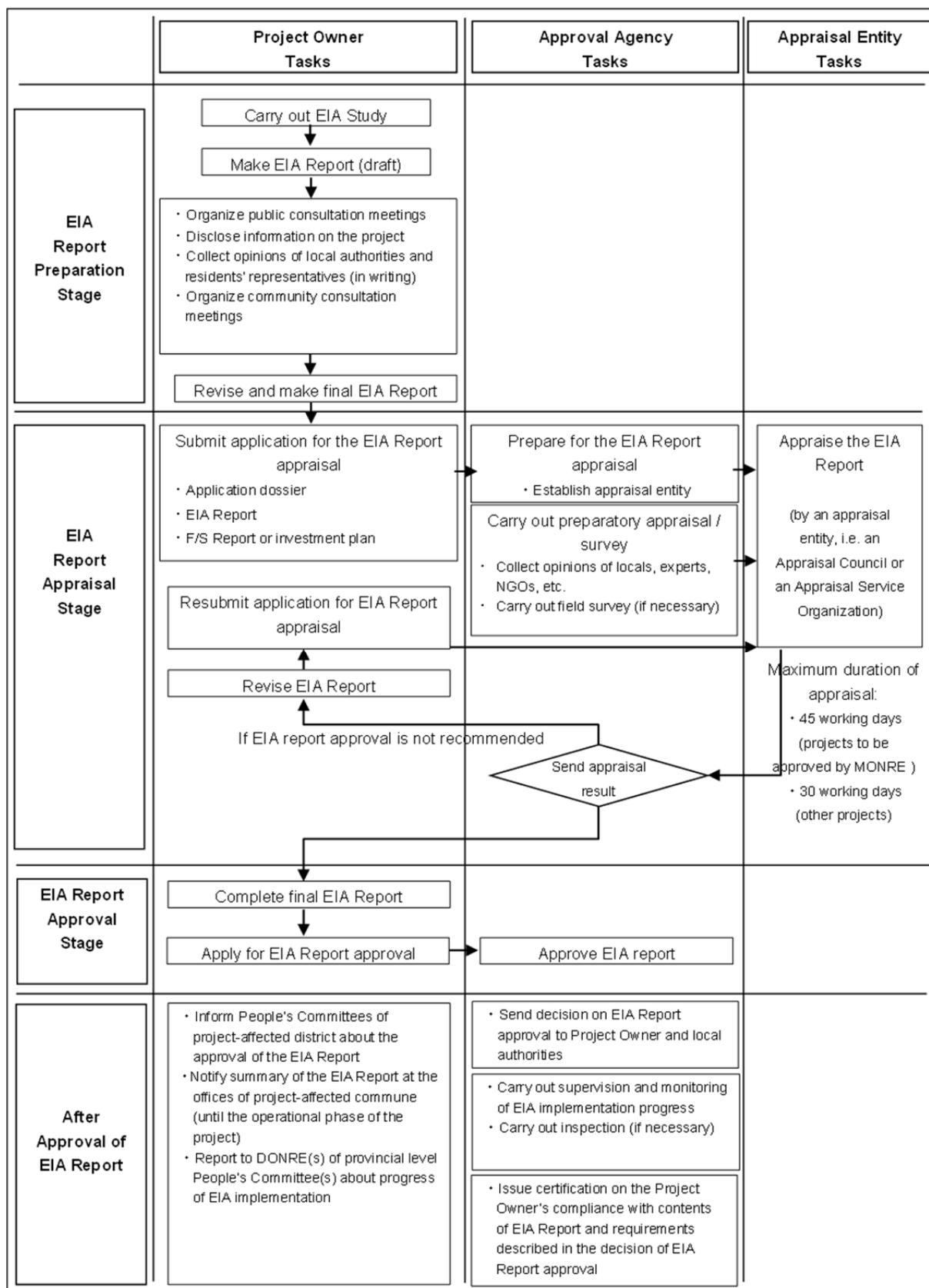


Figure 3.3.1 Procedure for Preparation, Appraisal and Approval of EIA in Vietnam

Source: MONRE, Vietnam

3) Legal Framework in Vietnam Relevant to Land Acquisition and Resettlement

The Land law (issued in 1993 and revised in 2003 and in 2013) is the over-arching law that regulates issues on land administration, in general, and land acquisition, in particular. As shown in Table 3.3.3, there are many laws and regulations relating to the issues of land acquisition for development projects. In addition, each People's Committee of local province/city has to stipulate its own regulations to govern issues of land acquisition in its own territory. Table 3.3.4 shows the decisions issued by the Ben Tre Province PC on land prices, property prices, and compensation, support and resettlement when the land in Ben Tre Province is acquired by the state.

Table 3.3.3 Laws and regulations relating to land use right, land acquisition, etc. in Vietnam

Date of issuance	Title and content
20/04/2007	Ordinance 34/2007/PLUBTVQH11 (issued by National Assembly) on the exercise of democracy at commune/ward/town level, regulating issues need to be public to people, including information on "the projects, investments and priorities, implementation progress, compensation plan, support for site clearance, resettlement related to projects/work in commune, etc."
11/11/2009	Decree 105/2009/ND-CP (issued by Central Government) stipulating penalties for administrative violations in land issues
16/11/2012	Decision 52/2012/QĐ-TTg (issued by Prime Minister) stipulating policy on support for job creation and vocational training to labors whose agricultural land is acquired
23/04/2013	Decree 38/2013/ND-CP (issued by Central Government) on management and use of ODA sources and other concessionary loan
29/11/2013	Law on Land 45/2013/QH13, passed by National Assembly, comprehensive stipulations on land management.
09/01/2014	Circular 01/2014/TT-BKHDT guiding a number of articles of Decree 38/2013/ND-CP.
15/05/2014	Decree 43/2014/ND-CP (issued by Central Government) detailing a number of articles of the Law on Land 2013 (in replace to Decree 181/2004/ND-CP, Decree 17/2006/ND-CP, Decree 84/2007/ND-CP, Decree 69/2009/ND-CP, and Decree 88/2009/ND-CP)
15/05/2014	Decree 44/2014/ND-CP (issued by Central Government) on regulations on land price (in replace to Decree 188/2004/ND-CP and Decree 123/2007/ND-CP)
15/05/2014	Decree 45/2014/ND-CP (issued by Central Government) on the collection of land use charge.
15/05/2014	Decree 46/2014/ND-CP (issued by Central Government) on the collection of land rent and water surface rent.
15/05/2014	Decree 47/2014/ND-CP (issued by Central Government) regulations on compensation, support, and resettlement upon land expropriation by the State (in replace to Decree 197/2004/ND-CP).
30/06/2014	Circular 30/2014/TT-BTNMT (issued by MONRE) on land pricing method, compilation of and adjustment to land price lists, determination of specific land prices and consultancy on land pricing.
30/06/2014	Circular 37/2014/TT-BTNMT (issued by MONRE) detailed stipulation on compensation, supports, and resettlement upon land expropriation by the State.
27/01/2015	Circular 02/2015/TT-BTNMT (issued by MONRE) detailed stipulations on a number articles of Decree 43/2014/ND-CP and Decree 44/2014/ND-CP.

Source : JICA survey team (2016)

Table 3.3.4 Decisions recently issued by Ben Tre Province PC on land price, property price, and land acquisition in the province territory

Date of issuance	Title and content
19/11/2013	Decision No 43/2013/QĐ-UBND on land price in Ben Tre Province in 2013
09/11/2013	Decision No 40/2013/QĐ-UBND on unit price of house, new constructive architecture in Ben Tre Province.
31/12/2014	Decision No 40/2014/QĐ-UBND on compensation, support and resettlement when land acquisition by the State locating in Ben Tre Province.

Source : JICA survey team (2016)

a) Land Law (2013)

The Land Law of 2013 prescribes the legal frameworks of land use rights, powers and responsibilities of the state in managing land throughout the country. As stipulated in the Land Law, lands may be allocated to land users who have legal land use rights, and these rights can be transferred to others. The State has the right to appropriate land for the projects with national or public interest, including

ODA projects. Such land acquisition (land recovery) concepts are elaborated in Chapter 6 of the Land Law 2013.

It is critical that the new Land Law address prevailing gaps and shortcomings, yet also create a more favorable enabling environment for the more effective, equitable, and environmentally sustainable management of scarce land resources. In comparison with the 2003 Land Law, the new Land Law has 14 chapters with 212 articles, with an increase of 7 chapters and 66 articles. The new Land Law (revised) puts forth clearer and more specific regulations on the right of the state, as a representative of the whole people, of land ownership and responsibility over land. New regulations on state management over land are also added.

The state will have the authority to acquire land of people or organizations for the purpose of national security, defense, socio-economic development, public benefit projects or in cases where land is not being used in accordance with land-use certificates. Law and regulations clearly define the specific circumstances in which the state must acquire land (as adopted in the constitution).

The revised issues include the responsibility and authority of state-owned agencies in the area of land; the acquisition, assignment, hiring, and transfer of land use purpose, and granting of land use right certificates; price of land, land use fee, land hiring, compensation; and the right and responsibility of land users.

Regulations on land in the agricultural sector continue to be completed in detail in the decrees guiding to implement the Land Law. The regulations work to lengthen the time for the assignment of agricultural land within families and individuals; encouraging the hire of land use rights to reserve land for increasing agricultural and rural industrialization and modernization; strictly managing land use for rice planting and forestland to ensure national food security and environmental protection.

The Law also includes regulations to increase people's participation in land planning and use, solutions to compensation, support and resettlement to make land management more transparent and open to the public, contributing to prevent wrongdoing, corruption, waste, and reducing complaints on land. The Law has added new regulations on information systems, monitoring systems, ensuring openness and transparency. The Land Law also mentions land evaluation, pricing, and its publication.

According to Article 33 of the Land Law, a People's Committee at provincial level shall establish a land price framework and price list (tariffs) every 5 years starting in 2015 based on the price framework provided by Ministry of Natural Resources and Environment. However, Article 114 provides the list of cases using land price table and according to that, compensation for land acquisition is not covered by the 5 years' updating price system. Based on Provision 4 of Article 114, unit price of compensation for land acquisition belongs to special cases and are determined by independent evaluating method.

In addition to compensation for land and structures, the Land Law stipulated principles of compensation for the damage to assets and the damage incurred due to stopped production and business when the state recovers land in Article 88, and compensation for plants and livestock in Article 90.

For special cases of compensation, assistance and resettlement, Clause 2 of Article 87 stipulated that: "For projects using loans from international or foreign organizations for which Vietnam has committed to a policy framework for compensation, support and resettlement, that framework policy shall apply."

b) Decree No. 43/2014/ND-CP

This Decree covers and describes some specific articles of the Land Law as shown below:

- The system of land management office,
- Land use plan,
- Land acquisition, land distribution, land lease, change of land purpose,
- Land registration, land use right, ownership of properties on the land,
- Land use framework, and
- Land management and administrative procedures

c) Decree No. 44/2014/ND-CP

The Decree defines the determination of land price based on the Land Law as shown below:

- Land price determination method; such as the sales comparison approach, income approach, and discount cash flow method, etc.,
- The land price framework managed by MONRE is the basis for the land price tariff determined by a People's Committee at the provincial level, and
- Consultancy services for land price determination.

However, this land pricing system is not applicable to land acquisition by the state based on e), 4, of Article 114 of the Land Law, where "Specific land price" are defined. Based on this regulation under the new Land Law (2013), the most important function of this decree in terms of resettlement is Section 3: Specific Land Price in Chapter 2, which shows the measures for evaluating and calculating compensation amounts.

d) JICA's Policy on Involuntary Resettlement

The policy provisions on involuntary resettlement of JICA are shown in the JICA Guidelines for Environmental and Social Considerations. Item 3 of Article 2.6 in this guideline describes, "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Therefore, the main documents relevant to the land acquisition and resettlement of the Project are:

- JICA Guidelines for Environmental and Social Considerations (2010),
- The World Bank's Safeguard Policies (Operational Policy / Bank Policy 4.12 and its Annex in particular), and
- Involuntary Resettlement Sourcebook (the World Bank).

e) Policy Gap

Policy gaps related to land acquisition and resettlement were analyzed by comparing the JICA Guidelines for Environmental and Social Considerations and the Vietnamese legal system (see Table 3.3.5 below for the result of the gap analysis). Referring to past projects in Vietnam, key gaps or notable points were discussed.

As stipulated in Clause 2, Article 87 of the Land Law, the Project is one of the special cases and committed policies between Government of Vietnam (GOV) and development partners, JICA Guidelines for Environmental and Social Considerations, in this case, shall apply principally. It is also confirmed as "in case there is gap between Vietnamese regulations and the JICA's involuntary resettlement Policy, legal basis which assure that the JICA's Involuntary Resettlement Policy shall take precedence if necessary."

3.3.2 GAP ANALYSIS WITH JICA ENVIRONMENTAL GUIDELINES

Table 3.3.5 shows the gaps between JICA Guidelines for Environmental and Social Considerations and relevant Vietnam legal framework for EIA.

Table 3.3.5 Gaps between JICA Environmental and Social Considerations Guidelines and Vietnam Legal Framework for EIA

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
Underlying principles		
1. Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	According to the new Law on Environmental Protection, implementation of strategic environment assessment (SEA) is required before stage of F/S, for general strategy and planning for socio-economic development of keys regions, centrally governed cities, industrial zones, etc. Only for the project which causes significant impacts (as listed up in Appendix II of Decree 18/2015/ND -CP), implementation of EIA is required during F/S stage.	In this Preparatory survey, the environmental assessment is carried out based on the framework of EIA report stated in JICA Guidelines for Environmental and Social Considerations (JICA Guidelines) and World Bank Operational Policy (OP).
2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social, and technical analyses of projects.	There is no particular provision on this item in the legal framework on EIA in Vietnam.	Analysis of alternatives and mitigation measures is carried out in quantitative terms as much as possible.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts.	A project that may cause significant adverse environmental impacts should prepare an EIA report as stipulated in the new Law on Environmental Protection (Article 19) and Decree 18/2015/ND-CP.	In this Preparatory survey, an EIA report is prepared based on both legal frameworks on EIA in Vietnam and in conformity with requirements of JICA Guidelines.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seek their opinions, in order to increase accountability.	There is no particular provision on this item in the legal framework on EIA in Vietnam.	The Study Team intends to monitor and confirm the accountability of the project activities, during its implementation process, through the local stakeholder consultation meetings and other on-site studies. If it observes any identified critical problem, then proper solutions will be examined.
Examination of Measures		
1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures.	Examination of alternatives on the project location was stipulated in Circular 26/2011/ TT-BTNMT. However, such examination is not mentioned in the recently- issued Circular 27/2015/TT-BTNMT.	In the Preparatory survey, several alternatives including zero-option are examined.
2. Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; the costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. Plans for	The structure and content of and EIA report are stated in detail in Appendix 2.3 of Circular 27/2015/TT-BTNMT issued by MONRE on May 29, 2015. According to this Circular, an environmental management plan and an	In the Preparatory survey, an environmental management plan and an environmental monitoring plan are prepared and described in the EIA report in conformity with Vietnam regulations on EIA.

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
projects with particularly large potential adverse impacts must be accompanied by detailed environmental management plans.	environmental monitoring program should be described in detail in Chapter 5 of an EIA report.	
Scope of Impacts to be assessed.		
<p>1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions. It also includes existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.</p>	<p>According to Appendix 2.3 of Circular 27/2015/TT-BTNMT (stipulating in detail a number of articles of Law on Environmental Protection and Decree 18/2015/ND-CP), impacts in pre-construction phase, construction phase, and operation phase should be anticipated and assessed.</p> <p>In pre-construction phase, the suitability of the project location should be assessed.</p> <p>In construction phase and operation phase, all project activities should be identified and impacts caused by these activities should be anticipated and assessed while taking into considerations the source of impact, subject of impact, extent of impact, occurrence frequency of impact, recovering possibility, etc.</p> <p>Major impacts, which need to be assessed as listed in Appendix 2.3 of Circular 27/2015/TT-BTNMT are: (1) impacts to natural environment; (2) impacts to biodiversity; (3) impacts to public health; and (4) impacts to climate change.</p>	<p>It can say that in Vietnam, stipulations on impact assessment for items such as natural environment and pollution are relatively well prepared.</p> <p>There are many detailed provisions, technical specifications, standards, etc. relating to ambient air, water quality, noise, vibration, soil pollution, etc.</p> <p>However, it can say that stipulations on assessment of impacts to social environment of the communities around the project area are not properly mentioned.</p> <p>Under this situation, the following environmental factors will be particularly considered by the JICA Survey Team during the Preparatory survey:</p> <p>(1) local economy (employment, livelihood, etc.); (2) utilization of land, etc.; (3) local resources, social institutions, (4) vulnerable social groups (the poor); (5) equality of benefits and losses; (6) gender, children's rights; and (7) local conflicts of interest.</p>
<p>2. In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.</p>	<p>There is no particular provision on this item in the legal framework on EIA in Vietnam.</p>	<p>In addition to the direct and immediate impacts of the project, the derivative, secondary and cumulative impacts as well as the impacts of projects that are indivisible from the project will be also examined and assessed in this Preparatory survey.</p>
Compliance with Laws, Standards, and Plans		
<p>1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction.</p>	<p>According to Appendix 2.3 of Circular 27/2015/TT-BTNMT, all laws and regulations that form the basis of the EIA study should be listed up in the preface of an EIA report.</p>	<p>The Preparatory survey is planned in conformity with the Law on Environmental Protection and other regulations, technical specifications, standards, etc., on EIA in Vietnam.</p>
<p>2. Projects, in principle, must be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas.</p>	<p>Any project that requires using the land of national parks, wildlife sanctuary, world heritage sites, biosphere reserved, historic -cultural sites, or national scenic beauties should prepare an EIA report as stipulated in Appendix II of Decree 18/2015/ ND-CP. Development project in these areas/sites is not strictly forbidden, but an EIA report should be prepared and approved.</p>	<p>There is no designated protected area or historic-cultural heritage within the project area.</p>

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
Social Acceptability		
1. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.	According to Decree 18/2015/ ND-CP (Article 12), consultation with affected people is carried out through the following methods: (1) Consultation with the People's Committee of communes (commune PCs) where the project is carried out, and with organizations or community under the direct impact of the project; (2) Consultation with the community under the direct impact of the project, in the form of community meeting co-chaired by project owner and the commune PC where the project is carried out together with the participation of representatives of Vietnamese Fatherland Front of communes, socio-political organizations, socio-professional organizations, neighborhoods, villages convened by the commune PC. All opinions of delegates attending the meeting must be sufficiently and honestly stated in the meeting minutes.	In Vietnam, the requirement of carrying out consultation meeting with the project-affected community during the EIA implementation is stipulated by law. However, there is no clear provision which states that project-affected people should be invited to the consultation meetings. The concept of "local stakeholders" is not commonly recognized in Vietnam. In addition, the main objective of the consultation in the communes is just to check whether the communes agree with the project or not. In this Preparatory survey, the following efforts will be paid, aiming to improve local residents' awareness about the project and promote their participation into the project activities. This includes (1) Printing and distribution of a leaflet introducing the outline of the project; (2) Carrying out a socio-economic survey (household survey); (3) Organization of a number of local stakeholder consultation meetings subject directly to project-affected people.
2. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities, and all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society.	There is no particular provision on this item in the legal framework on EIA in Vietnam.	Comments, requests, etc., of vulnerable social groups are collected through the SHCMs, socio-economic surveys (household surveys), etc., and are reflected in RAP and other plans prepared during the project implementation.
Ecosystem and Biota		
1. Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.	An EIA report should be prepared and approved by competent authority for any project that requires deforestation, change in forest land uses, and change in paddy land uses, as stipulated in Appendix II of Decree 18/2015/ ND-CP.	The Preparatory survey is planned to assess the impacts taking into account of critical natural habitats and critical forests.
2. Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging.	Activities that cause damages to natural resources and illegal exploitation of natural resources are prohibited (Article 7 of Law on Environmental Protection).	The project will have permission from competent agency to cut down the mangroves, if needs.
Indigenous Peoples		
1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.	There is no particular provision on indigenous peoples in legal framework on EIA in Vietnam.	Indigenous peoples are not observed in the project area.
2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of	- ditto -	- ditto -

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation.		
3. Measures for the affected indigenous peoples must be prepared as an indigenous peoples plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B.	- ditto -	- ditto -
Monitoring		
1. After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring.	Article 22 of the Law on Environmental Protection stipulates that a chapter on environmental management plan and environmental monitoring program should be prepared as a part of the EIA report.	There is no gap between JICA Guidelines and Vietnam regulations on EIA about the need to formulate the environmental monitoring plan.
2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.	- ditto -	In the stage of F/S or D/D of the project, the environmental management plan (EMP) and the environmental monitoring plan (EMoP) should be updated taking into account of the latest situations.
3. Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.	In Decree 18/2015/ND-CP (Article 16), there is a statement saying: "(... after obtained the EIA approval), the project owner should make an environmental management plan (EMP) on the basis of plan for environmental management and monitoring suggested in the EIA report, and posted it at the premises of the commune PC where the consultation is taken place when implementing EIA." However, in the legal framework on impact assessment in Vietnam, there is no provision on the project owner's obligation to publicize results of monitoring process, and the procedure to settle complaints raised by the public on environmental issues relating to the project.	JICA will discuss with the project proponent about the framework to disclose results of environmental monitoring.
4. When third parties point out, in concrete terms, that environmental and social considerations are not being fully	In actuality, when local residents find out that impacts of water pollution, noise, etc., are intolerable, they can do is	In the construction phase, it needs to establish and enforce a system that can appropriately disclose information

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.	sending the complaints to the head of residential block. However, it is very rare for the complaints to be forwarded to the contractors and properly treated by the contractors.	on monitoring results to local residents, and can get local residents' participation into the tasks to monitor the obligation of contractors.

Source: JICA Guideline, Vietnam Regulations on EIA, arranged by JICA survey team (2016)

3.3.3 GAP ANALYSIS BETWEEN JICA GUIDELINES AND VIETNAM LEGAL FRAMEWORK ON INVOLUNTARY RESETTLEMENT.

Policy gaps related to land acquisition and resettlement were analyzed by comparing the JICA Guidelines for Environmental and Social Considerations and the Vietnamese legal system (see Table 3.3.54.3.6 below for the result of the gap analysis). Referring to past projects in Vietnam, key gaps or notable points were discussed.

Table 3.3.6 Policy gaps between JICA Guidelines and Vietnamese Country System on land acquisition and resettlement

No.	JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for filling gaps
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	N/A	Based on the JICA Environmental Guidelines, land acquisition and resettlement shall be avoided and/or minimized during the process to decide locations of the sluice gates, to plan their structures, and to discuss about any issues related to resettlement.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	N/A	
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	Clause 2 of Article 85 of the Land Law stipulates that "in the concentrated resettlement areas, infrastructure must be developed synchronously, ensuring construction standards and regulations and conformity with the conditions, customs and practices of each region and area".	RAP secures "improve or at least restore their standard of living, income opportunities and production levels to pre-project levels" by using appropriate entitlement matrix.
4.	Compensation must be based on the full replacement cost as much as possible.	[Land] Clause 2 of Article 74 of the Land Law states that "the compensation must be made for the land area which is actually used and does not exceed the agricultural land allocation quota prescribed in Article 129 (e.g. Not exceeding 02 hectares for each type of land). [Structures] Clause 1 and Clause 3 of Article 89 of the Land Law specifies that "the compensation amount is equivalent to the value of new construction facilities with equivalent technical standards prescribed	Replacement Cost Survey (RCS) had been conducted in 2014, and was confirmed again during the Preparatory Survey based on the standard of the JICA Environmental Guidelines. The result is compared with the government's official unit price for determining validity. The result shall be respected for future CAR Plan in Vietnamese domestic procedures. If there are cases stipulated in Clause 2 of Article 77 or Clause 2 of Article 89 of the Land

No.	JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for filling gaps
		<p>by specialized law". However, the case of Clause 2, PAPs except the cases illustrated in Clause 1 does not mention clearly "compensation by replacement cost".</p> <p>In addition, business/production loss and other properties such as plants and livestock are stipulated in the Land Law, however, it is not clearly mentioned "compensation by replacement cost".</p>	Law, compensation and assistance should be given by using concept of the JICA Environmental Guidelines.
5.	Compensation and other kinds of assistance must be provided prior to displacement.	Clause 1 of Article 93 of the Land Law stipulated that "Within 30 days after the decision on the land recovery by a competent state agency takes effect, agencies and organizations in charge of compensation shall pay compensation and support to people whose land is recovered."	Based on the JICA Environmental Guidelines, compensation, assistance, and relocation site have to be done and prepared prior to displacement.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	<p>Article 67 of the Land Law states that: "(... on land recovery for national defense or security purpose; or for socio-economic development in the national or public interest), competent state agencies shall notify the land users about the land recovery before undertaking the surveys on affected land/properties... and making of plans for compensation, support and resettlement."</p> <p>However, the Public Investment Law stipulates that: "... before issuing the notification on land acquisition, the project investment policy (including Pre-F/S) should be approved."</p> <p>There is no system to prepare resettlement action plan at the time of pre-feasibility study or environmental review by development partners.</p>	It is anticipated that large-scale involuntary resettlement is not happened by the Project. Therefore, in the Project, the preparation of RAP is not required. However, the Preparatory Survey Team had provided supports to the Vietnam counterpart agencies in developing the Compensation, Supports and Resettlement with sufficient adherence to the JICA Environmental Guidelines.
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	Article 69 of the Land Law specifies public consultation at planning and implementation stage as followings: "The organization in charge of compensation and ground clearance shall make the plan for compensation, support and resettlement and coordinate with the commune-level People's Committee in the locality to conduct consultations on the plans for compensation, support and resettlement in the forms of meetings with land users living in the recovered area, posting up the plan for compensation, support and resettlement at offices of the commune-level People's Committee and at common public places of the residential	Not required
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people		Based on the JICA Environmental Guidelines, consultations have to be implemented in understandable language
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.		Based on the JICA Environmental Guidelines, in case of the Category A projects, stakeholder meetings are organized at least two times, at the time of the draft scoping and at

No.	JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for filling gaps
		<p>areas of which land is recovered. The consultation results must be recorded in minutes which are certified by representatives of the commune-level People's Committee and Vietnam Fatherland Front, and users of recovered land."</p>	<p>the time of draft reporting, supplemented by focus group meetings as parts of public participation in planning stage. In addition to above mentioned meetings, the RAP proposed promotion of public participation in monitoring stage as well as implementation stage.</p>
10.	<p>Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.</p>	<p>Article 204 (Chapter 13) of the Land Law stipulated that: "Land users and people who have land use-related rights and obligations are entitled to lodge complaints about, or file lawsuits against, administrative decisions or administrative acts in land management."</p>	<p>During the Preparatory Survey, a Grievance Redress Mechanism was prepared, based on the JICA Environmental Guidelines, and was included in the RAP. In general, the Commune PCs or the District PCs take role as the first places for people to address complaints of file lawsuits. If the complaints/lawsuits cannot be settled at these levels, people can address it at the higher administrative levels.</p>
11.	<p>Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.</p>	<p>After project approval by the Government followed by the decision of land acquisition by the People's Committee, a detailed measurement survey (DMS) is implemented.</p>	<p>Based on the JICA Environmental Guidelines, the cut-off date is explained at the 1st time stakeholder meetings organized in the stage of Preparatory Survey. After conducting the detailed measurement survey (DMS) during the detailed design (DD), the information on affected households and properties will be updated and finalized.</p>
12.	<p>Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.</p>	<p>Article 82 of the Land Law stipulates that illegal land use can be recovered by the State without compensation. Clause 2 of Article 92 of the Land Law stipulates illegal land attached assets can be acquired without compensation. Clause 2 of Article 77 of the Land Law, the Government does not compensate land users who violate land legislation, elaborated in Article 64 of the Land Law, and owners of illegally established land attached assets, and unregistered land users of agricultural land after 1 July 2004. Article 88 and 92 of the Land Law does not allow compensation for non-legitimate owner of the land attached assists.</p>	<p>Based on the JICA Environmental Guidelines, appropriate entitlements are discussed in the RAP for both formal and informal cases. In principle, both formal and informal settlers are eligible for compensation and other conditions, including assistances, rights to relocate to the resettlement site, etc.</p>

No.	JICA Guidelines for Environmental and Social Considerations with World Bank Safeguard Policy	Vietnamese Law & Regulations	Countermeasures for filling gaps
		Article 94 and 157 of the Land Law covers compensation for the damage caused by limited land use and damage on land attached assets in case of restrictions due to establishment of safety corridors, but only for legally recognized land users.	
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.	Article 74 of the Land Law mentions the "land for land" compensation in principle. In the case of relocation site preparation, Article 85 of the Land Law describes the introduction of necessary infrastructure and considerations on harmonization with surrounding communes.	PAPs shall be given compensation options based on the RAP to select "land for land" or "cash for land".
14.	Provide support for the transition period (between displacement and livelihood restoration).	Article 84 of the Land Law covers some kinds of assistance for business disturbance and income restoration. However, unregistered owners of commercial structures/business for the cost of re-establishing their business activities, net income loss during the transition period, and cost of transferring and re-installing plant, machinery, etc. are not eligible for compensation.	The Updated RAP covers the non-registered cases and compensation for temporary business disturbance, income restoration at the early stage, or any other allowance are considered.
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.	There is no clear description of special considerations for socially vulnerable groups except Article 27 of the Land Law regarding land use fee and land allocation.	Based on needs assessment through stakeholder meetings, socio-economic surveys, focus group meetings etc., special considerations for vulnerable groups, such as households headed/with woman, handicapped, elderly, poor, and etc., are discussed and reflected in the RAP.
16.	Internal and external monitoring system must be established and implemented properly	Article 13 of the Land Law covers general monitoring and evaluation, but not particularly resettlement.	Based on the JICA Environmental Guidelines, a monitoring framework composed by internal monitoring, external monitoring, and evaluation is established in the RAP.
17	The project proponent is urged to present results of monitoring to local stakeholders.	N/A	In the next stage of project preparation, the Ben Tre PPC shall be urged to present the results of monitoring to local stakeholders.

3.3.4 ORGANIZATION IN VIETNAM RELEVANT TO ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

1) Main Organizations Relevant to EIA in Vietnam

In Vietnam, MONRE is in charge of environmental protection policies as the central governmental

agency. Under the MONRE, Vietnam Environmental Protection Administration (VEPA) was recently in charge of policies formulation for environmental protection, monitoring of the Environmental Law and compliance situations with relevant standards, as well as instruction to regional and local relevant divisions and agencies. Furthermore, VEPA integrated with EIA Division in 2008, in order to expand the authorities and human resources of environmental policies, and restructured as Vietnam Environmental Administration (VEA). Figure 3.3.2 shows present organization chart of VEA.

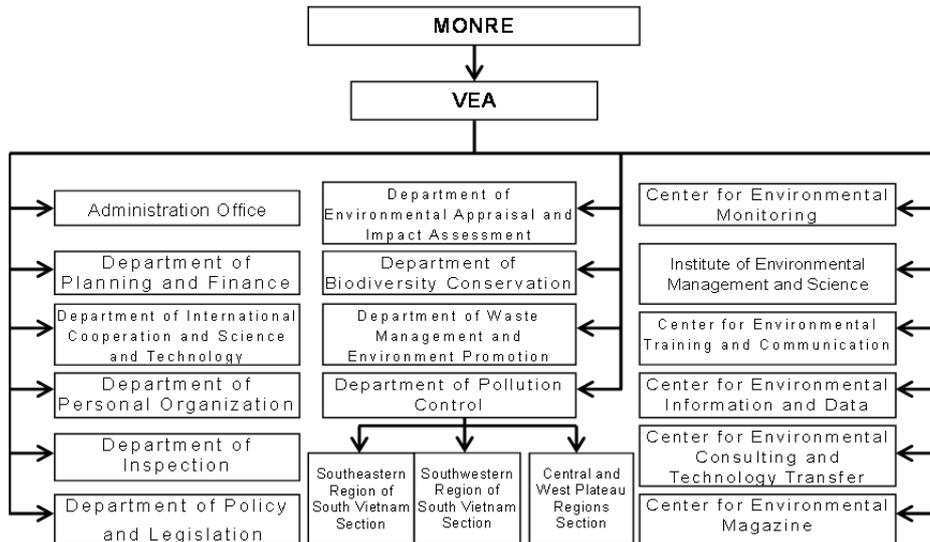


Figure 3.3.2 Present Organization Chart of Vietnam Environmental Agency (VEA)

Source : MONRE, VIETNAM

In terms of the local situations for environmental policy measures and EIA approvals, the Department of Science, Technology, and Environment (DOSTE) was restructured in 2002 by the reform of the central government and the regional/local governments, and DONRE was established under the People's Committee of the province or central direct jurisdiction.

Main role of the DONRE are as follows:

- Issue of permission for factory operation,
- Environmental monitoring of water and air quality,
- Environmental inspection to factories, treatment and disposal facilities, and
- Exposure for illegal activities in terms of environmental protection.

In terms of evaluation and approval of the EIA report, the MONRE approves the large-scale projects; the DONRE in the project area approves other projects based on Appendix II of Decree No. 18/2015/ND-CP.

2) Main Organizations Relevant to Land Acquisition and Resettlement

According to Article 23 of the Land Law 2013, responsibilities for management land are assigned as following:

- The Government shall perform the unified state management over land nationwide,
- The Ministry of Natural Resources and Environment shall take responsibility before the Government for the unified state management over land,
- Related ministries and ministerial-level agencies shall, within the scope of their respective tasks and powers, assist the Government in performing the state management over land, and
- People's Committees at all levels shall perform the state management over land in their localities according to their competence prescribed in this Law.

According to Article 66 of the Land Law 2013, the competence to acquire land is assigned as follows:

Clause 1 Provincial People's Committee	a) Recovery of land from organizations, religious establishments, overseas Vietnamese, foreign organizations with diplomatic functions, and foreign-invested enterprises, excluding the case prescribed at Point b, Clause 2 below; b) Recovery of agricultural land which is part of the public land funds of communes, wards or townships.
Clause 2 District-level People's Committees	a) Recovery of land from households, individuals and communities; b) Recovery of land from overseas Vietnamese who are allowed to own houses in Vietnam.
Provincial People's Committee; or authorized district-level People's Committees	In case both subjects prescribed in Clauses 1 and 2 of this Article exist in one recovered area.

3) Procedural Steps of Compensation, Support, and Resettlement Process

Table 3.3.7 shows the procedure of compensation, support and resettlement under the New Land Law.

Table 3.3.7 Procedure of Compensation, Support and Resettlement

No.	Steps	Descriptions
1	Notify land acquisition	The provincial-level People's Committee shall notify land acquisition or authorize the district-level People's Committee to do this. Land acquisition notification is sent to each organization, household or individual who has the land to be acquired. Local people are informed via public meetings, local mass media and posting up at head offices of commune-level People's Committees of localities.
2	Conducting Detailed Measurement survey	The Commune People's Committee is responsible for coordinating with the organizations in charge of compensation and site clearance to conduct the detailed measurements survey (DMS).
3	Preparation of Compensation, Support and Resettlement Plan	The organizations in charge of compensation and site clearance shall prepare the Compensation, Support and Resettlement Plan.
4	Collection of public comments on the Compensation, Support and Resettlement Plan	Opinions of affected people are collected during the preparation of the Compensation, Support and Resettlement Plan through the meetings with affected people in the project area; and through the notice of the plan at the commune PC offices and the public places in the communes. Opinions of affected people on the plan shall be recorded in minutes with confirmation of representatives of Commune PC, representatives of Commune Fatherland Front, and representatives of people whose land are acquired. The organizations in charge of compensation and site clearance shall be responsible for summarizing these opinions in writing, with clear descriptions on the number of agreed and disagreed opinions, as well as the number of opinions differed from the Compensation, Support and Resettlement Plan. If the number of disagreed opinions is large, the responsible organizations have to explain to affected people. The organization in charge of compensation and site clearance shall adjust the Compensation, Support and Resettlement Plan and submit it to the competent agency.
5	Revision of Compensation, Support and Resettlement Plan	The competent agency appraises the Compensation, Support and Resettlement Plan and submits the plan to the People's Committee for approval.
6	Decision on land acquisition and decision on approval of Compensation, Support and Resettlement Plan	The Authorized People's Committees issue the decision on land acquisition and the decision on approval of compensation, support and resettlement on the same date.
7	Disclosure of Compensation, Support and Resettlement Plan	The organizations in charge of compensation and site clearance shall coordinate with the commune-level People's Committee in disseminating the decision approving the Compensation, Support and Resettlement Plan and publicly notify it at the offices of the commune-level People's Committees and public places in the affected residential areas. The decision on compensation, support and resettlement to each affected person will be sent, by indicating the compensation and support level, arrangement of a resettlement house or land (if any), time and place for paying the compensation and support money, and time for handing over the recovered land to the organizations in charge of compensation and site clearance.
8	Compensation payment	The organizations in charge of compensation and site clearance shall pay compensation and allowances according to the approved Compensation, Support and Resettlement Plan.
9	Transferring ownership and evacuation	The organizations in charge of compensation and site clearance is responsible to manage the acquired land and handover it to the project proponents.

Source: JICA survey team(2016), based on Article 69 of the new Land Law 2013

3.4 ALTERNATIVE ANALYSIS AND SCOPING

3.4.1 ALTERNATIVE ANALYSIS

1) Basic Ideas

As described at the previous section, this Project was prepared based on the Master Plan of “The project for climate change adaptation for sustainable agriculture and rural development in the coastal Mekong Delta in Viet Nam”, which was completed in April 2013.

An alternative analysis was conducted based on quantitative assumptions from economic feasibility, technical feasibility, and environmental and social impacts aspects as well as considerations on the Master Plan, in order to select an optimal option from plural options. The basic ideas for the alternative analysis are as follows:

As for basic measures for salt intrusion relevant to climate change, there are two ideas; one is a soft measure, which a land use plan should be adapted to salt intrusion; the other one is construction and operation of sluice gates to prevent salt intrusion physically. It could be considered as a realistic feasible option based on these two basic ideas.

Within the latter idea (construction of sluice gates), there are two options; one is the construction of large-scale sluice gates in the Mekong River to prevent salt intrusion for more broad target areas; the other one is the construction of middle-scale sluice gates in the tributaries or canals of the Mekong River to prevent salt intrusion. The following focus points were considered for the abovementioned each alternative option:

- To mitigate damages of agricultural products by predicting salt intrusion relevant to climate change
- To minimize damages of agricultural products by predicting fluctuation of river water volume in Mekong River due to dam development in the upstream
- To minimize adverse environmental and social impacts in the project areas and the surroundings during the construction, operation, and maintenance phases of the project.

In the case of the zero option, it is assumed that it could not be adapted to predict sea level rise relevant to climate change and predict the fluctuation of river water volume in the Mekong River due to dam development in the upstream, although it will not cause any impacts on the present natural and social environments. Particular in river water volume in the Mekong River, the prediction of the water volume is very difficult mainly due to human activities in the upstream countries and the countermeasures are limited. It is predicted that the lost profits in the future, as per the above situation, will be very large.

In the case of the soft option, which is adapted to a land use plan flexibly, it is necessary to place quick measures on a yearly basis for saline water intrusion relevant to climate change and water volume fluctuation of the Mekong River. However, this is not a realistically feasible option, although it could be considered as a theoretic plan. The farming plan of each farmhouse will lack consistency and it is very difficult to secure costs, technology, and market relevant to change of land use. It will not cause significant adverse natural impacts even that the natural conditions are unchanged and it could be adaptable. However, this option is not adaptable to future impacts relevant to climate change and water volume fluctuation of the Mekong River, mainly due to human activities in the upstream countries. In addition, this option will be very difficult to secure stable livelihood of the residents.

The option for the large-scale sluice gates is the construction of sluice gates in the main stream (such as the old Balai River) of the Mekong River. In the Ben Tre Province, large-scale sluice gates will be constructed at two sites in the branches within the province to prevent salt intrusion by closing off the gates during the dry season. If these gates are closed, the impacts will affect in not only the Ben Tre

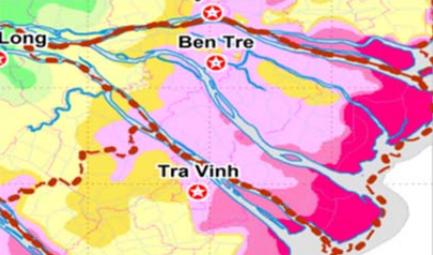
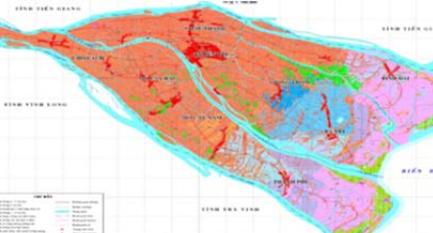
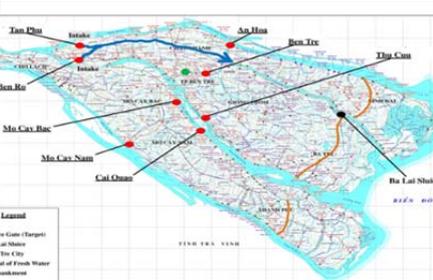
Province, but also the Tien Giang province, the Vinh Long province, and the Dong Thap province, as well as water level within Cambodia (Tonle Sap Lake). If the habitat area of the migrated fishes includes the Mekong Delta area, the significant impacts on the ecosystems, including mangrove are assumed.

In case of the option of the middle-scale sluice gates construction, it is assumed that the impacts will be confined within the Ben Tre Province. It is possible to control the saline contents within the province by enclosing it with small and middle-scale sluice gates, consisting of sandbank within the Mekong River. It may be easy to prepare a land use plan for sea level rise relevant to climate change and fluctuation of river water volume in the Mekong River. However, it is expected that the natural environment could be conserved, although ecosystems of mangroves, wetland areas, and agriculture fields may be partially disturbed.

2) Summary of Each Alternative

Table 3.4.1 summarized the comparison results of the alternatives at present survey phase. At this phase, a middle-scale sluice gates construction was proposed.

Table 3.4.1 Summary of Comparison Results of the Alternatives

Alternatives	Comparison Summary	
Option 0 Zero Option		<p>It could not be adapted to predicting sea level rise relevant to climate change and river water volume fluctuation in the Mekong River due to water resources development in the upstream, although it will not cause any impacts on present natural/social environments. Particular in river water volume in the Mekong River, the prediction of water volume is very difficult due to human activities in the upstream and the countermeasures are limited. The lost profits in the future will be very large.</p>
Option 1 Soft Option (Flexible preparation of land use plan)		<p>It is necessary to conduct quick measure on a yearly basis for salt intrusion relevant to climate change and water volume fluctuation of the Mekong River. The farming plan of each farmhouse will lack consistency. It could be adaptable for the present situations, but it will not be adaptable to future impacts relevant to climate change and water volume fluctuation of the Mekong River. Therefore, it will be very difficult to secure stable livelihood of the residents.</p>
Option 2 Large-scale sluice gates construction		<p>Large-scale sluice gates will be constructed at two sites in the branches of the Mekong River within the Ben Tre Province to prevent salt intrusion by closing off the gates during the dry season. If these gates are closed, the impacts will affect not only the Ben Tre Province, but also in the Tien Giang province, the Vinh Long province, and the Dong Thap province, as well as water level within Cambodia (The Tonle Sap Lake). If the migrated fish habitat area includes the Mekong Delta area, significant impacts on the ecosystems, including mangroves are assumed.</p>
Option 3 Middle-scale sluice gates construction		<p>It is assumed that identical impacts will occur within the Ben Tre Province. It is possible to control the saline contents within the province by enclosing it with small/ middle-scale sluice gates in the province, consisting of sandbanks off the Mekong River. It may be easy to prepare a land use plan for sea level rise relevant to climate change and fluctuation of river water volume in the Mekong River. However, it is expected that natural environments could be conserved, although the ecosystems of mangrove species, wetland areas, and agriculture fields may partially disturbed.</p>

Source: JICA survey team (2016)

3) Comprehensive Evaluation

Table 3.4.2 summarized detailed comparison results of the alternatives based on environmental items. In this comparison study as well, the Option 3: Middle-scale sluice gates construction is the most preferable.

The reason why the Option 1: Soft Option (Flexible preparation of land use plan) cannot be adapted is it is judged realistically inapplicable as the impacts on socio-economic activities and community development in the project area is too extensive. For example, it is unrealistic to change crops every year according to the change of salt water uprush.

The reason why the Option 3 is judged as the best option is it is more flexible compared to Option 1 to adapt to the salt water uprush by climate change and the water use situation of countries along the Mekong River. Regarding the Option 2: Large-scale sluice gates construction, it is judged flexible to adapt the salt water uprush. However, it is inferior to Option 3 because it gives substantial negative impacts on the natural environment including the countries along the river by closing the main stream.

Table 3.4.2. Summary of the Evaluation Results of the Alternatives

Evaluation:		◎ : Optimal, ◐ : Second option, Δ : Third option, x : not suitable		
Alternatives	Option 0: Zero Option	Option 1:(Software Measure) Flexible preparation of land use plan	Option 2: Large-scale sluice gates construction	Option 3: Middle-scale sluice gates construction
Summary and Objectives of Alternatives	Keep the present conditions (No environmental and social impacts are expected.)	To adapt salt intrusion by preparation of land use plan flexibly without structural measures. As the measurement cost could be lower, this option could be slight impacts on the environment and very effective, if the fluctuation of water volume and sea level rise of the Mekong River.	To prevent from salt intrusion by large-scale sluice gates construction at two sites in the branch of Mekong River within Ben Tre Province. Salt intrusion could be prevented not only in Ben Tre Province, but also in Tien Gian Province, Vinh Long Province, and Tra Vinh Province. The impacts will cause more broader areas including Tonle Sap Lake in Cambodia due to the gate closes.	To prevent from salt intrusion and to adapt water volume fluctuation of Mekong River by middle-scale sluice gates construction and water intake from upstream within Ben Tre Province. In the operation, the gate will be controlled depending on salt intrusion monitoring results to prevent the intrusion. This option is a measure, combined with hardware and software measure, which could be proper cultivation plan and land use plan in the survey area.
Social Impacts (Land acquisition and resettlement)	◎ No resettlement. No land acquisition	◎ No resettlement. No land acquisition	X It is assumed that total 4,183,000m ² land acquisition areas and more than 340 households resettlement are necessary by large-scale sluice gates construction at two sites and the surrounding embankment dikes.	○ It is assumed that total 6,447m ² land acquisition areas and 33 households' resettlement are necessary by middle-scale sluice gates construction at eight sites.
Impact on Natural Environment	◎ No impact.	◎ No impact due to land use preparation based on the present natural conditions.	X It is assumed that ecosystems will be disturbed and the impacts will affect the water level within Cambodia. The impacts will also affect fish habitat areas due to river dredging and structures construction.	△ It is assumed that mangroves may be partially disturbed due to the construction. Also, the impacts on the migrated fish's habitat area by partial closing the gates.

<p>Impact on Water Quality</p>	<p>△ The status quo is maintained thus no impacts are expected. However, it is impossible to take mitigation measures on the water contamination caused by the adjustment of the water level by sluice gates operation.</p>	<p>◎ No impacts are expected as the land is used according to the natural conditions.</p>	<p>△ Although temporarily, there is a concern of water contamination on a wide scale as a result of the construction of sluice gates.</p>	<p>○ Although temporarily, there is a concern of water contamination at the construction sites as a result of the construction of sluice gates. Water contamination concerned during the dry season can be mitigated by finely tuned operation of sluice gates.</p>
<p>Impact by Climate Change</p>	<p>X At present, there is no significant impact. But in the future, it is assumed that significant adverse impacts on many agricultural products due to sea level rise relevant to climate change and severe salt intrusion.</p>	<p>X At present, there is no significant impact. But in the future, it is assumed that significant adverse impacts on many agricultural products due to sea level rise relevant to climate change and severe salt intrusion because only flexible preparation of land use plan is not adaptable to the issues.</p>	<p>X It is assumed that the impacts will affect the water level in Cambodia and more than 17 million persons in the whole Mekong Delta will be affected due to close the gates in main stream of Mekong River.</p>	<p>○ As preventing from salt intrusion during dry season at dense saline content area and adapting water volume fluctuation of Mekong River by middle-scale sluice gates construction and water intake from upstream within Ben Tre Province, few adverse impacts on the social environment due to stable water resources supply.</p>
<p>Medium-term impacts to the Project by water use management of the Makong River Countries</p>	<p>X It is assumed that significant negative impacts on the agricultural products due to no response for adaptation on the water resources management in the upstream countries.</p>	<p>△ It is assumed that medium negative impacts on the agricultural products due to limited measures such as revising the land use plan in the project area.</p>	<p>X This implementation of this option is difficult to conduct. Because, this option is need to consensus for water resources management among all the Makong River countries, including Cambodia</p>	<p>○ It could be expected that proper adaptation for water resources changes in the upstream countries by monitoring of salt intrusion and the gate operation.</p>
<p>River Transportation/ General Transportation</p>	<p>◎ No impact.</p>	<p>◎ No impact.</p>	<p>X It will cause significant impacts on up and down river transportation, in particular middle/large cargo ship transportation on Mekong River, although an access road and a ship way on/with the sluice gates will be constructed.</p>	<p>○ It will cause some impacts on river transportation, in particular small/middle cargo ship transportation between Ben Tre Province and the other provinces on the rivers, although an access road and a ship way on/with the sluice gates will be constructed.</p>

Impacts on socio-economic activities and regional development	X It will be serious for lacks of fresh water and damages of salt intrusion year by year. It will cause significant adverse impacts on regional development due to significant adverse impacts on well-known agricultural products in Ben Tre Province. Also, it will cause adverse impacts due to climate change to the residents, who use blackish water.	X It is assumed that accumulated technologies for agriculture activities may not be caught up the flexible land use plan, which should be adapted to each situation. Also, the residents, who use blackish water, will fear to the consistency of the land use plan.	X It will cause significant adverse impacts on socio-economic activities due to drastic change of water resources volume in dry season in Mekong Delta. Also, the residents, who use blackish water or fresh water, will be affect drastic change of water resources volume in dry season.	O It is possible that impacts on regional development will be minimized due to adjustment of saline contents based on the land use plan. Also, the residents, who use blackish water or fresh water, could consider various agriculture products based on the saline contents adjustment.
Resilience to the present livelihood of the residents by salt intrusion	X The resilience capacities are very low due to much change of salt intrusion areas by fluctuation not only by climate change, but also water uses situations in the upstream countries.	X It is difficult to secure the resilience (recovering and sustainability) of the present livelihood due to much change of salt intrusion areas by fluctuation not only by climate change, but also water uses situations in the upstream countries. It is also difficult to secure drinking water and the present livelihood.	O It is expected much resilience (recovering and sustainability) for salt intrusion due to more broad areas measures. It will be possible to secure the drinking water as well.	O It will be possible to prevent salt intrusion due to control of the gates. But the resilience capacities are low compared with the Option 2 due to limitation of the available intake points.
Flexibility of annual environmental change	X It is difficult to adapt flexibly much change of salt intrusion such as the salt intrusion incidents from the end of year 2015 to in the begging of year 2016, and other environmental changes.	X The salt intrusion incidents from the end of year 2015 to in the begging of year 2016 due to rainfall shortage showed that limitation of the software measure	O It is possible to supply freshwater safety for annual environmental changes, because of closing of the wide-range sluice gates in the broad areas.	O It is possible to prevent salt intrusion flexibly by control of the sluice gates. However, it might be difficult to control salt intrusion for broad area flexibly, if much salt intrusion will be occurred.
Stability for the livelihood and living environment of the residents	X It is very low resilience capacities for the livelihood and living environments of the residents. Because the climate changes will directly affect to the freshwater security of the residents.	X It is a limited contribution to the security of the livelihood and living environments of the residents. Because, this land use plan may corresponding to actual climate changes.	O It is possible to secure necessary freshwater for living, irrigation water, and freshwater for controlling of blackish water. It is the most securable measure for maintaining of the livelihood and living environments of the residents.	O It is a limited contribution to secure necessary freshwater for living, irrigation water, and freshwater for controlling of blackish water depending on the salt intrusion situations. But it is a high securable measure for maintaining of the livelihood/living environments of the residents.

Project Costs	⊙ Not necessary for costs of land acquisition and construction.	○ Necessary for initial and O&M costs of water quality monitoring. But the project costs will be low significantly compared with project costs of sluice gates construction.	X Huge project costs are necessary.	△ Project investment costs will be limited due to middle-scale sluice gate construction compared with other alternatives.
O&M Costs	⊙ Not necessary for O&M costs	○ Slight O&M costs of the facilities are necessary due to no facilities construction.	X Necessary for many O&M costs of two large-scale sluice gates.	△ Necessary for medium level O&M costs of eight middle-scale sluice gates
Total Score	16	17	11	23

Note: ⊙ means 3 point; ○ means 2 point, △ means 1 point; X means 0 point.

Based on the results of the comparison of alternatives summarized in Table 3.4.2 above, a further detailed analysis on alternatives for the monitoring and operation system for the sluice gates in case of the Option 3 was done, and the results of such an analysis were shown in Table 3.4.3 below.

The construction of middle-scale sluice gates in Ben Tre Province will result in creating two relatively large polder areas in Ben Tre Province by closing canals with the constructed gates. The areas having risks of damage by saline water intrusion vary every year depending on the water level of Mekong River in the dry season. To prevent the polder areas from saline water intrusion, it is important to operate sluice gates systematically, and not to operate each gate individually. In order to smoothly manage the process from the monitoring of water levels and the salinity in water to the operation of sluice gates, it is indispensable to establish and apply a comprehensive gate operation system comprising of the following three sequential components: 1) Monitoring (Continuous monitoring of water levels and quality of Mekong River and inland canals); 2) Data processing (Determination of the gate operation in accordance with monitoring data); 3) Systematic Operation (Operation of each gate with systematic procedures).

The option recommended is a mixture of measures with hardware and software; the construction of structure will be essential for the gate operation system and gate operation requires appropriate human resources development coupled with systematic operation software.

The monitoring equipment will be installed at various points in Ben Tre Province; the data processing equipment in the data center and the operation equipment at each gate. Not only what to be installed but also how to be operated will form part of the determining factors of the gate operation system. Therefore, it is necessary to fully examine the gate operation equipment together with the operating system/structure prior to the construction of sluice gates.

Table 3.4.3 Summary of Comparison Results of the Water Level/Salinity Monitoring Systems for the Option 3

Alternatives	Option 3 (Basic Concept)	Option 3-0: Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
<p>Summary and Objectives of Alternatives</p> <p>To prevent from saline intrusion and to adapt water volume fluctuation of Mekong River by medium scale sluice gates construction and water intake from upstream within Ben Tre province.</p>	<p>No additional monitoring system and devices are required. Conventional manual observation of water level and salinity will be carried out at 8 sluice gates project site to be newly constructed.</p> <p>Current monitoring system is utilized and it can contribute minimizing the project cost among the alternatives. Real time observation is not available.</p>	<p>Monitoring stations will be installed at total 18 points with regular interval along the 4 major tributaries of Mekong River. Each monitoring station will be equipped with automatic observation system of water level and salinity. Manual observation will be also conducted. The observed data will be transferred to a data center and sluice gates will be manually operated based on results of data processing. Relay station is not required.</p> <p>Real time saline intrusion monitoring will be available at the major tributaries of Mekong River; the processed data can be used as a reference for sluice gates operation.</p>	<p>Monitoring stations will be installed at total 49 points in Ben Tre. Each monitoring station will be equipped with automatic observation system of water level and salinity. Manual observation will be also conducted. The observed data will be transferred to a data center and sluice gates will be manually operated based on results of data processing. Relay station is not required.</p> <p>Water level and salinity will be observed at inside and outside of sluice gates; detailed saline intrusion condition and water volume inside of canals can be grasped in real time. Appropriate and timely gate operation can be carried out. Some misconduct of gate operation can also be watched out in real time.</p>	<p>Monitoring stations will be installed at total 49 points in Ben Tre. Each monitoring station will be equipped with automatic observation system of water level and salinity. Manual observation will be also conducted. The observed data will be transferred to a data center and sluice gates will be operated with remote operation system based on results of data processing. Installation of relay stations is required.</p> <p>Automatic remote operation system can avoid human errors such as delay of water level / salinity observation and misconduct of gate operation.</p>	<p>Monitoring stations will be installed at total 49 points in Ben Tre. Each monitoring station will be equipped with automatic observation system of water level and salinity. Manual observation will be also conducted. The observed data will be transferred to a data center and sluice gates will be operated with remote operation system based on results of data processing. Installation of relay stations is required.</p> <p>Automatic remote operation system can avoid human errors such as delay of water level / salinity observation and misconduct of gate operation.</p>

Alternatives	Option 3 (Basic Concept)	Option 3-0 : Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
Social Impact (Land acquisition and resettlement)	It is assumed that total 6,447m ² land acquisition areas and the resettlement of 33 households are necessary by middle scale sluice gates construction at 8 sites.	⊙ No land acquisition. No resettlement.	△ It is assumed that land acquisition will be required at 18 sites along the Mekong River.	⊙ Additional land acquisition is not assumed because monitoring stations will be constructed at inside of sluice gates project site.	△ It is assumed that land acquisition will be required at 5 data relay stations and 20 relay stations for automatic remote operation; each station which requires about 25 m ² of area. Resettlement is not assumed.
Impact on natural environment	It is assumed that mangroves may be partially disturbed due to the construction. Also, the impact on the migrated fish's habitat area by partial closing the gates.	⊙ No impact on natural environment; there is no construction plan for new and/or additional monitoring stations.	△ It is assumed that mangroves may be partially disturbed due to construction of monitoring stations along Mekong River tributaries.	⊙ No additional impact on natural environment is assumed; all monitoring stations will be constructed inside of the sluice gate project sites.	○ It is assumed that impact on natural environment is limited; required areas for relay stations are quite small.

Alternatives	Option 3 (Basic Concept)	Option 3-0: Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
Impact on socio-economic activities and regional development	<p>It is possible that impacts on regional development will be minimized due to adjustment of saline contents based on the land use plan. Also, the residents, who use brackish water or fresh water, could consider various agriculture projects based on the saline contents adjustment.</p>	<p>x</p> <p>It is assumed that saline intrusion causes damage on agriculture project and domestic water quality due to possible human errors in observations, communications, and operations.</p>	<p>O</p> <p>It is assumed that saline intrusion causes damage on agriculture project and domestic water quality due to possible human errors in communications, and operations.</p>	<p>◎</p> <p>Real time monitoring on water level and salinity can minimize saline intrusion to Ben Tre.</p>	<p>◎</p> <p>Real time monitoring on water level and salinity can minimize saline intrusion to Ben Tre. Human errors are not assumed. Damages on agriculture products and domestic water quality are quite limited and/or not expected.</p>
		<p>Damages caused by the saline intrusion may increase due to shortage of monitoring; only 2 times a day and also delay of actions of countermeasures.</p>	<p>Real time observation can contribute reducing saline intrusion caused by accident; sluice gates cannot be operated timely because observation points are limited and not so close to sluice gates' sites. Such condition keeps some risks of saline intrusion.</p>	<p>Human error in gate operation may cause saline intrusion; such saline intrusion damages agriculture products and domestic water quality but damage will be limited.</p>	<p>System errors are assumed due to long period electric power interruption, computer software error, and malfunction of monitoring devices. Such system error may cause damage on agriculture projects and domestic water quality.</p>

Alternatives	Option 3 (Basic Concept)	Option 3-0: Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
Project cost and operation and maintenance cost	<p>Cost for medium- scaled sludge gates construction project is needed. Comparing to other alternatives, investment cost is limited and relatively low.</p> <p>Medium cost for operation and maintenance of 8 sludge gates is needed.</p>	<p>◎ It needs to install equipment to measure salinity at 8 sluice gates. However, initial cost is the lowest, comparing to other alternatives.</p> <p>Cost would be the lowest because it only needs to pay cost for updating measurement equipment and for personnel cost.</p>	<p>○ It needs cost to construct 18 automatic monitoring stations and one data center.</p> <p>It needs cost to update equipment and personnel cost for 18 monitoring stations and one data center.</p>	<p>△ It needs cost to construct 49 automatic monitoring stations and one data center.</p> <p>It needs cost to update equipment and personnel cost for 49 monitoring stations and one data center.</p>	<p>x It needs cost to construct 49 automatic monitoring stations, one data center, and data relay stations.</p> <p>It needs cost to update equipment and personnel cost for 49 monitoring stations, one data center, and data relay stations.</p>

Alternatives	Option 3 (Basic Concept)	Option 3-0: Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
Technical issues on the gate structure		<p style="text-align: center;">x</p> <p>Salinity cannot be measured automatically in real-time, and therefore, the sluice gates which cannot be operated promptly. Conventional types of sluice gates shall be adopted to this alternative such as swing gate, tainter gate and so on.</p> <p>Gates are closed/opened depending on the tides, therefore it is difficult to be actively operated, and cannot be flexibly operated to prevent saline intrusion.</p>	<p style="text-align: center;">△</p> <p>It can observe the salinities in real-time for a wide area, therefore, slide gates can be adopted in addition to the swing gates, tainter gates, etc.</p> <p>It cannot precisely measure the salinities at the sites around the sluice gates, therefore the gates may not be closed/opened promptly in time, and it cannot appropriately prevent saline intrusion, even in case of slide gates.</p>	<p style="text-align: center;">○</p> <p>It can observe salinities in real-time at the sites around the planned sluice gates; therefore slide gates is appropriate gate type which can enable the gate operation in correspondence to salinities observed.</p> <p>The data center can obtain data on the salinities observed at the gates in real-time, therefore, the gates can be promptly closed/opened in response to the situation at the site. Countermeasures can be taken because of real time observation even when the gate closing/opening is oblivious.</p>	<p style="text-align: center;">◎</p> <p>It can observe salinities in real-time at the sites around the planned sluice gates; therefore slide gate is appropriate gate type which can enable the gate operation in correspondence to salinities observed.</p> <p>The data center can obtain data on the salinities observed at the gates in real-time, therefore, the gates can be automatically closed/opened, and can effectively reduce damage caused by saline intrusion.</p>

Alternatives	Option 3 (Basic Concept)	Option 3-0: Zero Option (Manual Observation)	Option 3-A: Automatic Observation at 18 Points along the Rivers	Option 3-B: Automatic Observation at 48 Points in the Area	Option 3-C: Automatic Observation at 48 Points with Automatic Gate Operation
Impacts to waterway users		x Salinities are measured by the staff once a day, and it takes long time to close/open the gates. Therefore, it is difficult to promptly close/open the gates for the waterway users to pass through the gates when it is necessary.	△ It is possible to observe the salinities in a wide area of Ben Tre Province. However, it is difficult to obtain information on the actual situation at each sluice gate site, and therefore, it is difficult to respond promptly to the need of waterway users to navigate through the gates.	○ It is possible to observe the salinities at the sites around each sluice gate, and therefore, it can flexibly respond to the need of waterway users, and can mitigate social impacts caused by the project.	○ It is possible to observe the salinities at the sites around each sluice gate, and therefore, it can flexibly respond to the need of waterway users, and can mitigate social impacts caused by the project.
Impacts on natural environment caused by the gate operation		x Comparing to other alternatives, the gates cannot be frequently closed/opened; therefore, it would cause impacts of polluted water stagnancy, and hinder the movement of immigrant fishes.	△ Gate opening/closing frequency is lower than that of Alternative-3-B and Alternative 3-C; therefore, it would cause impacts of polluted water stagnancy, and hinder the movement of immigrant fishes.	○ Gate opening/closing frequency is higher than that of Alternative 3-0 and Alternative 3-A, therefore, impacts of polluted water stagnancy, and impacts to the movement of immigrant fishes would be minimized.	◎ Gate opening/closing frequency is higher than that of Alternative 3-0, Alternative 3-B; and Alternative 3-B; therefore, impacts of polluted water stagnancy, and impacts to the movement of immigrant fishes would be the minimized the best.
Score accumulated					
			9 points	16 points	14 points

◎ : 3points, ○ : 2 points, △ : 1 point, × : 0 point

3.4.2 SCOPING

Table 3.4.4 shows the scoping results based on the understandings in this survey stage.

Table 3.4.4 Scoping Results of This Project

Classification	No	Items Impacted	Impact Assessment		Reasons for Evaluation
			Construction Phase	Operation Phase	
Pollution	1	Air Pollution	B ⁻	C	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that construction vehicles for the site preparation may cause dust, especially in dry season. The air quality may be slightly deteriorated temporarily. It is assumed that construction machines for the site preparation/access road development may generate emission gases, especially in the dry season. The air quality may be slightly deteriorated temporarily. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> A small-scale access road will be constructed at each proposed sluice gate. The vehicles on the road will generate emission gases. There is a possibility that slight air pollution may occur due to the transportation of the vehicles.
	2	Water Pollution	B ⁻	B ⁻	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that polluted water may be generated by the sluice gate construction. The surface water may be slightly deteriorated temporarily in the water bodies near each sluice gate site. It is assumed that polluted water may generate at borrowing pits or rock quarry sites due to sediment discharge by heavy rainfall, if the borrowing pit or quarry site is not properly managed. There is a possibility that the water quality may be deteriorate temporarily by dredging activities near by the sluice gates. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> It is assumed that water quality deterioration or eutrophication may occur in the partial river or canal section of urban areas during the dry season due to a decrease of water volume by closing the gates. There is a possibility that water quality at embankment sites may deteriorate temporarily due to soil erosion by heavy rain or flood. There is a possibility that water pollution may occur in borrowing pits or rock quarry site due to sediment discharge by heavy rainfall, if the borrowing pit or quarry site is not properly managed.
	3	Wastes	B ⁻	B ⁻	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that construction wastes and municipal wastes at construction offices will be generated. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> There is a possibility that wastes sedimentation will occur due to the closing of the sluice gates.
	4	Soil Contamination	D	D	<p>【The Construction Phase/The Operation Phase】</p> <ul style="list-style-type: none"> Soil contamination is not assured because materials, which will cause soil contamination, are not used in both phases.
	5	Noise/Vibration	B ⁻	D	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that construction noise due to construction activities will be temporally generated. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> It is not assumed noise/vibration issues are generated by sluice gates operation.
	6	Land Subsidence	C	C	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> There is a possibility that small-scale land subsidence will be occurs in some sites relevant to embankment construction. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> There is a possibility that small-scale land subsidence will be occurs in soft ground sites relevant to embankment.

Classification	No	Items Impacted	Impact Assessment		Reasons for Evaluation
			Construction Phase	Operation Phase	
	7	Offensive Odor	D	D	<p>【The Construction Phase/ The Operation Phase】</p> <ul style="list-style-type: none"> It is not assumed offensive odor because materials, which will cause offensive odor, will not be used in both phases.
	8	Bottom Sediment	B-	B-	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that demolition, excavation and construction wastes hold high sediment load.at the construction sites may cause additional sedimentation in the rivers/canals. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> There is a possibility that possible soil erosion may cause additional sedimentation in the rivers/canals, if inappropriate design, construction, or maintenance are conducted.
Natural Environment	9	Protected Area	C	C	<p>【The Construction Phase/ The Operation Phase】</p> <ul style="list-style-type: none"> Three protected areas are designated within Ben Tre Province. However, the nearest protected area is located in more than 25 km from the proposed sluice gate construction site. Therefore, the adverse impacts on the protected areas are not assumed. However, it is necessary to confirm the habitat areas of the fauna in the protected areas as further survey.
	10	Ecosystem	B-	B-	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> It is assumed that small-scale alteration of ecosystem due to partial cutting of mangrove species by sluice gates construction will occur. There is a possibility that adverse impacts will occur on the habitat areas of fishes or aquatic organism in the rivers/canals. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> There is a possibility that adverse impacts will occur on the fishes, which was migrated through the proposed sluice gates sites.
	11	Hydrology	B-	B-	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> There is a possibility that present hydrology will change temporarily or partially by the sluice gates construction. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> There is a possibility that present hydrology may change partially due to the operation of the sluice gates.
	12	Geography/Geology	D	D	<p>【The Construction Phase】</p> <ul style="list-style-type: none"> Any impacts on geography or geology are not assumed because the construction is not large-scale, which will not cause geography or geology alteration. <p>【The Operation Phase】</p> <ul style="list-style-type: none"> It does not assume any impacts on geography or geology, because the main project activity is the operation of sluice gates.
Social Environment	13	Involuntary resettlement	B-	D	<p>【The Pre-construction Phase】</p> <p>Nine (09) households would be relocated to make land for construction of the 8 sluice gates. (In addition, other 24 households would lose their agriculture or residential land for the Project but would not have to relocate.)</p> <p>【The Construction Phase】</p> <p>Temporary lease of land and additional small scale resettlement would be required for the construction yards.</p> <p>【The Operation phase】</p> <p>Additional land acquisition and resettlement is not expected.</p>
	14	The poor	B-	B-	<p>【The Construction Phase/The Operation Phase】</p> <p>Some of the poor people who will loose their own land for living and/production would be seriously affected by resettlement and may lose their business opportunity if appropriate compensation and supports are not provided.</p>
	15	Indigenous and ethnic people	D	D	<p>【The Construction Phase/The Operation Phase】</p> <p>It is observed that indigenous and ethnic people do not reside around the Project area.</p>
	16	Local economy	B±	B±	<p>【The Construction Phase】</p>

Classification	No	Items Impacted	Impact Assessment		Reasons for Evaluation
			Construction Phase	Operation Phase	
		such as employment and livelihood			<p>Local residents may have the opportunity to work as construction workers at the Project sites.</p> <p>Activities of ferrymen, boats transporting goods, fish boats on the rivers near the sluice gates would be impeded during the construction period.</p> <p>【The Operation Phase】 Development of a high value-added agricultural production such as fruit tree cultivation, livestock, etc., would be enabled when fresh water is constantly supplied throughout the year.</p> <p>Access roads planned on the sluice gates may contribute to the improvement of local road network, and promotion of local economy and industry development.</p> <p>Some areas may not have enough saline water for shrimp aquaculture.</p> <p>Ferrymen who are carrying out business near the sluice gates may lose their existing means of livelihood due to the development of the roads on the sluice gates.</p> <p>Activities of ferrymen, goods transporting boats, fishing boats, etc. would be impeded by the newly constructed sluice gates.</p>
	17	Land use and utilization of local resources	B-	B±	<p>【The Construction Phase】 Some lots of agricultural land around the sluice gates would be lost by the Project.</p> <p>【The Operation Phase】 The expansion of land for cultivation of fruit trees, vegetables are expected due to the stable supply of fresh water.</p> <p>Land for shrimp aquaculture would be reduced due to the lack of saline water.</p> <p>Local resources would be efficiently utilized because of the development of local road network.</p>
	18	Water usage	B-	B±	<p>【The Construction Phase】 Irrigation water would be temporarily affected due to the polluted water generated from the construction sites.</p> <p>【The Operation Phase】 With the proper operation of the sluice gates, the river water quality and water flow can be adjusted to suit the needs of local residents.</p> <p>Saline water may be insufficient for shrimp aquaculture in some areas.</p>
	19	Existing social infrastructure and service	B-	B±	<p>【The Construction Phase】 Transportation on the rivers may be temporarily impeded during the construction of the sluice gates.</p> <p>【The Operation Phase】 Local residents will be able to easily access public facilities in the area due to the road network development associated with the sluice gates construction.</p> <p>On the other hand, the existing service by the ferrymen may be suspended.</p> <p>Transportation on the river may be obstructed by the appearance of the sluice gates.</p>
	20	Social capital, local organizations such as decision-making authorities	D	D	<p>【The Construction Phase/The Operation Phase】 Impacts on social capital, local organization, etc. are not expected.</p>
	21	Misdistribution of benefits and damage	C	B-	<p>【The Pre-construction phase/ The Construction Phase】 Residents residing near the sluice gate construction sites would be directly affected by noise, water pollution, etc.</p> <p>【The Operation Phase】 Residents living near the sluice gates may be directly benefitted in terms of reduction of travel time.</p> <p>Farmers who are using freshwater would earn more benefits from the Project than farmers who are using saline water.</p> <p>There would be conflict on the need of water supply between</p>

Classification	No	Items Impacted	Impact Assessment		Reasons for Evaluation
			Construction Phase	Operation Phase	
					farmers who want to have freshwater and the ones who want to have saline water for shrimp aquaculture.
	22	Local conflicts of interest	D	B-	<p>【The Construction Phase】 Conflicts of interest between local residents during The Construction Phase are not expected.</p> <p>【The Operation Phase】 There would be conflict on the need of water supply and water treatment between farmers who are using freshwater and the ones who are using saline water.</p>
	23	Cultural, historical heritage	D	D	<p>【The Construction Phase/ The Operation Phase】 No cultural or historical heritage is observed around the construction sites of the sluice gates.</p>
	24	Landscape	D	D	<p>【The Construction Phase/ The Operation Phase】 Landscape that needs to be preserved is not observed around the construction sites of the sluice gates. And the appearance of the sluice gates would not cause impact to the surrounding landscape.</p>
	25	Gender	D	D	<p>【The Construction Phase/The Operation Phase】 Impacts on gender issues that require particular consideration are not expected during both the construction phase and the operation phase. Gender discrimination is not identified even when the contractors employ local residents to work as construction workers during the construction phase.</p>
	26	Children's rights	D	B+	<p>【The Construction Phase】 Impact on children's rights that require particular consideration is not expected.</p> <p>【The Operation Phase】 The students may be easier to go to the schools with the use of the access roads to be constructed on the sluice gates.</p>
	27	Infectious diseases such as HIV/AIDS	B-	D	<p>【The Construction Phase】 The risk of spread of infectious diseases such as HIV/AIDS may be increased due to the construction workers from outsides.</p> <p>【The Operation Phase】 Travel on land may be improved, but the risk of spread of infectious diseases is not expected.</p>
	28	Working environment (including work safety)	B-	D	<p>【The Construction Phase】 Construction workers' health may be affected by air pollution generated from the construction works, if the working environment is not appropriately improved.</p> <p>【The Operation Phase】 Impact on working environment that requires particular consideration during the operation phase is not expected.</p>
	29	Accidents	B-	C	<p>【The Construction Phase】 There would be the risk of occurrence of accidents during construction, if working safety is not appropriately improved. Accidents on the rivers would occur near the construction sites of the sluice gates.</p> <p>【The Operation Phase】 Traffic accident may increase due to the increased traffic volume and vehicle speed.</p>
Others	30	Transboundary impacts, global warming	C	D	<p>【The Construction Phase】 Greenhouse gases would be generated by construction works.</p> <p>【The Operation Phase】 Significant generation of greenhouse gases is not expected.</p>

Source: JICA survey team (2016)

Note: A: Significant impacts may cause
B: Medium-scale impacts may cause
C: Impacts are unknown
D: No impact will be cause

3.4.3 TOR OF THIS ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

In this survey, main surveys for environmental and social considerations are reviewing and revision of

the EIA survey, which was conducted by Vietnam's side. Also, additional survey will be conducted based on the scoping results, which were described in previous section.

Table 3.4.5 shows the TOR for environmental and social considerations based on these understandings.

Table 3.4.5 TOR for Environmental and Social Considerations

Classification	Items Impacted	Impact Assessment		survey Items	survey Methods
		Construct-ion Phase	Operation Phase		
Pollution	Air Pollution	B-	C	<ul style="list-style-type: none"> - Air quality items - Air quality standards - Impacts on air quality by construction and operation activities 	<ul style="list-style-type: none"> - Existing documents reviews - Confirmation (Hearing) of construction contents/methods, and construction vehicles - Similar case studies
	Water Pollution	B-	B-	<ul style="list-style-type: none"> - Water quality items - Surface water quality standards - Impacts on water quality by construction and operation activities 	<ul style="list-style-type: none"> - Existing documents reviews - Confirmation (Hearing) of construction contents/methods, - Similar case studies - For water quality simulation, MIKE-11 model will be applied (water quality targets will be the surface water quality standards in Vietnam)
	Wastes	B-	B-	<ul style="list-style-type: none"> -Wastes disposal methods at construction sites and the surroundings - Wastes sedimentation situations in the canals at operation phase 	<ul style="list-style-type: none"> - Hearings to the relevant persons. - Field reconnaissance - Similar case studies
	Noise/Vibration	B-	D	<ul style="list-style-type: none"> - Present noise level - Noise permission levels - Locations of the houses/public facilities - Power level of heavy construction machines/vehicles 	<ul style="list-style-type: none"> - Confirmation (Hearing) of construction contents/methods - Sampling of background noise data at the houses/public facilities located in construction sites - Noise forecasts by
	Land subsidence	C	C	<ul style="list-style-type: none"> - Characteristics of ground and geology at construction sites 	<ul style="list-style-type: none"> - Confirmation (Hearing) of construction contents/methods - Similar case studies
	Bottom Sediment	B-	B-	<ul style="list-style-type: none"> - Characteristics of geography and soil of the bottom sediments - Intensity of rainfall 	<ul style="list-style-type: none"> - Confirmation (Hearing) of construction contents/methods - Similar case studies
Natural Environment	Protected Area	C	C	<ul style="list-style-type: none"> - Characteristics of habitats of the migratory species in the protected area 	<ul style="list-style-type: none"> - Review of existing documents - Hearings to local natural environmental experts - Similar case studies
	Ecosystem	B-	B-	<ul style="list-style-type: none"> - Characteristics of the ecosystem in the rivers/canals - Habitat characteristics/areas of rare species 	<ul style="list-style-type: none"> - Review of existing documents - Hearings to local natural environmental experts - Field reconnaissance - Similar case studies

	Hydrology	B-	B-	- Hydrology characteristics of the rivers/canals	- Review of existing documents - Hearings to relevant persons - Similar case studies
Social Environment	Involuntary Resettlement	B-	D	- Scale (land area, household, property) of resettlement - Review of RAP	- Law/organization survey - Field reconnaissance - Stakeholder meetings - Hearings to householders - Revision of RAP
	The poor	B-	B-	- Living situations of the affected persons	- Review of existing documents - Stakeholder meetings - Hearings to householders
	Local economy such as employment and livelihood	B±	B±	- Living situations of the affected persons - Living situations of ferry persons - River crossing situations at the sluice gates - Confirmation of fishermen's living situations	- Review of Existing documents - Field reconnaissance - Hearings to ferry persons
	Land use and utilization of local resources	B-	B±	- Land use situations at sluice gate sites /the surroundings - Economic activities	- Review of Existing documents - Field reconnaissance - Hearings to relevant persons
	Water usage	B-	B±	- Water use situations near the sluice gates	- Review of Existing documents - Field reconnaissance - Hearings to relevant persons
	Existing social infrastructure and service	B-	B±	- Setting situations of the utilities - River transportation situations - Impacts by sluice gates	- Review of Existing documents - Field reconnaissance - Hearings to relevant persons
	Misdistribution of benefits and damage	C	B-	- Living situations of the affected persons - RAP	- Review of Existing documents - Field reconnaissance - Hearings to relevant persons
	Local conflicts of interest	D	B-	- Possible causes of conflicts for water use and discharge	- Review of Existing documents - Stakeholder meeting - Hearings to relevant persons
	Infectious diseases such as HIV/AIDS	B-	D	- Health conditions of the laborer	- Review of Existing documents - Hearings to relevant persons
	Working environment (including work safety)	B-	D	- Working environment	- Review of Existing documents - Hearings to relevant persons
	Accidents	B-	C	- Working accidents - Number of traffic accidents	- Review of Existing documents - Hearings to relevant persons
Others	Transboundary impacts, global warming	C	D	- Construction vehicles	- Review of Existing documents - Review of construction plan

Source: JICA survey team (2016)

Note: A: Significant impacts may cause
B: Medium-scale impacts may cause
C: Impacts are unknown
D: No impact will be cause

In term of the alternative analysis of the TOR, it was conducted by comparative analyses with the following indicators for this Project:

- Social impacts (Land acquisition and resettlement)
- Impacts on natural environments
- Impacts on climate change
- River transportation
- Impacts on regional development
- Project costs
- Operation and maintenance costs
- Resilience for changes of livelihood means of the residents with salinity intrusion
- Flexibilities of annual environmental changes

3.5 ENVIRONMENTAL AND SOCIAL SURVEY RESULTS AND IMPACT EVALUATION

3.5.1 ENVIRONMENTAL SURVEY RESULTS AND IMPACT EVALUATION

1) Scoping and Environmental survey Results

Table 3.5.1 shows the scoping results and the environmental survey results for pollution and natural environmental items:

Table 3.5.1 Evaluation by Scoping and Environmental survey Results

Classification	No.	Items Impacted	Impact Assessment at Scoping		Impact Assessment based on survey Findings		Evaluation Reasons
			Pre- and Mid Const- ruction	Operation	Pre- and Mid Const- ruction	Operation	
Pollution	1	Air Pollution	B ⁻	B ⁻	B ⁻	B ⁻	It may be expected that the use of construction vehicles bring about the emissions of dust and air pollutants. The project also includes access roads connecting to existing roads, resulting in the slight increase in dust and exhaust gas emissions. However, the air impacts will be within the permissible range.
	2	Water Pollution	B ⁻	B ⁻	B ⁻	B ⁻	Wastewater discharge and surface water runoff from construction sites may carry organic, sediment loads that deteriorate surface/groundwater sources. It is predicted that the closure of sluice gates might create water stagnancy, and accumulation of both wastes and water pollution, if no countermeasures are taken.
	3	Wastes	B ⁻	B ⁻	B ⁻	B ⁻	The construction phase is reported to generate many waste types such as construction wastes, excavation materials, felled vegetation, and possible oil spills. Wastes from

							domestic, agricultural sources could be also trapped when closing gates, if no countermeasures are taken.
	4	Noise and Vibration	B ⁻	C	B ⁻	D	Noise that are generated by construction machineries may affect residential areas near construction sites. The increase in traffic volume will not affect noise at residential areas because the expected volume is small scale.
	5	Land Subsidence	C	C	D	D	According to the assessment on the construction methods and geology of the characteristics, the construction and the sluice gates operation will not cause any land subsidence.
	6	Bottom Sediment	B ⁻	B ⁻	B ⁻	B ⁻	Demolition, excavation and construction wastes hold high sediment load. Also, the closure of sluice gates induces water stagnation, thus deposition of sediments is likely to increase and accumulation of wastewaters may be deteriorate bottom sediments. It is a possibility that a temporal water turbidity will be generated due to sediment discharge, and a temporal negative impacts on the bottom sediment.
Natural Environment	7.	Protected Area	C	C	D	D	The construction and the operation activities will not cause any impacts on the protected areas due to the location of the protected areas.
	8	Ecosystem	B ⁻	B ⁻	B ⁻	B ⁻	The Project is anticipated to have some certain impacts on ecosystems, mainly by clearance of vegetation, altering hydrology, and pollution. Closing sluice gates are reported to interrupt the movement of migratory fishes, thus affecting their recruitment and survival. The Project is anticipated to have some negative impacts temporarily on benthos and so on due to the temporal occurrence of turbidity by the sediment outflow from the construction of the revetment and bed protection.
	9	Hydrology	B ⁻	B ⁻	B ⁻	B ⁻	It is expected that the Project would exert impacts on hydrological regimes in The Construction phase and the operation phase, including narrowing and reducing river flow by the construction of the gates, while increasing water flow in other areas.

Source: JICA survey team (2016)

Note: A: Significant impacts may cause

B: Medium-scale impacts may cause

C: Impacts are unknown

D: No impact will be cause

2) Main Forecasts for Possible Adverse Environmental Impacts

a) Noise

Noise will be emitted from construction sites during the site preparation and the construction activities by utilization of heavy construction machines and the movement of construction vehicles. Noise during The Construction phase will primarily be contributed by heavy construction machineries to the local residential areas near each sluice gate construction site. Noise power levels for different types of heavy construction machinery, which will generate high noises by the construction activities, are shown in Table 3.5.2.

Table 3.5.2 Noise Power Level of Main Heavy Construction Machines

Equipment	Sound Level at Operator (unit: dB (A))	
	Average	Range
Bulldozer	93.0	-
Paving and machine	87.7	87.0 – 88.5
Land scraper, compactor	86.5	80.0 – 93.0
Puller	86.5	77.0 – 96.0
Concrete mixer	81.5	75.0 – 88.0
Moving crane	81.5	76.0 – 87.0
Air compressor	81.0	75.0 – 87.0

Source : Cited from "North Ben Tre Irrigation Project (Ben Tre Water Management Project) – Environmental Impact Assessment Report", 2014
The impacts of construction noises in the sites are predicted using the following formula for calculation of noise prediction for a stationary source.

$$L_{A,i} = L_{WA,i} - 20 \log_{10} R_i + \Delta_{cor.,i}$$

Where,

$L_{A,i}$: Noise level at a distance R_i from the noise source at A characteristics [dB (A)]

$L_{WA,i}$: Noise power level of a construction machine at A characteristics [dB (A)]

R_i : Distance from the noise source [m]

$\Delta_{cor.,i}$: Correction factors depended on conditions of attenuation [dB (A)]

Note: There was no available data for the above correction factors in Vietnam, therefore, the $\Delta_{cor.,i}$ is adopted as 0 dB (A).

For the prediction of the noise levels, it is calculated for the worst case scenario using the following conditions:

- Maximum noise power level of the bulldozer is assumed for the noise impact forecast as the worst case;
- The noise forecast levels are assumed at points, which are the nearest residential house yard from each proposed sluice gate construction site.

The prediction results of the noise levels at each point is shown in Table 3.5.3.

Table 3.5.3 Predicted Noise Levels by a Bulldozer at Each Point

Proposed Sluice Gates	Approximate distance from each construction site [m]	Predicted Noise Level [dB (A)]	Noise Level Limits for Normal Area*1 in Vietnam*2[dB (A)]	
			Day time (6 am – 9 pm)	Night time (9 pm – 6 am)
An Hoa	9.5	73.44	70.0	55.0
Ben Ro	43.2	60.30		
Ben Tre	20.4	66.80		
Cai Quao	32.2	62.84		
Tan Phu	21.3	66.44		
Thu Cuu	30.5	63.32		
Vam Nuoc Trong	19.7	67.12		
Vam Thom	14.4	69.84		

Source: Additional surveys by JICA survey team (2016)

Note *1: Normal Area includes residential area, hospital, and school

Note *2: National Technical Regulation 26/2010/BTNMT in Vietnam

Almost all the predicted noise levels (worst case) were not exceeded the Noise Level Limits for Normal Area in Vietnam in daytime, except for the predicted noise level at the nearest residential house of the proposed An Hoa Sluice Gate.

On the other hand, most of the predicted noise level (the worst case scenario) in the night time were exceeded the Noise level for Normal Area in Vietna. Therefore, the construction activities should be conducted only during the daytime.

2) Air quality

As mentioned in the previous section of this report, almost all the air quality pollution substances were not exceeded each value in the latest Vietnamese Standard. However, during The Construction phase, dome dust and emission gases will be generated by the construction vehicles and the increased traffic volume in the developed access roads.

Taking into account of the above situations, each forecasted traffic volume per 1 hour during day time was assumed based on the each forecasted traffic volume on the EIA Report, which was prepared by Vietnamese side, for the 11 sluice gates (refer to Table 3.5.4)、

Table 3.5.4 Estimated Traffic Volume in the proposed 8 Sluice Gates

Proposed Sluice Gates	Construction Phase (*1) (unit: 1hour VPH)	Operation Phase (*2) (unit : 1hour VPH)		
		Truck	Sedan	Motor cycle
An Hoa	35	40	800	1,000
Ben Ro	6	5	60	80
Ben Tre	40	50	1,200	1,500
Cai Quao	8	10	800	1,000
Tan Phu	4	5	60	80
Thu Cuu	8	10	200	300
Vam Nuoc Trong	26	40	800	1,000
Vam Thom	30	40	800	1,000

Source : JICA survey team (2016)

Note *1: It is estimated only the construction vehicle (more than 2 ton capacity) based on the relevant document.

Note *2: It is estimated traffic volume in 2023 based on the relevant reports and site observations by JICA survey Team.

The concentration of each average air pollutant from continuous source is calculated by a simple modified plume dispersion model, which is widely used for forecast of dispersion/dilution of emission gases.

Based on the estimated data presented in Table 3.5.4 and the above dispersion model, the forecast results show that:

- For the concentration of CO and NO₂, all of the 8 sluice gates are within the National Technical Regulation (05: 2009 (average 1 hour) at both The Construction phase and the operation phase.
- At The Construction phase: the concentration of dust and PM10 at the proposed Sluice Gates of Ben Tre, An Hoa, Vam Nuoc Trong, and Vam Thom are slightly exceeded the National Technical Regulation (05: 2009 (average 1 hour).
- At the operation phase: the concentration of dust and PM10 at the proposed Sluice Gates of Ben Tre are slightly exceeded the National Technical Regulation (05: 2009 (average 1 hour).

Based on the above results, it will be necessary appropriate countermeasures for possible dust and PM10 at the relatively large-scale proposed sluice gates sites during The Construction phase and for Ben Tre Sluice Gate during the project operation phase.

Furthermore, it is recommended to conduct a regular air quality monitoring not only for dust and

PM10, but also for basic air quality items in urban area, where air pollution will be generate in Ben Tre Province.

3) Water Quality

As described at the previous section, the water quality deterioration in the rainy season is not significant comparing with the data in the dry season as a whole. On the other hand, some water quality items such as ammonia and coliform in the dry season exceeded the permissible level of the surface water quality standards in Vietnam.

The recent water quality deterioration may cause the absence of centralized wastewater treatment facility in Ben Tre Province, and recent rapid population growth in the residential areas, and the recent increase in livestock activities such as pig breeding. According to the interview survey at the district committee who is controlling the sewage treatment at the subject area and field surveys at the households and a large livestock farm in the concentrated residential areas, septic tanks which disposing are installed at the domestic miscellaneous wastewater a lot of household in the concentrated residential areas, however removing of the sludge is and the much domestic miscellaneous wastewater flow into the river/channel without treatment.

In the dry season, the water quality survey was conducted between January and May, 2016, the survey results show that at the point of the downstream including Balai Sluice Gate during nitrogen level causing the eutrophication exceeded the permissible level of the surface water quality standards in Vietnam drastically whereas the data exceeded permissible level slightly at downstream of Ben Tre City. On the other hand, phosphorous level, another cause of the eutrophication, did not exceed the permissible level of the surface water quality standards in Vietnam at all the points.

This Project is composed of the construction of small and middle scale sluice gates at the 8 points of the river/channel from upstream to downstream. In consideration of the above mentioned water quality status and its causes, water pollution including the eutrophication are concerned at a part of section of upstream decreasing water level in construction and operation phase. It is not expected that water quality get worse after the implementation of this Project because water volume at upstream will be controlled by the operation of sluice gates based on the data of water quality and salinity concentration at the upper stream or downstream of the sluice gates installed by this Project.

The points of sluice gates planning on this Project and its neighboring areas, except Ben Tre luice Gate are located at the rural area, unused area without building such as residences and factories or district that small scale fruits cultivated land is located at both riverside. Therefore, possible water pollution is concerned and the flow control operating water gate considering water quality at downstream is important to prevent water pollution in construction and operation phase. Furthermore, in consideration of increasing population in the future, it can be said that installing the facility disposing the domestic miscellaneous wastewater adequately and operating that facility efficiently are required in future.

Therefore, in terms of wastewater and sewage among sluice gates, while the impact against water quality by implementation of this Project is hardly expected, installing the facility disposing waste water adequately at large scale livestock (pig, chicken) farm, which is expected that being increasing in future, and administrative instruction are important to prevent possible water pollution.

4) Hydrology and Riverbank Erosion

As described at the previous section, flow condition of river and channel change temporarily and partially during the construction phase and the operation phase, there is a possibility that the planned sluice gates may influence the flow condition of the rivers/channels. While there are some points that flow down width become narrower and flow become smaller, there is a possibility that the flow become larger at the other points.

However, measures which do revetment construction and riverbed protection construction to the both banks and the riverbed are considered in the all range expected the hydraulics impact by the operating sluice gates of this Project. And it is expected that the impact to the hydrometeor become temporarily and small scale during the construction phase.

Further, it can be said that hydrology is hardly influenced by the sluice gates in the rainy season because all the sluice gates proposed on this Project keep open during the rainy season. In addition, it can be said that that controlling hydrology of river/channel adequately become possible since this Project includes not only constructing but also operating open and close all the gate, and working adequately based on the data of salinity concentration and water quality through real time data such as flow at the river/channel.

For the riverbank erosion, it is one of the most important issues in Ben Tre Province as described at previous section. According to a staff of Rural Development Division in charge of riverbank erosion, the cause of the riverbank erosion is lateral erosion by running water, not seepage failure.

Other opinions implied some causes that a ship-run generates water wave; dredging work degrades the riverbed. On the other hand, there is also a part of sediment deposition conversely. Riverbank erosion and sediment deposition are regarded as homeostatic phenomenon caused by river force.

It is not confirmed that construction of the proposed sluice gates will cause any favorable or negative impacts on the present riverbank erosion. In this Project, the river protection measures will be conducted all of the riverbank at the construction sites. Therefore, the Project will not cause significant riverbank erosion.

However, it is necessary that the above Rural Development Division in charge of riverbank erosion should conduct more frequency regular monitoring for riverbank erosion, and conduct effective countermeasures for the riverbank erosion, based on the erosion situations in the sites..

5) Ecosystems

Mangroves

At present, small amount of mangrove clusters, which consist only two non-endangered species: *Nypa palm* (*Nypa fruticans*) and mangrove apple (*Sonneratia caseolaris*), still remain along rivers and canals, including the river banks of all the proposed sluice gates in inland of Ben Tre Province. Other founded vegetation was common water hyacinths (*Eichhornia crassipes*) and domestic crops and fruits trees, including domestic banana, coconut, jackfruit, durian, and rose apple (see Figure 3.5.1 and Figure 3.5.4).



Figure 3.5.1 Nyoa Palm with Present Vegetation (near Proposed Vam Nuoc Trong Sluice Gate)

source : JICA survey team (2016)



Figure 3.5.2 Mangrove Apple with Present Vegetation (near Proposed Tan Phu Sluice Gate)

source : JICA survey team (2016)



Figure 3.5.3 Common water hyacinths with Present Vegetation (near Proposed Tan Phu Sluice Gate)

source : JICA survey team (2016)



Figure 3.5.4 Coconuts Fruits Garden (near Proposed Tan Phu Sluice Gate)

source : JICA survey team (2016)

Table 3.5.5 shows salt tolerance of the mangrove species in the survey Area and coasts in Ben Tre Province.

Table 3.5.5 Salt Tolerance of the Mangroves in the Survey Area, and Coasts in Ben Tre Province

Species of mangrove	English name	Japanese name	Salt tolerant	Source
<i>Nypa fruticans</i>	Nipa palm	Nippayashi	10 ‰	[1]
<i>Sonneratia caseolaris</i>	Mangrove Apple	-	35 ‰	[2]
<i>Sonneratia alba</i>	-	Hamazakuro	35 ‰	[3]
<i>Avicennia marina</i>	Grey Mangrove	Hirugidamashi	35 ‰ <	[4]

Source: [1] Ellison, J., Koedam, N.E., Wang, Y., Primavera, J., Jin Eong, O., Wan-Hong Yong, J. & Ngoc Nam, V. 2010.

[2] Kathiresan, K., Salmo III, S.G., Fernando, E.S., Peras, J.R., Sukardjo, S., Miyagi, T., Ellison, J., Koedam, N.E., Wang, Y., Primavera, J., Jin Eong, O., Wan-Hong Yong, J. & Ngoc Nam, V. 2010.

[3] Ball, M. C. and Pidsley S. M., 1995, Growth Responses to Salinity in Relation to Distribution of Two Mangrove Species, *Sonneratia alba* and *S. lanceolata*, in Northern Australia, Functional Ecology, Published by: British Ecological Society, DOI: 10.2307/2390093, Stable URL: <http://www.jstor.org/stable/2390093>

[4] Aziz, I. and Khan M. A., 2000, Physiological adaptations of *Avicennia marina* to seawater concentrations in the Indus Delta, Pakistan, *Pakistan Journal of Botany*, 32(1):151-169

In all the eight proposed sites, remain mangrove forests are few, low in density, scattered, fragmented, only form a thin strips near the water body. The mangrove clusters in Tan Phu, Thu Cuu and Cai Quao is relative bigger than the other sites, but the strips are still less than 2 m in width. Current conditions are the results of development history and population pressure.

The mangroves found in near the sluice gate construction sites are common species, which have not been protected by Vietnamese or international laws, has not been listed in Vietnamese Red Data book (2007). In addition, these species have been listed as Least Concern by IUCN. Table 3.5.6 shows vegetation areas that need to be cleared for the sluice gates construction.

Table 3.5.6 Vegetation Areas need to be cleared for the Sluice Gates Construction

Proposed Sluice Gates	Estimate vegetation clearance (ha)	Approximate clearance area cover by mangrove species (%)	Approximate clearance area cover by Nypa palm (<i>Nypa fruticans</i>) (%)	Approximate clearance area cover by mangrove apple (<i>Sonneratia caseolaris</i>) (%)	Approximate clearance area cover by mangrove species (ha)	Approximate clearance area cover by Nypa palm (<i>Nypa fruticans</i>) (ha)	Approximate clearance area cover by mangrove apple (<i>Sonneratia caseolaris</i>) (ha)
An Hoa	0.98	40	30	10	0.39	0.30	0.10
Thu Cuu	0.40	30	25	5	0.12	0.10	0.02
Ben Tre	0.75	80	20	60	0.60	0.15	0.45
Tan Phu	0.40	30	5	25	0.12	0.02	0.10
Ben Ro	0.37	30	10	20	0.11	0.04	0.07
Cai Quao	0.19	70	60	10	0.13	0.11	0.02
Vam Nuoc Trong	0.84	30	25	5	0.25	0.21	0.04
Vam Thom	0.36	50	10	40	0.18	0.04	0.14
total	4.29				1.91	0.96	0.95

Source : JICA survey team (2016)

According to the Provincial Department of Forestry in Ben Tre, the remaining mangroves along the river near the sluice gates construction sites have not been considered as forest. These mangroves are not considered as a habitat and/or feeding ground of aquatic creatures according to relevant materials and site visits. This means that the mangroves currently do not have an important ecological role .

The ecological important role of mangroves here means a coastal protection function against natural disasters such as typhoons, a cultivation function of fishery resources and a function to preserve a landscape. The reason why those roles/ functions are judged absent in the sluice gates construction sites and their surrounding river banks is these all river bank vegetation is mixed with very small-size clusters of mangrove species and others. Each cluster of mixed vegetation is approx.. 2m width at a maximum and approx.. 3m length at a maximum and located discontinuously in low density.

On the other hand, river bank vegetation has an ecological function as a hiding/ resting ground for fish species. However, the scale of the target river bank vegetation is very small and the impacts on these functions by cutting trees is anticipated minor.

As a result of above, it is expected that habitat's cutting including remaining mangrove species at the entire proposed construction site of sluice gates or surrounding area of each sluice gate site cause few impacts on natural environment. Furthermore, these mangrove species are used as a kind of wood of roof but impacts on social economic and culture of local residences by cutting above volume are few because these species are abundance and growing speed is very fast.

However, it is proposed to conduct a fish capture survey as an environmental monitoring parameter during the detailed design phase in order to verify the impacts on the ecological function of the river bank vegetation.

Apart from the above, there are opinions that habitats along riverside including mangrove species restrain the progress of riverbank erosion. But these characteristic is not only ecological function mangrove species has and it can be said that there is a possibility that general habitats mixing another species restrain the progress of riverbank erosion partially. This Project's designing includes revetment construction and streambed protection construction between both riverside around upper and downstream of the proposed sluice gates and riverside expected hydrology impacts due to operation of sluice gates.

As the result, clearance of some remain mangrove clusters at all of the proposed sluice gate construction sites are completely legal in Vietnamese laws or international regulations. The clearance of remain mangrove have few foreseen environmental impacts. Those clusters currently do not play

significant ecological roles as they do not provide either roosting site or foraging site for fauna.

Fishes

As mentioned in section 4.2.1 of this report, there are some vulnerable species live in the survey Area.

The followings impact analyses based on the fish catch surveys and interview surveys to the local fishermen/aquaculture farmers, and the local fish sellers in the survey Area conducted from August 2015 to May 2016.

a) Findings from The Fish Catch survey

The fish catch survey was regularly conducted by Vietnamese side at 20 sampling points until August, 2015, which were covered local EIA for 11 sluice gates including 8 sluice gates of this Project. In this survey, catch surveys taking over Vietnamese surveys were conducted twice a month at the 20 points as sub-contracted surveys.

In 253 species fish observed on the sub-contracted surveys, fish which could live in only freshwater were 128 species, whose main habitats is freshwater and which don't migrate. There is a high possibility that these species become main fish fauna in upstream by opening and closings. Also, there is a high possibility that these species become main fish fauna in downstream of sluice gates after construction by opening and closing of the sluice gates in dry season. In the same way, fish which could live in only seawater were 72 species and there is a high possibility that these species become main fish fauna in downstream of sluice gates after construction by opening and shutting of sluice gates in dry season.

Classified species as more than Near Threatened (NT) category on IUCN Red List, 6th rarest species from extinct species; extinct risk is small at present but there are factors sliding to upper rank of an endangered species, were observed 9 species. In these species, it is thought that 3 species, *Carcharhinus leucas*, *Himantura walga* and *Epinephelus coioides*, can spend their whole life in seawater and 5 species, *Tenualosa thibaudeaui*, *Hypophthalmichthys molitrix*, *Clarias microcephalus*, *Pangasius krempfi*, and *Boesemania microlepis*, can spend their whole life in fresh water and impact by changing waters environment is relatively not significant.

Table 3.5.7 shows the observed species of field surveys focused on “importance of migration between brackish water and fresh water on life cycle”.

Table 3.5.7 Migration Categories Focused on Importance of Migration between Brackish Aater and Freshwater

Division		Contents
A: species requiring migration between fresh water and seawater (species concerned about ascension and descension)	A-1	They grow up in brackish water and seawater and ascension and lay eggs in fresh water (ascended migration)
	A-2	They grow up in fresh water and lay eggs in brackish water and seawater. (descended migration)
	A-3	They grow up and lay eggs in fresh water and live in brackish water and seawater on a period after hatching.(both side migration)
B: species whose main habitats are fresh water, brackish water or seawater but the other waters are also available.	B-1	They live mainly in fresh water but can migrate to brackish water and seawater
	B-2	They live mainly in brackish water but can migrate to fresh water
	B-3	They live mainly in seawater but can migrate to fresh water and brackish water.

Sources:

- 1) Fishbase: a global information system on fishes. FishBase, 2000.
- 2) Rainboth, W. J. (1996). Fishes of the cambodian mekong. Food & Agriculture Org..
- 3) Panikkar, N. K. (1967). Osmotic behaviour of shrimps and prawns in relation to their biology and culture. FAO.
- 4) Short, J. W. (2004). A revision of Australian river prawns, *Macrobrachium* (Crustacea: Decapoda: Palaemonidae). *Hydrobiologia*, 525(1-3), 1-100.
- 5) Aneykuty, J., Deepthi, G. N., & Lakshmi Devi, P. (2013). Habitat ecology and food and feeding of the herring bow crab *Varuna litterata* (Fabricius, 1798) of Cochin backwaters, Kerala, India.

Table 3.5.7 shows the observed species of field surveys focused on “importance of migration between

brackish water and fresh water on life cycle”..

The followings are expected impacts to fish migration by the construction of the sluice gates:

- 2 species, *Pisodonophis boro* and *Coilia lindmani*, were confirmed as ascended migration type species, which laid eggs in fresh water and descend to brackish water and seawater. If these species access the objective waters as a spawning ground, ascend in fresh water to lay eggs and descend of young fish to the river in brackish water or fresh water after laying eggs are prevented. An gonadal index of *Coilia lindmani* is 3, which is relatively high, there is a high possibility that it access upstream of the sluice gates as a spawning ground.
- 7 species, *Anguilla marmorata*, *Anodontostoma chacunda*, *Chelon subviridis*, *Ellochelon vaigiensis*, *Moolgarda cunnesius*, *Paramugil parmatus*, *Lates calcarifer* and *Terapon jarbua*, were confirmed as species which laid eggs in seawater and ascend to brackish water and fresh water to grow up. On this species, running down of adult fish to the river to lay eggs and running up of young fish to the upper stream are prevented. However, 6 species except *Anguilla marmorata* can live after construction of sluice gates if brackish water environment is exist because these species migrate between brackish water and sea water.
- *Glossogobius aureus* was confirmed as a both side migratory fish which laid eggs in fresh water, descend to brackish water and seawater after hatching and spent a period life of young fish then running up to the river again. Regarding this specie, there is possibility that running down to brackish water and seawater on a period of young fish and ascend in fresh water are prevented by construction of sluice gates and it cannot live in upstream of the sluice gates. By the way, this specie is only one proved as a both side migration type by existing knowledges.
- Migration of *Palaemonoidea* shrimp which has life cycle of ascended migration type such as *Macrobrachium mammillodactylus*, *Macrobrachium rosenbergii* and *Macrobrachium mirabile* are prevented by the construction of sluice gates and there is possibility that ascension to upstream of sluice gates get difficult.

It is considered that mitigation measures against the abovementioned expected impacts are operating open and shut of proposed sluice gates in the dry season with considering above mentioned migratory characteristics and installing fishway mitigating migratory block as an incidental facility of sluice gates with considering construction points of the sluice gates.

For any mitigation measures of the abovementioned migratory fishes, operating open and close of the proposed sluice gates in the dry season with considering above mentioned migratory characteristics and installing fishway mitigating migratory block as an incidental facility of sluice gates with considering construction points of the sluice gates.

Regarding the effectiveness of the fishway to be installed, from the detailed design phase as an environmental monitoring parameter, the species captured near the sluice gates shall be continuously verified in cooperation with local fishermen in order to collect information necessary for designing effective fishway. In addition, based on the judgment at the point of the detailed design, in the operation phase, it is proposed to monitor in collaboration with local fishermen whether the fish actually passes the installed fishway considering the switching of the sluice gates.

b) Findings from The Interview survey for The Local Fishermen/ Aquaculture Farmers, and the Local Fish Sellers

An interview survey for the local fishermen/aquaculture farmers, and the local fish sellers were carried out from the beginning of February to the middle of March 2016.

Forty fish sellers at the study sites, 83 aquaculture farmers (37 households (HHs) at the brackish-water study sites, 46 HHs at the freshwater-water study sites), and 166 fishing households (35 HHs at the study sites around the 8 proposal sluice gates, 63 HHs at the sites at 8 proposal sluice gate, 68 HHs at the coastal sites) were interviewed.

Based on this survey results, the livelihoods of the fisheries households might be affected due to any possible loss of their fishing ground, resulting in reducing their income from fishing activities. The

income sources of the fish sellers might be affected, because most the fish suppliers are from the local fishers. On the other hand, the fresh water resources coming from the project operation are considered by the local fishers and the local fish sellers as other options for their livelihoods such as agricultural farming, orchards, and aquaculture. Therefore, the most of them appreciate the supply of freshwater resource for their living by this Project.

The followings are additional findings for considering the countermeasures for the possible negative impacts:

- Besides fishing activity, most households of the fishers are involved in several activities such as orchards (41% of households surveyed), rearing of livestock (36%), wage labour (not fish related, 23%), aquaculture 16%) and rice farming (11%).
- Most of aquaculture households have land areas for farming, and the average land area per household is 1.2ha, in which aquaculture accounted for 53% of total land areas and followed by orchards (30%) and rice farming (9%).
- Fish sellers were mainly female and about 61% of them are retailers, followed by whole sellers (34%) and fishers (5%), of which 82% are professional sellers.

Birds and avian fauna

As described in the previous section, there is “Vam Ho Bird Sanctuary” in Ben Tre Province in order to protect birds. In this sanctuary, inhabiting of 30 species birds was reported at present. These are general species without migratory birds such as Little egret (*Egretta garzetta*), Intermediate egret (*Mesophoyx intermedia*), and species registered in Vietnamese Red date Book or IUCN Red List were not confirmed. Furthermore, though the field survey in the sites was not continuous, the feed of these birds are insects including harmful one in sanctuary and small fish so that there is few impact due to construction and operation of the sluice gates.

Among the eight planned sluiceway sites, birds were only observed at Cai Quao site and An Hoa site. The only two observed bird species were the White collared kingfisher (*Todirhamphus chloris*) and the yellowed vented bulbul (*Pycnonotus goiavier*), which are common and wide spread species. No evidence of endangered or concerned bird species has been found in all the sluice gates construction sites and adjacent areas.

Therefore, there are few impacts on the avian fauna, which habitat in the natural protected areas, where is located in more than 35km from the closest proposed sluice gate due to construction and operation of the sluice gates.

Other fauna

Most diverse and abundant fauna in Ben Tre Province is obviously insects. It was reported that thousands insects were live in Ben Tre Province and some species were worth economically such as weaver ant (*Oecophylla smaragdina*). For example, *Oecophylla smaragdina* which lives around South East Asia and Oceania builds big colony usually and move between trees because it feeds harmful insects of fruit tree. Bee larva lives in tree trunk of coconuts.

As another fauna, reptiles live near the construction areas of the sluice gates and bats and squirrels live in the coastal area in Ben Tre Province except the construction sites of the sluice gates. These fauna's habitats are not large, thus impacts on these habitats due to construction and operation of the sluice gates are not expected.

3.5.2 SOCIAL SURVEY RESULTS AND IMPACT EVALUATION

1) Involuntary Resettlement

During the Preparation survey, the following surveys had been carried out for updating Resettlement Action Plan (RAP) prepared by CPO in 2014: (a) socio-economic survey (SES), (b) inventory of loss (IOL), and (c) replacement cost survey. The results of the surveys are summarized in the Draft Updated RAP.

Table 3.5.8 shows the scope of land acquisition and resettlement, according to the inventory of loss survey.

Table 3.5.8 Scope of Land Acquisition and Resettlement

No.	Sluice gate	Commune	District	Land acquisition (m ²)	Resettlement (HH)
1	Bến Tre	Nhon Thạnh	Tp. Bến Tre	12,351	0
2		Phú Hưng		15,009	5
3	An Hóa	Long Định	Bình Đại	25,600	3
4		Giao Hòa	Châu Thành	15,500	0
5	Bến Rờ	Tiên Long		12,729	1
6	Tân Phú	Tân Phú		4,935	0
7		Phú Đức		8,842	0
8	Thu Cửu	Phước Long	Giồng Trôm	4,244	0
9		Thạnh Phú Đông	4,200	2	
10	Mỏ Cà Bắc	Tân Thành Bình	Mỏ Cà Bắc	13,126	3
11		Định Thủy	Mỏ Cà Nam	9,830	3
12	Mỏ Cà Nam	Khánh Thạnh Tân	Mỏ Cà Bắc	18,140	1
13		Thành Thới B	Mỏ Cà Nam	14,445	3
14	Cái Quao	Bình Khánh Đông		8,485	1
TOTAL				172,932	22

Source: Drawings on compensation boundary plan of the 8 sluice gates and the IOL

A total number of 160 affected households (AHs) will lose productive land. In which, 89 households (HHs) are lightly affected with less than 20% of their productive landholdings to be acquired (Table 3.5.9).

The number of households who would lose 20% or more of their productive lands is 71 HHs. These households are defined by the Project as severely AHs.

Table 3.5.9 Severity of Impacts on Productive Land

No.	District/ Commune	Total no. of AHs	AHs by severity of impacts				
			<20%	20% - 30%	More than 30%-70%	More than 70%	100%
I. Tp. Bến Tre							
1	Nhon Thạnh	14	7	2	5	0	0
2	Phú Hưng	1	0	0	1	0	0
II. Bình Đại							
3	Long Định	12	3	5	3	1	0
III. Châu Thành							

No.	District/ Commune	Total no. of AHs	AHs by severity of impacts				
			<20%	20% - 30%	More than 30%-70%	More than 70%	100%
4	Giao Hòa	19	9	1	9	0	0
5	Tiên Long	14	9	2	3	0	0
6	Tân Phú	11	6	2	3	0	0
7	Phú Đức	11	6	2	1	2	0
	IV. Giồng Trôm						
8	Phước Long	5	5	0	0	0	0
9	Thạnh Phú Đông	7	4	3	0	0	0
	V. Mỏ Cây Bắc						
10	Tân Thành Bình	15	8	0	7	0	0
11	Khánh Thạnh Tân	8	5	0	3	0	0
	VI. Mỏ Cây Nam						
12	Định Thủy	17	9	3	3	2	0
13	Thành Thới B	17	11	3	3	0	0
14	Bình Khánh Đông	9	7	0	1	1	0
TOTAL		160	89	23	42	6	0
Scale (%)		100	55.6	14.4	26.3	3.8	0

Source: IOL for the RAP preparation

All 160 households (100% of AHs) whose productive land will be acquired mentioned that they have land use right certificates (LURCs) over their affected land.

In the project-affected area, 30 houses in 10 communes will be affected. 23 of them are fourth-grade-dwelling type with the similar characteristics – tiled roof or corrugated iron roof, brick wall, concrete foundation. The other seven (7) houses are temporary houses.

Table 3.5.10 Impact on Houses

No.	Commune	No. of affected house			No. of house with <u>usable</u> remains	No. of house <u>unusable</u> remains	Total affected house area (m ²)
		TOTAL	4 th grade house	Temporary house			
1	Phú Hưng	6	6	0	3	3	534.7
2	Long Định	4	4	0	0	4	545
3	Phước Long	1	0	1	0	1	120
4	Thạnh Phú Đông	3	1	2	0	3	280.0
5	Khánh Thạnh Tân	2	1	1	0	2	320.0
6	Thành Thới B	5	5	0	3	2	861.0
7	Bình Khánh Đông	1	0	1	0	1	120.0
8	Định Thủy	4	3	1	1	3	380.0
9	Tiên Long	1	1	0	0	1	120.0
10	Tân Thành Bình	3	3	0	1	2	245.0
	TOTAL	30	24	6	8	22	3,525.7

Source: IOL for the RAP preparation

A total of 22 HHs would lose residential land and shall be displaced. In which, 14 DHs have large enough remaining self-owned land to reconstruct their houses (on-site relocation), while the other 8 DHs will have to resettle in other places.

Relocated households will face issues due to involuntary resettlement and loss of properties, including:

- Loss of houses and community relations: The households to be relocated settled down right from the early days. Once relocated, the neighborhood and family relationships maintained for generations will be interrupted.
- Loss of production facilities: Besides the current area of agricultural land allocated according to the norms prescribed by the localities, the households to be relocated would also lose the garden area adjacent to the residential land where they plant perennial and short-term crops to generate incomes. The households to be relocated are mainly agricultural households without additional jobs. When relocated, without farming land, their life will encounter many difficulties.
- Loss of community resources such as natural habitats and cultural features: the households to be relocated are presently living under a peaceful environment, but they may lose their current living conditions after resettlement.

Measures to mitigate impacts of involuntary resettlement are described in the separately-prepared RAP.

2) The Poor

According to the SES and IOL, there are a number of vulnerable people (VP) in 10 communes (among 14 affected communes) who would be affected by the land acquisition. They belong to 4 categories, including: the poor, socially policy-treated HH, the lone elderly, and landless HH. Of which, the poor and socially policy-treated HH occupy the largest ratios. No other category of the vulnerable groups (such as ethnic minority, female headed with dependents) was discovered during the survey. Among the affected households, there is one landless household in Thạnh Phú Đông Commune of Giồng Trôm District. Detailed numbers are presented in the following table.

Table 3.5.11 Estimated Number of Vulnerable Households to be affected

No.	District/ Commune	Total no. of VHs	Vulnerability			
			The poor	Policy treated HH	The lone elderly	Landless HH
	I. Tp. Bến Tre					
1	Nhon Thạnh	4		2	2	
2	Phú Hưng	1	1			
	II. Bình Đại					
3	Long Định	2	1		1	
	III. Châu Thành					
4	Tân Phú	1	1			
5	Phú Đức	1			1	
	IV. Giồng Trôm					
6	Thạnh Phú Đông	1				1
	V. Mô Cày Bắc					
7	Tân Thành Bình	3		3		
8	Khánh Thạnh Tân	1	1			
	VI. Mô Cày Nam					
9	Định Thủy	1		1		

No.	District/ Commune	Total no. of VHs	Vulnerability			
			The poor	Policy treated HH	The lone elderly	Landless HH
10	Binh Khanh Dong	1	1			
TOTAL		16	5	6	4	1
Scale (%)		100	31.25	37.50	25.00	6.25

Source: SES for the RAP preparation

These households would face difficulty in restoring their living and livelihood after resettlement. Therefore, they should be provided with special assistants as described in RAP.

3) Local Economy such as Employment and Livelihood

- Positive impacts to local economy

Agriculture constitutes the largest share of the economy of affected communes. The most popular crop type is coconut, which is grown in large scale in all communes. There are some communes where its land is almost dominated by coconut gardens, namely Phu Duc, Phuoc Long, Thanh Phu Dong, Thanh Thoi B, and Dinh Thuy. In contrast, fruit gardens (excluding coconut) make up the majority of the agricultural area in some communes like Tien Long and Tan Phu. The most popular fruit crops are pomelo, durian, rambutan, mango and longan. Paddy cultivation is diminished significantly in most communes, except Long Dinh and Phu Hung. In some areas, farmers also grow some different crops in coconut garden, including cacao, banana and some fruits. In general, the diversity of crops reflects the impact of saline intrusion on local agriculture, as most of fruit species are not saline water-tolerant, leading to the predominance of coconut in a large number of communes.

Besides horticulture, husbandry also plays an important role in local economy. The most prevalent domestic animal is pig, with more than 124 thousands of individuals in total. It is followed by the population of goats and cows of which herd sizes vary from a few to more than thousands (in Khanh Thanh Tan, Tien Long, Phu Hung, and Tan Phu). Poultry is also widely raised, accounting for more than 360 thousand of chicken, ducks and birds in 14 communes. In addition, there is also small areas dedicated for aquaculture, which are either freshwater (for fish and freshwater prawn) or brackish (for shrimp). The largest aquaculture area belongs to Tan Phu Commune (89 ha) and Thanh Phu Dong Commune (88 ha).

Table 3.5.12 Agriculture in the affected communes

No	Commune	Farm area (ha)					Husbandry (thousands)				Aqua-culture (ha)
		Rice	Annual crops (excl. rice)	Coconut	Cacao (mixed)	Fruits	Pig	Cow	Goat	Poultry	
1	Nhon Thanh	-		387.55	-	297.5	1.30	0.116	0	13.00	24.0
2	Phu Hung	97.6	26.0	338.0	-	42.0	1.20	1.209	0	15.00	7.1
3	Long Dinh	158.6	21.5	96.8	-	333.9	2.12	0.206	0.237	18.63	2.2
4	Giao Hoa	22.4	9.2	194.4	-	145.4	0.97	0.075	0.286	4.59	13.1
5	Tien Long	-	-	142.6	-	789.4	0.93	0.009	1.193	26.46	75.0
6	Tan Phu	-	-	90.9	-	1078.0	1.36	0.087	1.240	23.03	89.4
7	Phu Duc	-	-	110.1	-	-	1.12	0.020	1.250	5.43	75.0
8	Binh Khanh Dong	-	-	676.9	31.0	28.0	19.52	0.237	0.411	20.03	
9	Thanh Thoi B	-	-	847.0	27.4	-	40.60	0.772	0	48.36	15.0
10	Dinh Thuy	-	-	1112.1	33.2	79.0	18.50	0.112	0	75.00	23.3

No	Commune	Farm area (ha)					Husbandry (thousands)				Aqua-culture (ha)
		Rice	Annual crops (excl. rice)	Coconut	Cacao (mixed)	Fruits	Pig	Cow	Goat	Poultry	
11	Tan Thanh Binh	26.1	32.5	1195.6	-	122.2	10.18	0.374	0.684	62.39	61.4
12	Khanh Thanh Tan	20.0	83.4	679.3	-	135.6	18.60	2.350	0	22.50	27.8
13	Phuoc Long	-	-	1118.3	-	85.7	4.48	0.074	1.252	25.74	39.7
14	Thanh Phu Dong	-	-	1058.0	-	-	4.00	0	1.582	0.67	88.7

Source: Annual socio-economic reports provided by CPCs, 2015

According to participants in the stakeholder consultation meetings in the communes, the most concerned issues of the farmers in the Ben Tre Province are as following (Table 3.5.13).

Table 3.5.13 Most concerned issues of local residents

No.	Concerns of stakeholders	Stakeholders						
		Local authority	Rice farmer	Coconut farmer	Fruit farmer	Husbandry	Aquaculture farmer	Others
1	Lack of freshwater causing low agricultural productivity	****	****	****	****	****	**	**
2	Sluice-gate operation schedule	****	***	***	***	***	***	**
3	Water pollution due to industrial/agricultural discharge	****	****	****	****	****	****	**
4	Water logging due to closure of sluice-gate	****	***	***	***	**	*	*
5	Develop irrigation canals	***	**	**	**	*	*	*
6	Capital support	***	***	***	***	***	***	*
7	Technical supports to change livelihood activities	**	**	**	**	**	***	**
8	Market of agricultural products	*	**	**	**	**	**	*
9	Detail plan of brackish and freshwater areas	**	**	**	*	*	**	NA
10	Control pest and disease	**	**	**	**	**	NA	NA
11	Impact of the project on fishery resource	***	NA	NA	NA	*	****	**

Source: JICA survey team(2016)

It can say that the lack of freshwater is the most concerned issue among the farmers in the Ben Tre Province. The sluice gates system planned under the B-SWAMP project would help constantly supply freshwater to the area throughout the year, thus help provincial people develop high value-added agricultural production such as fruit tree cultivation, livestock, etc. In addition, the bridge and access roads planned together with the sluice gates may contribute to the improvement of local road network, and promote local economy and industry development.

- Adverse impacts to local economy

The project shall need to acquire some lots of agricultural land for construction of sluice gates and roads. Particularly, three coconut coir manufacturing enterprises (two in Phu Hung commune, one in Thanh Thoi B commune), and one construction and trade company of Phu Hung commune would be affected by land acquisition for the Project. Of which, one coconut coir production enterprise and the construction and trade company are slightly affected as their acquired areas are less than 20%. The other two coir production enterprises are considerably affected with the percentage of land to be acquired is higher than 50%. These two enterprises may be difficult to continue their operation since the remaining areas are insufficient to sustain their business.

In addition, a part of local fishermen and fish sellers may be affected by the project. According to the interview survey to these fishermen and fish sellers carried out in February and March 2016, income of the local fishermen and fish sellers whose livelihood depends on catching fisheries would be reduced to some extent due to the operation of the sluice gates. Presently, according to fishermen (98 persons interviewed by the Survey Team) who are carrying out catching fisheries around the planned sluice gates, due to the exceeded catching, unlawful catching, water pollution, etc., the quantity of caught fishes is decreasing year by year, and it becomes hard to catch the shrimps, crabs with high market value. In the future, when the planned sluice gates are brought into operation, these gates would be closed during the dry seasons, and it would cause the additional change in fish catch, due to the change of river ecosystem, water salinity, water quality, and the tides and water flows in the areas inside the gates.

On the other hand, it is said that a large number of fishermen are also earning incomes from fruit cultivation, livestock, part time labor, aquaculture, rice cultivation, etc., beside fish catching. In actuality, a fisherman household usually has a land lot of about 3,500 m². About a half of this land area is using for fruit cultivation. A large number of interviewed fishermen said that they expect the Project will be soon implemented, because they think it would help supply freshwater stably throughout the year that is necessary for their daily life, livestock, orchard, etc. A part of fishermen said that they can change the fishing ground and continue their fish catching. Besides, they expect that they can improve their livelihood by concentrate efforts into fruit cultivation, livestock, etc. with the use of freshwater to be supplied as a result of the Project. However, local authorities such as DARD should make further efforts to help fishermen who needs to change livelihood by providing them with know-how and technical assistance for fruit cultivation, stock raising, etc.

Based on the above, most of the local fishermen are doing fishing activities in the variety of the waterbodies, and has each alternative fishing ground. It is difficult to think that this sluice gates construction and their operations of this project will cause direct significant adverse impacts on the earning incomes of the local fishermen. Also, as it is described the above, most of the local fishermen have alternative earning incomes except for the fisheries. It is difficult to think that actual main source of the earning incomes of the local fisherman is came from the local fisheries.

Therefore, it could be said that this Project will not cause significant adverse impacts on the local fishermen. Monitoring on the local fishermen will be conducted during the period of the project implementation stage; if some adverse impact on the local fishermen's household is identified as a result of the monitoring, formulation of mitigation measures such as compensation and/or assistance shall be recommended to the Ben Tre PPC.

- Impedance of waterway transportation

The newly constructed sluice gates might impede a number of goods transporting boats, fishing boats, etc. One ferryman who is carrying out transportation service between two banks of the Vam Nuoc Trong River near the Vam Nuoc Trong Sluice Gate may lose his means of livelihood due to the development of the road on the sluice gates.

During the Preparation survey, a number of surveys were carried out to predict and assess impacts that may be caused by the project to the boats/ships which are frequently using the waterways where the sluice gates are planned.

4) Land Use and Utilization of Local Resources

In the construction phase, some lots of agricultural land around the sluice gates would be acquired to make land for the sluice gates and access roads.

In the operation phase, land for cultivation of fruit trees, vegetables would be expanded due to the stable supply of freshwater. Local resources would be efficiently utilized because of the development

of local road network.

According to results of the consultation meetings, focus group meetings, and field surveys, the lack of saline water for shrimp aquaculture in downstream of the rivers is considered not serious even in the operation phase of the project. Therefore, adverse impacts to shrimp aquaculture due to the lack of saline water in the operation phase are not expected. However, measures to control polluted water in the operation phase should be carefully prepared and implemented.

5) Water Usage

In the construction phase, the river water near the construction sites would be temporarily polluted. Residents living near the construction sites would have to treat river water before using it for livestock. Proper construction method should be applied to control polluted water from construction works.

In the operation phase, with the proper operation of the sluice gates, the river water quality and water flow may be adjusted to suit the needs of water usage of local residents.

6) Existing Social Infrastructure and Service

The areas around the planned sluice gates are almost being used for agricultural production with no specified public facilities (such as electric poles, water supply pipes, communication cables, etc.). However, transportation on the rivers may be temporarily impeded during the construction of the sluice gates.

In the operation phase, the road network development associated with the sluice gates construction would provide the local residents with the easy access to the public facilities in the area. On the other hand, the existing ferry service near the planned Vam Nuoc Trong Sluice Gate may be suspended. And transportation on the river may be obstructed by the appearance of the sluice gates.

7) Misdistribution of Benefits and Damage

It is expected that the Project will bring benefits widely to the residents of the Ben Tre Province. Misdistribution of benefits is not confirmed. Possibility of occurrence of damage concentratedly to a specific social group such as women, children, poor people, vulnerable people, etc., is not observed.

During the construction period, residents residing near the sluice gate construction sites would be directly affected by noise, water pollution, etc. However, these impacts are predicted insignificant since the construction are small scale, and the areas around the planned sluice gates are mostly agricultural land.

In the operation phase, residents living near the sluice gates may be directly benefited in terms of reduction of travel time with the use of improved road network associated with the sluice gates.

8) Local Conflicts of Interest

According to results of the consultation meetings in the communes, the focus group meetings, and the field surveys, it is concluded that possibility of occurrence of conflict between farmers who need freshwater for paddy cultivation and the ones who need saline water for shrimp aquaculture is not predicted, even in the operation phase of the project.

In actuality, it is observed that local residents are working close together in carrying out water management in the community. Brackish water is used for shrimp aquaculture mostly in the districts near the seashore (i.e. Binh Dai District, Ba Tri District and Thanh Phu District), where cultivation which needs freshwater such as rice, vegetable, fruit tree, etc., is not suitable. However, the farmers in some areas of these districts may try to cultivate rice in a part of his/her land during/after the rainy season. In this case, the farmers actually discuss together and make consensus on the water

management roles, schedule to close/open the sluice gates, etc. Trouble may happen between farmers when there is farmer who does not observe these roles or when there is leakage of brackish water into the paddy fields or orchards due to technical accident of the sluice gate or when the sluice gate is stuck by trashes, or other unusual things.

9) Infectious Diseases such as HIV/AIDS

In the construction phase, the risk of spread of infectious diseases such as HIV/AIDS may be increased, if without proper management of workers came from outside. In addition, construction workers may breach the local security and order, if without good propaganda and management.

In the operation phase, travel on land may be improved, but the risk of spread of infectious diseases is not expected.

10) Working Environment (Including Work Safety)

In the construction phase, human health and safety, both within the construction workforce and among the residents living around the planned sluice gates, may be issues for concern. Management plan of construction sites, construction yard, worker camps, etc. should be carefully examined in the EMP.

11) Accidents

Construction of the sluice gates will potentially cause technical incidents, leading to the works collapse, especially when installing the scaffolds and constructing the abutments. Once happening, incident will cause not only threat to workers' lives but also serious consequences to boats, ships, etc. passing the construction sites.

In the operation phase, risk of boat/ship collision may be increased due to the limited width of navigation clearance at the sluice gates, and the concentration of many boats/ships at the navigation locks when the main sluice gates are closed during the dry seasons. Proper operation of the navigation locks at the sluice gates of Vam Thom (Mo Cay Nam), Vam Nuoc Trong (Mo Cay Bac), Ben Tre, and An Hoa are particularly required to prevent vessel collision accidents at these sites.

Table 3.5.14 shows the results of social impact assessment based on scoping and survey findings.

Table 3.5.14. Evaluation based on Scoping and survey Findings (Social consideration)

Classification	No.	Items of Impact	Impact Assessment at Scoping		Impact Assessment based on survey Findings		Evaluation Reasons
			Pre- and Mid Const- ruction	Opera- tion	Pre- and Mid Const- ruction	Opera- tion	
Social Environ- ment	13	Involuntary resettle- ment	B-	D	B-	D	<p>【The Pre-construction Phase】 A total of 22 HHs would lose residential land and shall be displaced. Of which, 14 DHs have large enough remaining self-owned land to reconstruct their houses (on-site relocation), while the other 8 DHs will have to resettle in other places.</p> <p>【The Construction Phase】 Temporary lease of land and additional small scale resettlement would be required for the construction yards.</p> <p>【The Operation Phase】 Additional land acquisition and resettlement is not expected.</p>
	14	The poor	B-	B-	B-	B-	<p>【The Construction Phase/ The Operation Phase】 Five poor HHs would lose their own land for living and/production. These HHs would be seriously affected by resettlement and may lose their business opportunity and should be provided with appropriate</p>

Classification	No.	Items of Impact	Impact Assessment at Scoping		Impact Assessment based on survey Findings		Evaluation Reasons
			Pre- and Mid Construction	Operation	Pre- and Mid Construction	Operation	
	16	Local economy such as employment and livelihood	B±	B±	B±	B±	<p>【Construction phase】 Local residents may have the opportunity to work as construction workers on the Project. Activities of ferrymen, boats transporting goods, fish boats on the rivers near the sluice gates would be impeded during the construction period.</p> <p>【Operation phase】 Development of high value-added agricultural production such as fruit tree cultivation, livestock, etc., would be enabled when fresh water is constantly supplied throughout the year. Access roads planned on the sluice gates may contribute to the improvement of local road network, and promotion of local economy and industry development. One ferryman who are carrying out business near the Vam Nuoc Trong (Mo Cay Bac) Sluice Gate would lose his existing mean of livelihood due to the development of the road on the sluice gate. A number of waterway users (goods transporting boats, fishing boats, etc.) would be impeded by the newly constructed sluice gates.</p>
	17	Land use and utilization of local resources	B-	B±	B-	B+	<p>【Construction phase】 Some lots of agricultural land around the sluice gates would be lost by the Project.</p> <p>【Operation phase】 The expansion of land for cultivation of fruit trees, vegetables are expected due to the stable supply of fresh water. The lack of saline water for shrimp aquaculture in the river downstream is assessed insignificant. Local resources would be efficiently utilized due to the development of local road network.</p>
	18	Water usage	B-	B±	B-	B+	<p>【Construction phase】 Irrigation water would be temporarily affected due to the polluted water generated from the construction sites.</p> <p>【Operation phase】 With the proper operation of the sluice gates, the river water quality and water flow can be adjusted to suit the needs of local residents.</p>
	19	Existing social infrastructure and service	B-	B±	B-	B±	<p>【Construction phase】 The transportation on the rivers may be temporarily impeded during the construction of the sluice gates.</p> <p>【Operation phase】 Local residents will be able to easily access public facilities in the area due to the road network development associated with the sluice gates construction. On the other hand, the existing service by the ferryman near Vam Nuoc Trong Sluice Gate would be suspended. The transportation on the river may be obstructed by the appearance of the sluice gates.</p>
	21	Misdistribution of benefits and damage	C	B-	B-	D	<p>【Pre-construction phase/Construction phase】 Residents residing near the sluice gate construction sites would be directly affected by noise, water pollution, etc.</p> <p>【Operation phase】 Residents living near the sluice gates may be directly benefitted in terms of reduction of travel time. Conflict on the need of water supply and water treatment between farmers is assessed insignificant.</p>
	22	Local conflicts of interest	D	B-	D	D	<p>【Construction phase】 Conflicts of interest between local residents during construction phase are not expected.</p> <p>【Operation phase】</p>

Classification	No.	Items of Impact	Impact Assessment at Scoping		Impact Assessment based on survey Findings		Evaluation Reasons
			Pre- and Mid Construction	Operation	Pre- and Mid Construction	Operation	
							Possibility of occurrence of conflict between farmers who need freshwater for paddy cultivation and the ones who need saline water for shrimp aquaculture is not predicted.
	27	Infectious diseases such as HIV/AIDS	B-	D	B-	D	【Construction phase】 The risk of spread of infectious diseases such as HIV/AIDS may be increased due to the construction workers from outsides. 【Operation phase】 Travel on land may be improved, but the risk of spread of infectious diseases is not expected.
	28	Working environment (including work safety)	B-	D	B-	D	【Construction phase】 Construction workers' health may be affected by air pollution generated from the construction works, if the working environment is not appropriately improved. 【Operation phase】 Impact on working environment that requires particular consideration during the operation phase is not expected.
	29	Accidents	B-	C	B-	B-	【Construction phase】 There would be the risk of occurrence of accidents during construction, if working safety is not appropriately improved. Accidents on the rivers would occur near the construction sites of the sluice gates. 【Operation phase】 Risk of boat/ship collision may be increased due to the limited width of navigation clearance at the sluice gates, and the concentration of many boats/ships at the navigation locks when the main sluice gates are closed during the dry seasons

3.6 MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT/ MONITORING PLAN

3.6.1 MITIGATION MEASURES FOR ENVIRONMENTAL IMPACTS

Table 3.6.1 shows mitigation measures for possible adverse environmental impacts.

Table 3.6.1 Mitigation Measures for Possible Adverse Environmental Impacts

Impacts	Mitigation measures	Implementing organization	Responsible organization	Overall cost per year (1,000 VND)
Construction Phase				
Air pollution	-Vehicles carrying demolition and construction materials must have waterproof covering tarps to prevent emission. Covering tarps – included in construction cost -Sprinkling water in the demolition area and the transport roads to diminish dust. <i>Water sprinkling cost</i> $10,000 \text{ VND/m}^3 \times 2 \text{ m}^3/\text{site/day} \times 8 \text{ sites} \times 100 \text{ day/year} = 16 \text{ million/year}$ - Controlling the quality of vehicles and machinery and periodically maintaining them for limiting excessive exhaust emissions. -All trucks and motorized construction equipment have to meet the criteria set by Vietnam Register (VR).	Construction Unit	ICMB9	16,000
Water pollution	- Prohibiting defecation and disposal of wastes into the river. - Installing toilets at construction sites with temporary wastewater treatment system (septic tanks). <i>Mobile toilets</i> $2 \text{ toilet/site} \times 8 \text{ sites} \times 15 \text{ million VND/toilet} = 240 \text{ million VND}$	Construction Unit	ICMB9	240,000

Impacts	Mitigation measures	Implementing organization	Responsible organization	Overall cost per year (1,000 VND)
	<p><i>Septic tanks</i> $1 \text{ septic tank/site} \times 8 \text{ sites} \times 10 \text{ million VND/septic tank} = 80 \text{ million VND}$</p> <p><i>Cleaning fees</i> $0.128 \text{ kg/person/day} \times 100 \text{ worker/site} \times 8 \text{ sites} \times 150.000 \text{ VND/ton} \times 0.001 \text{ ton/kg} \times 100 \text{ day/year} = 15.36 \text{ million VND/year}$</p> <p>- Limiting the runoff discharges of rainwater/water used for washing equipment to the river by building temporary drainage ditch and settling tank surrounding the construction sites.</p> <p>--Wastewater pH disposal related to concrete constructions $pH \text{ disposal fee: } 18 \text{ million VND} \times 8 \text{ site} = 144 \text{ million VND}$</p> <p>-Water pollution diffusion prevention fence, if necessary $\text{Water pollution diffusion prevention fence fee: } 10 \text{ million VND} \times 8 \text{ site} = 80 \text{ million VND}$</p>			80,000
				15,360
				144,000
				80,000
Wastes	<p>- Demolition and construction wastes are gathered and segregated at source.</p> <p>- Spilled materials have to be collected and treated as other wastes.</p> <p><i>Renting containers for construction wastes and hazardous wastes.</i> $4 \text{ container/site} \times 8 \text{ site} \times 1 \text{ million/container} = 36 \text{ million VND}$</p> <p><i>Waste bins</i> $2 \text{ waste bins} \times 1.5 \text{ million/bin} \times 8 \text{ camps} = 24 \text{ million VND}$</p> <p><i>Transportation and treatment fees (according to Decision No. 21/2011/QĐ-UBND by Ben Tre PPC)</i> $0.6 \text{ kg/person/day} \times 100 \text{ worker/site} \times 8 \text{ sites} \times 360.000 \text{ VND/ton} \times 0.001 \text{ ton/kg} \times 100 \text{ day/year} = 17.28 \text{ million VND/year}$</p> <p>- Hazardous wastes, including combustible wastes and waste oil, have to be stored in isolation and to be treated in accordance with the regulations specified in the Circular No. 36/2015/TT-BTNMT issued by MONRE.</p>	Construction Unit	ICMB9	36,000
				24,000
				17,280
Ecosystems	<p>- The scope of the project site must be measured properly to ensure the minimum cutting of trees, and maintaining the green coverage in the area. (Riverbank protections are conducted all the vegetation clearance sites by the construction).</p> <p>- Prohibiting of illegal wastes disposal on the ecosystem and leakage of materials to rivers /canals.</p> <p>- For the migratory fishes, any escape migratory route in some sluice gate construction sites should be set up.</p>	Construction Unit	ICMB9	
Noise and vibrations	<p>- Anti-noise equipment should be installed for the machinery such as generator, air compressor, etc.</p> <p>- Construction vehicles and machinery should be inactive for 6pm to 6am.</p> <p>- The schedule of construction vehicles and equipment should be aptly regulated to avoid raising the intensity of vehicles during rush hours and noon.</p> <p>- Periodic maintenance of construction vehicles and machinery, especially ones generating high noise level should be conducted.</p>	Construction Unit	ICMB9	
Operation Phase				
Air pollution	- Controlling the quality of vehicles and machinery and periodically maintaining them for limiting excessive exhaust emissions.	DONRE	ICMB9,	
Water pollution	<p>- Operating the sluice gates (opening and closing) timely, properly and in accordance with changes in salinity and water quality.</p> <p>- Dredging canals on a periodic basis.</p> <p>- For the long-term base, developing and launching wastewater management and treatment plans.</p> <p>-Raising awareness of local residents in environmental protection; and setting policies to discourage the release of untreated wastewater and wastes into the canals/rivers.</p> <p><i>Awareness raising program</i> $5,000,000 \text{ VND/commune/year} \times 44 \text{ communes} = 220 \text{ million VND/year}$</p>	Sluice Gate Operation Organization	ICMB9	220,000
		Local Government		
Ecosystem	- Design the gates to minimize the turbulence of water outside the gates and maximize the flow of water.	Detail Design Origination	ICMB9	

Impacts	Mitigation measures	Implementing organization	Responsible organization	Overall cost per year (1,000 VND)
	<ul style="list-style-type: none"> - <i>Installing auxiliary structures to facilitate the fish migration.</i> - Only closing the sluice gates when necessary, keeping the gates open at maximum in sensitive period (e.g. breeding season). 	Sluice Gate Operation Organization		

3.6.2 MITIGATION MEASURES FOR SOCIAL IMPACTS

1) Involuntary Resettlement

- Measures to mitigate impacts of involuntary resettlement are described in the separately-prepared Resettlement Action Plan (RAP) . Table 3.6.2 shows the major items of RAP.
- The RAP has contents in conformity with Vietnamese laws and regulations as well as the JICA Environmental Guidelines (2010), and was reviewed by both JICA and Vietnamese side. The RAP was submitted to Ben Tre PPC for approval and will be used as a basis to prepare the Policy Framework for Compensation, Support and Resettlement Alternative, as stipulated in Article 17 of Decree 47/2014/ND-CP).
- Local residents shall be informed about the project plan, and shall be urged to participate in the Project from the early stage of the project planning to the construction stage, through the informative / discussion meetings to grasp their needs and to build consensus on the Project. Discussion meetings, hearings, etc. should be organized with aim to diffuse information on the project design, anticipated impacts, recommended mitigation measures, etc. and collect opinions of local residents and competent authorities on these issues.
- Necessary information, documents on the project plans, and budgets for carrying out compensation, supports and resettlement shall be sufficiently and timely provided.

Table 3.6.2 Major items of RAP

<p>1. COMPENSATION POLICY, ELIGIBILITY AND ENTITLEMENT</p> <p>1.1 Eligibility to compensation and resettlement assistance</p> <p>Types of households eligible for compensation and resettlement assistance will include: (a) those who have formal legal rights to land or other assets; (b) Those who initially do not have formal legal rights to land or other assets but have a claim to legal rights based upon the laws of the country; upon the possession of documents such as land tax receipts and residence certificates; or upon permission of local authorities to occupy or use the project affected plots; and (c) Those who have no recognizable legal right or claim to the land they are occupying. Persons covered under (a) and (b) are provided compensation at full replacement costs for the land they lose, payment for non-land assets they own and necessary assistance in cash or in-kind. Persons covered under (c) are provided compensation at full replacement cost for non-land assets they own and resettlement assistance, in lieu of compensation for the land they occupy, and other assistance, as necessary, to achieve the objectives set out in this policy provided that they occupy the project area prior to the cut-off date of the project. Persons who occupy the project area after the cut-off date will not be eligible to any compensation or assistance.</p> <p>1.2 Cut-off date</p> <p>For this Project, the cut-off date is defined as the date when the land acquisition notification (“Thông báo thu hồi đất”) for the Project is declared by Ben Tre PPC, following the project approval decision (“Quyết định phê duyệt dự án”) by MARD. Persons who occupy the project site after the cut-off date will not be eligible for compensation and relocation assistance.</p> <p>1.3 Entitlement matrix</p> <p>The Entitlement Matrix, presented in the RAP, covers the impacts currently identified during project preparation. It covers also the impacts which could arise during the construction period.</p>
<p>2. INCOME RESTORATION AND REHABILITATION</p> <p>2.1 Policy</p> <p>According to the Policy Framework on Compensation and Resettlement for the Project, the following households, who would lose 20% or more (from 10% for the vulnerable households) of their productive landholdings, will be subject to the Income Restoration Plan (IRP) of the Project. The IRP is designed and implemented in consultation</p>

with those affected during the project implementation.
Number of AHs given participation into the IRP

PAPs	Displaced households	HHs losing \geq 20% productive land	Vulnerable households	Total
Number	22	71	16	109

2.2 Income Restoration Plan

During the SES & FGMs, the PAPs were asked to raise their needs on the income restoration. The following table presents the need assessment of the PAPs as a result.

Needs assessment of the PAPs for income restoration

PAP	Impact	Recommended solution	Need
Farmer	Losing income from garden and husbandry because of productive land shortage	Increase productive benefit on the remaining land	Concessional loans for new investment Technical training
	Remaining land is no longer larger enough and unfeasible to keep cultivation	To buy alternative productive land	Compensation at full market price for the lost land area
	Productive land is fragmented into small pieces	To acquire small plots of remaining land at full market price	Vocational training, job introduction
Resettled business HH	Losing familiar customer after resettlement	Positioned business after resettlement	Resettlement near the existing location
Small industry enterprise and worker	Remaining area after land acquisition is no longer larger enough and unfeasible to keep working	To revise the design of the sluice gates to avoid or minimize land acquisition of the enterprise (in Thanh Thoi B commune)	

The IRP will focus on different activities to: (i) provide supports and appropriate technique to PAPs whose remaining agricultural land is still viable for implementing agricultural extension, (ii) organize training courses which are suitable to PAPs' capacity; provide supplementary trainings, consultations, allowance and other supports to participants attending the courses as well as services for creating and introducing jobs to trainees after being trained; and (iii) provide technical advice, pilot models on small business/services and other training courses, study tours on efficient economic enterprises.

3. RESETTLEMENT ARRANGEMENT

3.1 Entitlement for resettlement

The degree of impact on affected residential land with houses thereon may be any of these two possibilities: (i) the remaining unaffected portion of the residential land is sufficient for the AHs to reconstruct their house thereat; or (ii) the entire residential land is acquired or the remaining unaffected area is not sufficient for the household to reconstruct their house and, thus, they have to move to a new place either through an arrangement with the DCSCC or by themselves (self-resettlement).

3.2 Consultation with the DPs on resettlement preferences

During the SES and IOL, each resettling households was consulted on their relocation preferences. As a result, among 22 households to be resettled of the project, 9 households expressed intention to resettle on their remaining lands (on-site relocation), and other 8 households expressed intention to receive adequate compensation and allowance for self-relocation with appropriate legislative support from local government. The other 5 households whose remaining land is sufficient to reconstruct their house but it is likely difficult to maintain agriculture have not made decision yet. These households said that they will wait for obtaining further information from the detailed design of the sluice gates and will make decision at that phase.

Resettlement preferences of the DHs

No.	Commune	Total HHs to be resettled	Preference		
			On-site resettlement	Self-resettlement	Not decided yet
	Phú Hưng	5	2	0	3
	Long Định	3	1	1	1
	Khánh Thành Tân	1	1	0	0
	Bình Khánh Đông	1	0	1	0
	Thanh Phú Đông	2	0	2	0
	Tân Thành Bình	3	0	3	0
	Thành Thới B	3	1	1	1
	Định Thủy	3	3	0	0
	Tiên Long	1	1	0	0
	TOTAL	22	9	8	5

Most of resettled households said that they have lived in the affected areas for a long time. Therefore, they do not

want to relocate outside the commune because it will impact on their existing socio-economic settings and relations.

Considering to above resettled households' preferences on their relocation and the fact of that low number of resettled households whose remaining land are not sufficient to rebuild their house, no new resettlement site needs to be developed for this project.

2) The Poor

There are 16 vulnerable households among 160 HHs who would lose land for the Project, according to the results of the socio-economic survey. Number of households which are identified as "poor"¹⁰ is 5 HHs. Measures to mitigate impacts to these vulnerable households, including the poor households are described in the separately-prepared RAP. Special support policies for the poor are as following:

- For relocated poor and other vulnerable HHs, the Project will provide special assistance to ensure that they are able to move and re-establish their living at the new sites.
- Relocated poor people, who has 20% or more of their productive land to be affected, or the affected land is smaller than 20% of the productive land but the remaining land is rendered unviable: will be received the special support according to the regulation of Ben Tre PPC.
- The landless household (in Thanh Phú Đông Commune of Giồng Trôm District) affected by the Project should be assisted to have an apartment that they can rent or buy in installment.
- Others

3) Local Economy such as Employment and Livelihood

In the construction phase, the contractors shall be urged to employ local residents to work as construction workers especially for simple works. And proper construction method and construction schedule shall be carefully considered so as the construction works will not cause serious impedance to the waterway transportation.

In the operation phase, in order to mitigate adverse impacts to affected waterway users, the measures proposed in the Policy Framework for Waterway Users shall be further examined and implemented after having consent/approval by Ben Tre PPC and/or ICMB9.

4) Land Use and Utilization of Local Resources

Measures to mitigate impacts to residents who will lose land for the project are described in the separately-prepared RAP. These measures should be examined and implemented during the pre-construction phase and the construction phase.

In addition, according to the participants in the stakeholder consultation meetings in the communes, the full use of existing land resource is expected. A great number of participants expressed that they need to improve knowledge about advanced technologies on agricultural production, such as improved breeds for increasing production. Additionally, diversification of agricultural activities suitable to local conditions, development of secondary and tertiary industries, especially processing industries are considered necessary in order to modernize local economy. Pig husbandry, freshwater aquaculture, and fruit garden (particular green pomelo and coconut) are considered the most suitable agricultural productions in the locality because they are dominant in Ben Tre and the PAPs have much experience about its cultivation.

In addition, in order to help local residents in choosing the optimized cultivation that is suitable to the salinity of water in their area, a draft land use plan was made during the Preparatory Survey. Adequacy of crops to salinity, stakeholders' needs, and market potential were taken into consideration during the formulation of this draft land use plan. This land use plan is a temporal plan with some predicted

¹⁰ In Vietnam, a household is assessed "poor" when the average income is: (1) under VND 400,000 per capita per month or VND 4,800,000 per capita per year (roughly USD \$19 per capita per month) in rural areas, and (2) under VND 500,000 per capita per month or VND 6,000,000 per capita per year (roughly USD \$24 per capita per month) in urban areas.

conditions of sea level rise, Mekong River discharge, construction of sluices, market trend, and so on. Therefore, it should be updated by the local government of the Ben Tre Province once in a while based on the latest data and information. In this Preparatory Survey, a technical cooperation project attached to the loan assistance project is proposed with aim to strengthen officers concerned in responsible agencies of Ben Tre Province to carry out the simulation analysis, land use planning, monitoring of saline concentration, and operation and management of sluices.

5) Water Usage

In the construction phase, proper construction method and water quality management measures describe in the environmental management plan (EMP) should be implemented to control polluted water generated from construction works.

In addition, the Water Resources Management Committee should be established (as recommended in Section 13.1) and its capacity should be strengthened to properly and efficiently manage the precious freshwater resources in the Ben Tre Province. The proper operation of the sluice gates system in a whole (including the existing sluice gates and the newly-constructed ones) should be examined and implemented in order to meet the needs of freshwater widely among residents.

6) Existing Social Infrastructure and Service

In the construction phase, construction method and construction plan should be carefully prepared to avoid serious impedance to ships/boats which need to pass through the construction sites. Information on the blockage of the rivers or on the limited navigation due to the sluice gate construction should be disseminated widely to waterway users, in order to make them easily prepare the plan to shift the navigation route to the other waterways.

In addition, measures described in the Policy Framework for waterway users affected by the Project shall be further examined in detail and shall be duly implemented after having consent/approval by Ben Tre PPC and/or ICMB9.

7) Misdistribution of Benefits and Damage

In the pre-construction phase and the construction phase, measures to mitigate impacts of land acquisition and resettlement as described in RAP should be duly implemented. And measures described in the EIA Report to mitigate impacts of air pollution, water pollution, noise, etc., during construction period shall be duly implemented.

8) Infectious Diseases such as HIV/AIDS

In the construction phase, contractors should cooperate with local mass organizations such as Vietnam Fatherland Front, Women's Union, etc., to provide workers with knowledge about social evils, prostitution, epidemics in the area, etc.

In addition, in order to mitigate impacts caused by the concentration of workers from outside, contractors should be urged to hire local residents (both women and men) as much as possible to work as workers for the Project. For some works requiring qualified performers, the contractor will choose among the local workers and equip them with new skills so that they can meet job's requirements.

9) Working Environment (Including Work Safety)

During the construction period, contractors shall:

- Provide construction workers with sufficient personal protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others;
- Provide workers with seminars on safety issues for local residents;

- Provide construction workers with proper living condition (such as clean water, electric power, etc.) and health care during construction.
- Install warning signs where the potential dangers are present;
- Assign staffs near the sites to ensure safety where construction vehicles are crowded.

10) Accidents

In the construction phase, a proper construction method and a construction plan, including measures to mitigate traffic congestion on local road networks and on rivers, etc. should be carefully prepared. Beacon buoys should be installed for warning and signaling the construction and navigation on the rivers. Warning devices, marine delineators, marker posts, signboards, etc. should be installed in upstream and downstream of the construction sites.

In the operation phase, proper operation of the navigation locks associated with the sluice gates of Vam Thom (Mo Cay Nam), Vam Nuoc Trong (Mo Cay Bac), Ben Tre, and An Hoa are particularly required to prevent vessel collision accidents at these sites.

3.7 ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

3.7.1 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The management organizations system for the environmental and social monitoring in this Project is proposed based on the present roles and functions, as well as the realities of the relevant agencies (refer to Figure 3.7.1)

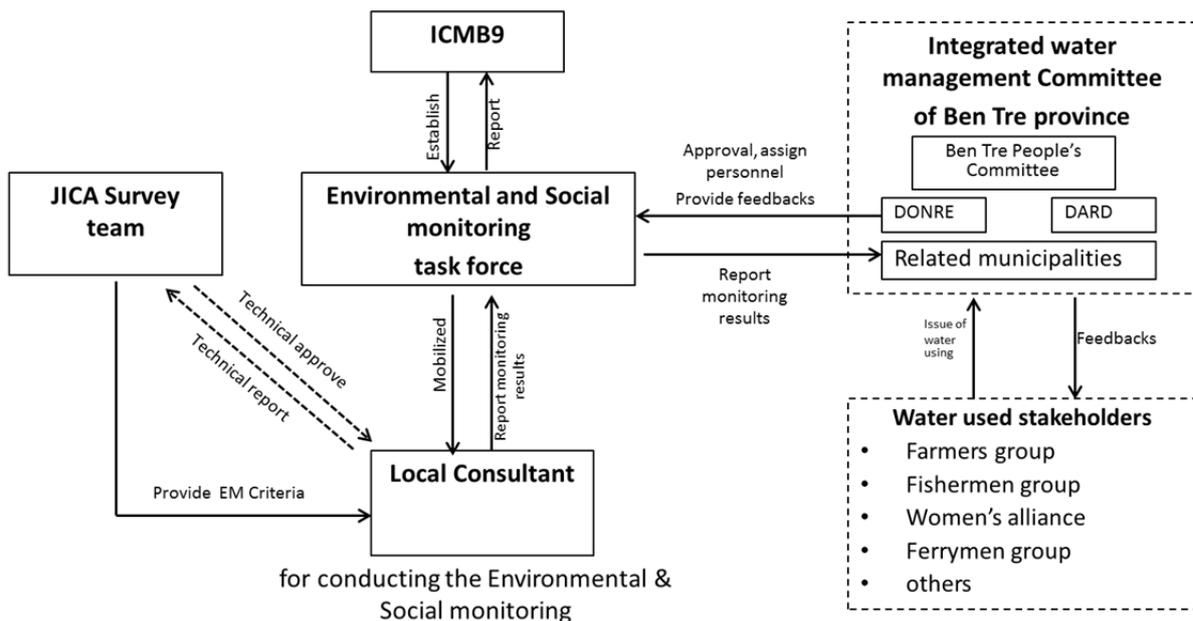


Figure 3.7.1 Proposed Management Organization Framework for Environmental and Social Monitoring

Source: JICA survey team (2016)

An Environmental and Social Monitoring Taskforce (ESMT) will be established by ICMB9 and the proposed Integrated Water Management Units (IWMUs) of the Ben Tre Province, for implementing environmental and social monitoring activities during the construction and operation phases of the Project . The EMST should have the following functions:

- Conduct related documentations –standard operation procedures for Environmental Management Plans and other related records;

- Design/plan regular environmental and social monitoring activities during the construction phase and the operation phase of the Project following the environmental and social monitoring criteria provided by the JICA survey team;
- Mobilize local consultants to conduct regular environmental and social monitoring activities during the construction phase and the operation phase of the Project;
- Receive and review technical reports from local consultants; and
- Provide regular reports on environmental and social monitoring activities for the Integrated Water Management Units (IWMUs) of Ben Tre Province and ICMB9.

The IWMUs is the proposed integrated committee for managing surface water quality and water volume within the Ben Tre Province, in collaboration with relevant governmental agencies and the water use stakeholders.

3.7.2 PROPOSED ENVIRONMENTAL MONITORING PLAN

The following environmental monitoring plan, which is shown in Table 3.7.1. could be proposed as essential monitoring activities, in order to confirm the possible environmental impacts situations related to the project.

Table 3.7.1 Proposed Environmental Monitoring Plan

Environmental Items	Items/Parameters	Sampling Points/Frequency	Implementing Organization	Responsible Agency
Construction Phase				
Air	<ul style="list-style-type: none"> ♦ TSP ♦ PM10 ♦ CO, ♦ NO_x ♦ SO_x 	8 points/ 2 times per month	Local Contractor (Local Consultant Team)	ICMB9
Surface water	<ul style="list-style-type: none"> ♦ pH ♦ TSS ♦ BOD₅ ♦ NO₃⁻ (in N) ♦ PO₄³⁻ (in P) ♦ Coliform 	8 points/ 2 times per month	Local Contractor (Local Consultant Team)	ICMB9
Ground water	<ul style="list-style-type: none"> ♦ pH ♦ TDS ♦ NH₄⁺ 	8 points/ 2 times per month	Local Contractor (Local Consultant Team)	ICMB9
Noise	<ul style="list-style-type: none"> ♦ Noise Leve (dB(A)) 	8 points/ 1 times per month	Local Contractor (Local Consultant Team)	ICMB9
Ecosystem	<ul style="list-style-type: none"> ♦ Fish catch survey 	16 points/ 2 times per month	Local Contractor (Local Consultant Team)	ICMB9
Operation Phase				
Air	<ul style="list-style-type: none"> ♦ TSP ♦ PM10 ♦ CO, ♦ NO_x ♦ SO_x 	8 points/ 2 times per month	Local Consultant Team	ICMB9
Surface water	<ul style="list-style-type: none"> ♦ pH ♦ TSS ♦ BOD₅ ♦ NO₃⁻ (in N) ♦ PO₄³⁻ (in P) ♦ Coliform 	8 points/ 2 times per month	Local Consultant Team	ICMB9
Ecosystem	<ul style="list-style-type: none"> ♦ Fish catch survey 	16 points/ 2 times per month	Local Consultant Team	ICMB9

Regarding the riverbank erosion, it is recommended that the Rural Development Section of DARD should conduct more detailed regular monitoring activities for river erosions in the rivers/canals, although there is no evidence that this Project may affect favorably or adversely impacts to the present riverbank erosions.

3.7.3 PROPOSED SOCIAL ENVIRONMENTAL MONITORING PLAN

Monitoring plan summarized in Table 3.7.2 shall be implemented to monitor and confirm the social impacts caused by the project, and performance of relevant impact mitigation measures.

Table 3.7.2 Social impact monitoring plan

No	Monitoring items	Construction phase	Operation phase
1	Involuntary resettlement	Monitoring plan is described in the separately-prepared RAP.	-
2	The poor	Monitoring plan is described in the separately-prepared RAP.	Monitoring plan is described in the separately-prepared RAP.
3	Local economy such as employ- ment and livelihood	Monitoring plan is described in the separately-prepared RAP.	Monitoring plan is described in the separately-prepared RAP.
4	Land use and utilization of local resources	Monitoring plan is described in the separately-prepared RAP.	-
5	Water usage	Monitoring plan for surface water quality is described in Section 13.2.	-
6	Existing social infra-structure and service	<u>1) Monitoring site</u> Around the sluice gates <u>2) Monitoring frequency</u> Periodic monitoring by PMU <u>3) Monitoring method</u> Check report made by contractors on the operational conditions, performance and maintenance of the safety facilities around the construction sites. Carry out field confirmation survey.	<u>1) Monitoring site</u> Accident prevention equipment installed around the sluice gates <u>2) Monitoring frequency</u> Monthly monitoring by DOT <u>3) Monitoring method</u> Check complaints raised by residents. Carry out field survey to inspect the operational conditions, performance of the accident prevention equipment.
7	Misdistribution of benefits and damage	Monitoring plan for noise, surface water quality is described in Section 13.2.	
8	Infectious diseases such as HIV/AIDS	<u>1) Monitoring site</u> Construction yards and worker camps <u>2) Monitoring frequency</u> Periodic monitoring by environmental supervisors <u>3) Monitoring method</u> Check reports made by contractor site-managers. Carry out field confirmation survey. Check information provided by local Women Union, Fatherland Front.	=
9	Working environ-ment (including work safety)	<u>1) Monitoring site</u> Construction sites and worker camps <u>2) Monitoring frequency</u> Periodic monitoring by environmental supervisors <u>3) Monitoring method</u> Check reports made by contractor site-managers. Carry out field confirmation survey.	=
10	Accidents	<u>1) Monitoring site</u> Construction sites (on land and on water) <u>2) Monitoring frequency</u> Periodic monitoring by environmental supervisors <u>3) Monitoring method</u> Check reports made by contractor site-managers. Carry out field confirmation survey.	<u>1) Monitoring site</u> Safety (accident prevention) equipment installed around the sluice gates <u>2) Monitoring frequency</u> Monthly monitoring by DOT <u>3) Monitoring method</u> Check monthly reports made by operators of the gates Check complaints raised by local residents. Carry out field survey to confirm performance and operational conditions of the safety equipment.

3.8 STAKEHOLDER CONSULTATION MEETINGS (SHCM)

1) The 1st SHCM (Ben Tre City)

The meeting was organized on 27 August, 2015, at the meeting hall of the DARD in Ben Tre city. There were 30 representatives from the DARD, DONRE and the Districts People's Committee (7 districts) participated in the meeting. During the meeting, participants were informed about the plan of the Ben Tre Water Management Project. In addition, the participants discussed about the methods to select 20 communes for the next following SHCMs. The criteria to select the communes were discussed, including the specific conditions, in terms of agricultural production, as well as water use to organize community consultation meetings.

The main outcome of the meeting was the list of 20 selected communes where the SHCMs shall be organized. Table 3.8.1 shows the list of these selected communes.

Table 3.8.1 Schedule and Number of Participants in the First SHCMs

No	Date of SHCM	Location		Number of participants			
		Commune	District	Total	Male	Female	
1st SHCM	27 Aug. 2015	DARD	Ben Tre City	28	23	5	
2 nd SHCM	1	03 Sep. 2015	Phước Long	Giồng Trôm	50	31	19
	2	08 Sep. 2015	Lương Hòa		43	21	22
	3	08 Sep. 2015	Phong Mỹ		58	42	16
	4	09 Sep. 2015	Bình Hòa		51	29	22
	5	10 Sep. 2015	Phú Hưng	Bến Tre City	51	33	18
	6	10 Sep. 2015	Nhơn Thạnh		50	26	24
	7	11 Sep. 2015	Giao Hòa	Châu Thành	56	30	26
	8	12 Sep. 2015	Tân Phú		50	34	16
	9	15 Sep. 2015	Châu Hưng	Bình Đại	60	34	26
	10	15 Sep. 2015	Long Hòa		50	27	23
	11	16 Sep. 2015	Thạnh Trị		42	24	18
	12	17 Sep. 2015	Bình Khánh Tây	Mỏ Cày Nam	52	34	18
	13	17 Sep. 2015	Bình Khánh Đông		54	40	14
	14	18 Sep. 2015	Thành Thới B		52	29	23
	15	22 Sep. 2015	Tân Xuân	Ba Tri	50	28	22
	16	22 Sep. 2015	Mỹ Chánh		60	34	26
	17	23 Sep. 2015	Phú Khánh	Thạnh Phú	54	38	16
	18	23 Sep. 2015	Quới Điền		60	39	21
	19	24 Sep. 2015	Hòa Lộc	Mỏ Cày Bắc	51	27	24
	20	25 Sep. 2015	Phước Mỹ Trung		50	24	26
Total				1,044	624	420	
Average				52	31	21	
Portion				100%	60%	40%	

Source: JICA survey team (2016)

2) 2nd SHCMs

Right after the target communes were selected, the People's Committees of the twenty communes were consulted about the detailed plan to organize the SHCM at each commune. As a result, the SHCM organization schedule at the communes was set up from 3 to 25 September, 2015 as shown in Table 3.8.1.

The participants at the SHCMs are diverse, including the representatives of local authority and organizations (Women's Union and Farmers' Union), local residents including farmers (agricultural and aquaculture) and ferrymen, and boat transporters.

During these SHCMs, the general information on the Ben Tre Water Management Project was presented. The information consists of the rationale/background of the Project (impacts of climate change, transboundary/regional/local impacts, etc.) and basic information on the project design such as locations of the sluice gates. Expected environmental and social impacts to the localities were also presented.

The main opinions raised by the participants are as follows:

- The sluice gate construction project would contribute to the improvement of local residents' life and livelihood, by reducing damages caused by saline intrusion, and providing stable freshwater supply to the locality. Therefore, we expect that the Project will be implemented soon.
- In the construction phase, impacts such as polluted water, noise, etc. may be generated from the construction sites, and adversely affect fruit trees, and residents' life. We expect that proper measures shall be carried out to mitigate these impacts.
- We want to know whether our land, and our houses will be affected by the Project or not. People who have to relocate to other places need to be informed about the resettlement plan as early as possible.
- There are many boats providing services such as transportation of people, goods, agricultural products, etc. on the rivers. These boat operators should be informed as early as possible about the Project, so as they can make plan to change the route to other rivers in a timely manner.
- Many residents want to cultivate citrus fruit trees in combination with aquaculture using freshwater. We want to have the instructions and supports from the relevant entities about this combined cultivation method.
- Plan to construct sluice gates on other canals around the commune should also be considered in order to efficiently prevent damages caused by saline water to the locality. We want to know if such plan is being considered or not.

3) 3rd SHCMs

The Third Round of SHCMs was held from 23 November to 4 December 2015 at the selected 20 communes to consult with the local communities and authorities on how changes in water salinity would affect local economic activities, domestic uses of water, etc.

Table 3.8.2 shows the organization schedule of the 3rd SHCM and number of participants by sex.

Table 3.8.2 The 3rd SHCM organization schedule and number of participants by sex

No.	Organization day	Organization place		Number of participants		
		Commune	District	Total	Mele	Female
1	23 Nov. 2015	Phú Hưng	Bến Tre City	47	30	17
2		Nhơn Thạnh		53	27	24
3	24 Nov. 2015	Phước Long	Giồng Trôm	60	45	15
4		Lương Hòa		48	40	8
5	25 Nov. 2015	Phong Mỹ		58	31	27
6		Bình Hòa		43	25	18
7	26 Nov. 2015	Hòa Lộc	Mỏ Cày Nam	57	32	25
8		Phước Mỹ Trung		50	28	22
9	27 Nov. 2015	Bình Khánh Tây	Mỏ Cày Bắc	50	31	19
10		Bình Khánh Đông		54	41	13
11	30 Nov. 2015	Thành Thới B	Châu Thành	59	33	26
12		Giao Hòa		56	34	22
13	01 Dec. 2015	Tân Phú	Thạnh Phú	39	23	16
14		Phú Khánh		53	40	13
15	02 Dec. 2015	Quới Điền	Ba Tri	52	44	8
16		Tân Xuân		48	30	18
17	03 Dec. 2015	Mỹ Chánh	Bình Đại	59	37	22
18		Châu Hưng		64	34	30
19	04 Dec. 2015	Long Hòa		44	23	21
20		Thạnh Trị		55	33	22
Total (pers)				1049	661	386
Total (%)				100%	63%	37%

Source: JICA survey team (2016)

Table 3.8.3 shows the number of participants in these meetings by occupation comparing with commune population by their occupation.

Table 3.8.3 Participants of 3rd SHCM by Occupation (unit: persons)

No.	Commune	Portion (number of participants in SHCM / total population in the commune)	Agriculture				Aquaculture	Fisher-men	Waterway transportation	Trade/Service HH	Local authority/organization	Other (vulnerable people)[1]	Total
			Rice/Vegetable	Fruit tree	Husbandry	Coconut tree							
1	Phù Hưng	a) Total in commune											
		b) Total in SHCM	16	0	16	5	0	1	0	7	2	47	
		c) Portion (=b/a, %)											
2	Nhơn Thành	a) Total in commune											
		b) Total in SHCM	0	14	1	23	0	0	0	10	5	53	
		c) Portion (=b/a, %)											
3	Phước Long	a) Total in commune											
		b) Total in SHCM	0	10	0	38	0	0	0	12	0	60	
		c) Portion (=b/a, %)											
4	Phong Mỹ	a) Total in commune											
		b) Total in SHCM	9	5	12	16	0	0	0	6	0	48	
		c) Portion (=b/a, %)											
5	Lương Hòa	a) Total in commune											
		b) Total in SHCM	3	16	0	23	0	0	3	12	1	58	
		c) Portion (=b/a, %)											
6	Bình Hòa	a) Total in commune											
		b) Total in SHCM	0	31	8	0	0	0	0	4	0	43	
		c) Portion (=b/a, %)											
7	Hòa Lộc	a) Total in commune											
		b) Total in SHCM	0	0	28	18	0	0	0	11	0	57	
		c) Portion (=b/a, %)											
8	Phước Mỹ Trung	a) Total in commune											
		b) Total in SHCM	1	4	22	10	0	0	3	10	0	50	
		c) Portion (=b/a, %)											
9	Bình Khánh Tây	a) Total in commune											
		b) Total in SHCM	3	5	30	0	0	0	2	10	0	50	
		c) Portion (=b/a, %)											
10	Bình Khánh Đông	a) Total in commune											
		b) Total in SHCM	3	6	30	0	0	0	2	9	0	50	
		c) Portion (=b/a, %)											
11	Thành Thới B	a) Total in commune											
		b) Total in SHCM	0	0	18	24	0	0	3	12	0	59	
		c) Portion (=b/a, %)											

During the meeting, the participants were informed about the forecasted changes of water environment, especially water salinity. And then, participants were separated into different groups (the fruit cultivation group, the paddy cultivation group, the aquaculture-animal husbandry group, etc.) to discuss about the possibility for them to change crop cultivation or varieties.

Main results of the discussion are as follows:

a) Main Economic Activities of Participants

The main income-generating activity of the participants is agriculture. In which, coconut and fruit tree cultivations are dominant.

Among 20 communes, only Thanh Tri has brackish-water aquaculture; My Chanh, Tan Xuan (Ba Tri District) and Chau Hung (Binh Dai District) are dominated by paddy field; Hoa Loc, Phuoc My Trung (Mo Cay Nam District) and Binh Khanh Tay (Mo Cay Bac) are characterized by husbandry; fruit tree plantation is found mostly in Binh Hoa (Giong Trom District) and Tan Phu (Chau Thanh District) and the remaining communes have coconut tree plantations.

b) Stakeholder Analysis

The Project is expected to bring both direct and indirect impacts to the stakeholders. The stakeholders, who work in agriculture, aquaculture, river transportation or local authorities, etc, may be benefited or damaged by the Project. Table 3.8.4 presents the results of this stakeholder analysis.

Table 3.8.4 Result of Stakeholders Analysis in the 3rd SHCMs

	Positive impacts	Negative impacts
Significant impact	Rice/vegetable farmers Fruit/coconut gardeners Husbandry	Brackish-water aquaculture households Waterway users
Light impact	Local authority Local organizations	Trade/service households

Stakeholders	Issues	Interest	Possibility	Relevant issues
Rice/ vegetable farmers Fruit/coconut gardeners	Lack of freshwater Water pollution Water logging Others (lack of capital, breed, technique)	Natural condition, Output market Reasonable investment	Extension of cultivation area	Provincial plans, Gov't support/policies
Husbandry farmers	Lack of freshwater Water pollution Others (lack of capital)	Output market Reasonable investment	Keep current economic activity	
Aquaculture farmers	Water pollution Eutrophication (due to logging of water in dry season)	High profit Available markets	Extension of cultivation areas Intensive farm	Conflict in water usage with other stakeholders
Local government	Capacity in management and operation of project Large project area Changes of policies	Better management of the system Improve local livelihood/economy Management of scarce resources	Impacts from the project implementation Pressure from local community.	Linkage of all stakeholders

Source: JICA survey team (2016)

c) Need and Concerns of People by Geographic Areas

Generally, most of people expressed that freshwater should be ensured for the domestic use, and for agriculture use.

In South Ben Tre (Mo Cay Nam, Mo Cay Bac and Thanh Phu Districts), husbandry is found as the main economic activity (except Phu Khanh and Thanh Thoi B communes where coconut tree is cultivated by most of people). In North Ben Tre, coconut, rice and fruit tree are most cultivated by the

local people (except Thanh Tri commune where brackish water extensive shrimp culture is dominant).

There is not much conflict between rice/vegetable/fruit farmers and shrimp farmers in the project areas. Beside the freshwater needs, the local people also presented other needs for development of agricultural activities, such as capital, technique, and new varieties, etc.

During the meetings, participants were asked to rank their demand/need as well as their concerns upon their current income-generating activities. As a result, participants from North Ben Tre presented diversified needs and concerns, while participants from South Ben Tre showed only several needs and concerns. Although people in both regions expressed their needs of freshwater for domestic uses, the people in North Ben Tre said that their most concern issue is “water shortage”, whereas those in South Ben Tre said that their most concern issue is “water pollution”.

Table 3.8.5 Ranking the Needs and Concerns of Local People

No.	Location / Items	Important agricultural productions ranked by participants of the consultation meetings				
		1 st	2 nd	3 rd	4 th	5 th
I	North Ben Tre					
	Type of cultivation	Coconut tree	Fruit tree	Rice/vegetable	Husbandry	Aquaculture
	Demand/Need	Freshwater	Market of outputs	Capital	Breed/ Varieties	Cultivation technique
	Concern	Lack of freshwater	Water pollution	Sluice-gate operation	Disease (in agriculture)	Difficulty in waterway transportation
II	South Ben Tre					
	Type of cultivation	Husbandry	Coconut tree	Fruit tree/ vegetable		
	Demand/Need	Freshwater	Capital	Breed/ varieties	Cultivation technique	Others
	Concern	Water pollution	Lack of freshwater	Sluice-gate operation	Difficulty in waterway transportation	

Source: JICA survey team (2016)

d) Suggestion of Stakeholders

After the group discussion, participants were asked whether they want to change their current income-generation activities if they are provided with freshwater throughout the year (i.e. in case that the Project is implemented), and how they will deal with freshwater shortage (if the Project is not implemented).

As a result, a large number of participants said that they want to keep their existing cultivation activities (no change) even in case of the project implementation. However, a small number of participants in the meetings in North Ben Tre (Thanh Tri: 28.6%, Chau Hung: 27.3%, Long Hoa: 20%, and Quoi Dien: 10%) said that they want to change their current cultivation. Regarding the reason of this change, these people said that they think surface water in the area may be polluted and their agricultural production would be decreased.

4) 4th SHCMs

The 4th SHCM was held in Ben Tre City on 28 March, 2016. There were 62 participants at the meeting, of which 3 participants from ICMB9, 8 participants from PPC, 11 participants from 8 city/districts (i.e. Ben Tre, Binh Dai, Ba Tri, Thanh Phu, Giong Trom, Mo Cay Nam, Mo Cay Bac, and Chau Thanh), and 40 participants from 20 selected communes.

Main objective of the meeting is to discuss following items: (1) results of the 3rd SHCMs, (2) land use plan, (3) water management plan, (4) surface water pollution issue, (5) environmental impacts, (6) impacts of land acquisition and other social impacts.

5) 5th SHCMs

The 5th SHCMs were organized from 9 to 25 May, 2016, in 20 communes selected during the 1st SHCM.

Main topics explained and discussed in the meetings are: (1) the results of the Preparation survey for the B-SWAMP (including the land use plan, the design of the sluice gates, the method of operation of the sluice gates, predicted saline concentration levels and pollution (BOD) levels in surface water, establishment and function of the Water Resource Management Committee), (2) natural environmental impacts and mitigation measures, and (3) social environmental impacts and mitigation measures.

Table 3.8.6 shows the meeting organization schedule and the number of participants in each meeting by sex.

Table 3.8.6 The 5th SHCMs organization schedule and number of participants by sex

No.	Organization day	Organization place		Number of participants		
		Commune	District	Total	Male	Female
1	09 May, 2016	Nhon Thạnh	Ben Tre City	50	26	24
2	10 May, 2016	Phước Long	Giồng Trôm	45	33	12
3		Lương Hòa		50	26	24
4	11 May, 2016	Phong Mỹ		51	35	16
5		Bình Hòa	48	33	15	
6	12 May, 2016	Hòa Lộc	Mỏ Cây Bắc	56	37	19
7		Phước Mỹ Trung		50	30	20
8	13 May, 2016	Bình Khánh Tây	Mỏ Cây Nam	54	36	18
9		Bình Khánh Đông		54	39	15
10	16 May, 2016	Thành Thới B	Châu Thành	56	43	13
11		Giao Hòa		45	27	18
12	17 May, 2016	Tân Phú	Thạnh Phú	52	31	21
13		Phú Khánh		51	36	15
14	18 May, 2016	Quới Điền	Ba Tri	53	40	13
15		Tân Xuân		45	27	18
16	19 May, 2016	Mỹ Chánh	Bình Đại	57	36	21
17		Châu Hưng		45	16	29
18	20 May, 2016	Long Hòa		51	34	17
19	25 May, 2016	Phú Hưng	Ben Tre City	46	30	16
20		Thạnh Trị	Bình Đại	49	18	31
Total (pers)				1,008	633	375
Total (%)				100%	63%	37%

Source: JICA survey team (2016)

CHAPTER 4 CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

Taking into account the points outlined below, this Preparatory survey concludes that the implementation of the Water Management Project in Ben Tre Province would be the most appropriate comprehensive approach in coping with unforeseeable circumstances in and around Ben Tre islets located at the estuary of the Mekong River, especially for the primary sectors and for rural development. The Government of Vietnam should therefore embark on commencement of project implementation recommended by the JICA preparatory survey.

- 1) On the evaluation of the project, the survey concludes that the project can be judged as feasible from the technical, environmental and social consideration, as well as economical viewpoints.
- 2) Since the agriculture sector constitutes about 50% of the workforce, development of the agriculture sector can significantly contribute in improving the livelihood of farmers in Ben Tre Province. Irrigation demand for agriculture sector requires a total of 97% of the entire freshwater demand in Ben Tre in dry season. This estimate of the irrigation demand highly depends on farmland use, which has to be planned and revised by the DARD staff taking into consideration crop production benefit and available freshwater volume.
- 3) Crop production benefit and available freshwater volume will always change and these are unforeseeable items from a regular and routine view point. Crop production benefit depends not only on domestic market but also on international market. The market trend is a variable that cannot be controlled by farmers or officials in Ben Tre Province. Hence, this information shall always be updated. Freshwater availability will change as a result of balance between sea level rise caused by climate change and discharges of the Mekong River. Predictions for the rise in the sea level depends on the scenario of climate change under global warming and this will be revised based on global industrial development.
- 4) The project shall always adjust prediction of Mekong River discharge since: a) a series of hydropower dam construction and operation in China will be conducted without any information sharing with the downstream countries of the Mekong River basin including Vietnam; and b) hydropower dam reservoir operation usually reduces flood water discharge of the downstream areas in the rainy season but increases the discharge in the dry season. However, if the increased discharge in dry season is utilized for irrigation in the upstream countries (i.e. increase of irrigation areas and irrigation demand), such increased irrigation demand in a draught year will not decrease. Consequently, the discharge flowing into Mekong Delta in a draught year may seriously decrease.
- 5) Closed sluice gate during dry season will cause water deterioration in the Ben Tre islets, which the activities aim at keeping freshwater for irrigation and domestic purposes. Opening and closing sluice gates during certain periods in dry season can decrease water deterioration by flushing polluted water out from Ben Tre islets but it may cause saline water intrusion into the islets and reduction of available freshwater reserve in canals in Ben Tre. An appropriate sluice gate operating rules should be established based on monitoring of the freshwater's saline contents, water levels, and some indicators for water quality.
- 6) A sluice gate operation alone cannot control and manage water quality, demand and pollution after the start of project operation. An integrated and comprehensive approach to water management will be able to support such water quality control and water use in the Ben Tre islets. Involvement of many organizations and groups will be required for effective control and management. A management unit to be formulated (an integrated surface water management unit) will be the main

body to handle those activities of the organizations and groups aforementioned.

- 7) Real-time and/or in-time sharing of information on water quality and saline contents was required from the stakeholders during ‘stakeholder consultation meetings’ held in several communes. The sharing of information can be implemented under the integrated surface water management unit previously described. The proposed activities of the integrated surface water management unit can contribute to the reduction of water pollution at different levels – such as households, work areas, and farms – as well as securing freshwater for irrigation or domestic uses during dry season.

4.2 RECOMMENDATIONS

During the process of conducting this preparatory survey for the Water Management Project, the JICA survey team encountered a number of issues that led to the recommendations presented below. However, as are cases with continuous processes from now on, the recommendations set forth are by no means exhaustive and may need to be changed or modified, depending upon the prevailing conditions at the time the project is to be implemented. Nevertheless, it is believed that the ones covered here constitute a broader spectrum on which people in the Ben Tre Province will be able to collectively attain control and management of the required freshwater resource:

- 1) Project implementation should be carried out as early as possible, especially the construction of sluice gate along the downstream areas of the Ham Luong River. Saline water intrusion in 2015-2016 dry season was severe at the areas along the Ham Luong River that a lot of farmers in Ben Tre were not able to harvest agricultural products and had to purchase freshwater for livestock. A total of 30,000 ha of farmland was reportedly damaged and 100,000 households suffered from domestic water during the 2015-2016 dry season. This led Ben Tre PPC to request the MARD to immediately allocate budget for construction of Chu Cuu sluice gate located along the Ham Luong River in North Ben Tre and suggested to exclude Chu Cuu sluice gate from the list of ‘Ben Tre Water Management Project’ to be financed by JICA. The Cai Quao sluice gate is planned at the opposite river side of Chu Cuu sluice gate and saline water intrusion situation in the same period was the same as surrounding areas of Chu Cuu. Thus, it is recommended that Chu Cuu and Cai Quao sluice gates’ construction should be implemented as early as possible and other sluice gates should follow as part of project implementation under JICA financial assistance.
- 2) In case of early implementation of the construction of the aforementioned two (2) sluice gates’ construction, technical level to be applied to the projects should be carefully considered. Geological Foundation conditions of those two (2) sluice gates are quite similar and they have very thick-soft foundation at each project site with about 100m thickness or more. Advanced technology on thick-soft foundation should be applied not only for the two (2) sluice gates but also to the other two (2) sluice gates. This excludes the Tan Phu and Ben Ro sluice gates which are relatively smaller-scale facilities among the eight (8) sluice gates. Appropriate quality of materials for the sluice gates should also be considered – one which has anticorrosive effect – to ensure that project benefits will be for a longer term. Use of stainless steel is highly recommended to the project so that in the future, the budget shall mainly be used for sluice gate operation instead of maintenance. Capacity development on sluice gate operation will further play quite important roles in Ben Tre Province in the future. Thus, more budget shall be allocated to operating sluice gates to secure freshwater supply and maintain appropriate water quality.
- 3) Implementation of technical cooperation for ‘Integrated Surface Water Management’ is highly recommended and it should begin before completion of sluice gate construction. On the Job Training (OJT) is inevitable for the technical cooperation because seminars and manuals developed under the technical cooperation will not suffice on its own. While it’s important to introduce advanced technologies, it’s equally necessary to develop human resources to tackle and

cope with various unforeseeable circumstances – such as the changing climate and varying degrees of water resource development/use in upstream countries of the Mekong River basin. JICA has the distinct advantage among donors for both financing the project budget and applying technical cooperation because of its financial capacity and established expertise in conducting OJT. Construction of sluice gates can be financed by any donor who can allocate the necessary budget. However, JICA's leverage is that JICA can conduct the technical cooperation with focus on OJT and capacity building while at the same time providing financial assistance to build infrastructure requirements. Systematic sluice gate operation is the main objective of this Water Management Project. As such, the construction of sluice gate is merely one of the tools to ensure effective and sustainable surface water management in the Ben Tre islets. Human resource development is the most important issue of the project for the farmers and stakeholders to collectively attain control and management of the required freshwater resource.

- 4) Information sharing with stakeholders will be the basis of activities for the integrated surface water management in Ben Tre. Information on saline contents and water quality shall be shared not only with project operation/monitoring organizations but also with farmers/women's groups and other related projects to be assisted by other donors. Disclosure of necessary information is the first step to guide the project towards the right direction, formulated with participation of the related stakeholders. Establishing an open and transparent communication system between governmental organizations and people in the communes is essential and highly recommended in order to avoid one-way communication. During the survey, transparency on information sharing has been committed by the Ben Tre PPC. It is believed that all information to be shared will be secured during project operation and management. In line with transparency on information sharing, requests raised from stakeholders shall be managed with established rules and regulations under the surface water management unit. A request (installation of navigation lock and fish-way at Cai Quao Sluice) made by a commune during the survey period shall also be managed by the same procedures. If necessary, the request aforementioned shall be examined in the detailed design stage.
- 5) Since 'Ben Tre Water Management Project' is a project with sluice gate operation oriented as aforementioned, systematic sluice gate operation shall be performed not only by the eight (8) sluices to be constructed but also by the existing sluice gates to be operated within the system. The opening and closing mechanism of the existing sluice gate in Ben Tre is usually automatic with the use of water level differences between the sea side and the canal side. Intentional sluice gate operation system shall be adopted for the project instead of automatic operation mechanism to secure freshwater recruitment, reserve water in canals, and drain deteriorated water out from the islets. For this, an additional project implementation is recommended after this project to install, either by rehabilitation and/or replacement, sluice gates with intentional operation system instead of the existing sluice gate. In addition, there are three (3) candidate canals in South Ben Tre where sluice gates are to be newly-installed. Those works shall be combined together and can be a future candidate project after this project.
- 6) Trend of distribution and transportation shall be considered in Ben Tre for creating development plans for all sectors. Cargo transportation by waterway in the seven (7) coastal provinces of Mekong Delta constitutes an average of 70% while that of the Ben Tre Province is 50%. The trend of cargo transportation by waterways has been decreasing in recent years and 90% of passengers use inland transportation instead. While the operation of sluice gates will contribute in securing freshwater, it will limit waterway transportation. On the other hand, bridges above the sluices will help develop inland transportation. As such, it is recommended that the distribution system in Ben Tre be examined carefully after commencement of sluice gate operation and be reflected into formulation of development plan for each sector of Ben Tre Province.