# Initial Environmental Examination

September 2014

# VIE: Viet Nam Water Sector Investment Program – Bac Giang Water Supply Subproject

Prepared by Bac Giang Water Supply Company for the Asian Development Bank.

## Asian Development Bank

## MFF0054-VIE: PFR3

## BAC GIANG WATER SUPPLY SUBPROJECT

## BAC GIANG CITY, BAC GIANG PROVINCE

# FINAL REPORT

## APPENDIX 11

## INITIAL ENVIRONMENTAL EXAMINATION REPORT

## September 2014

## LIST OF ABBREVIATIONS

| | |
|---|---|
| ADB | Asian Development Bank |
| BGPCC | Bac Giang Provincial People's Committee |
| EIA | Environmental Impact Assessment |
| GPMB | Site clearance |
| HH | Household |
| KCN | Industrial zone |
| MOC | Ministry of Construction |
| MOST | Ministry of Science and Technology |
| MTV | One Member |
| ND | Not Detected |
| NN&PTNT | Agriculture and Rural Development |
| PC | People's Committee |
| PCCC | Fire-fighting protection |
| PM | Project management |
| PTNT | Rural Development |
| QCVN | Vietnamese norm |
| QĐ - Ttg | Decision of the Prime Minister |
| TCN | Sectorial standard |
| TCVN | Vietnamese standard |
| TCXD | Construction standard |
| TNHH | Limited Liability |
| TT – BTC | Circular of Ministry of Finance |
| TVXD | Construction Consultant |
| UBMTTQ | Fatherland Front Commission |
| WASECO | Bac Giang Water Supply and Drainage One Member Limited Liability Company |
| WHO | World Health Organization |

Conversion
Currency - D (Vietnamese dong)
VND = USD
USD = VND

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## EXECUTIVE SUMMARY

### Background and Scope

1. The project, classified as Environment Category B, is judged to have some potential adverse environmental impacts, particularly in relation to pipeline construction activities and, to a lesser degree, the disposal of sludge from the water treatment process. The unavoidable construction impacts are temporary and can be mitigated, whereas adverse impacts related to sludge disposal have been avoided by incorporating sludge dewatering in the design of the water treatment facility.

2. Bac Giang's Committee (NPPC) has approval on Bac Giang water supply system expansion including construction of Phuc Ha WTP with capacity of 25,000 m3/day serving the North and South of Bac Giang city and connecting the commune newly merge to the city in the South. The IEE covers construction of the new intake, Pumping Station, raw water pipeline, WTP and distribution network.

### Project Description

3. Water demand of Bac Giang is projected to reach 60,000 m3/day by 2025 and 91,000 m3/day by 2035. The existing Bac Giang WTP has a capacity of only 25,000 m3/day and is serving the western area and the centre of the town. The main raw water resource is Thuong River surface water; it is also the same surface water that has been selected to be raw water resource for project.

4. Flow rate of Thuong river section passing Bac Giang town can ensure exploitation of water for domestic use with total capacity upon project's completion of 91,000 m3/day (by 2035). The exploitation of water doesn't make any negative impact on flow rate raise conflict nor raise any conflicts on water use at upstream and downstream of Thuong river.

5. By 2025, water use demand of the town reaches about 60,000 m3/day, so it is needed to construct Phuc Ha WTP with an immediate capacity of 25,000 m3/day and to increase serving capacity of the existing plant by 10,000 m3/day to reach a total production of 35.000 m3/day to meet projected demand.

6. Currently, Bac Giang WTP has an intake structure of 25,000 m3/day. Increase of the existing PS is impossible, so it is suggested to construct a new intake raw water PS for Phuc Ha WTP with an immediate capacity of 55,000 m3/day to reach the 2035 demand of 91,000 m3/day and an additional setup for the installations of another 6000 m3/day to prepare for the 2035 prevision. Construct a transmission pipeline working separately to lead raw water to Phuc Ha WTP, through a pipeline with a diameter of D700mm, L= 2,200m.

7. New WTP is located in Phuc Ha village, Song Mai commune without residents living around. The nearest residential area is about 200m-500m away from there. Raw water will flow from Thuong river pumping station through a pipeline to WTP and after treatment will flow to households (HHs) by gravity from the storage tanks.

8. The main water treatment process consists of 2 phases: (1) clarification, and (2) filtration and disinfection. Beside normal treatment clusters (receiving tank, reaction tank, settling tank, filtering tank and clean water tank), other constructions that will be located together with the WTP are the chemical house, Chlorine house, generator house, warehouse, pumping station, and administration office. Chemicals to be used on a regular basis during operation are poly-aluminium chlorine (PAC) for flocculation, soda for pH control, and chlorine for disinfection.

9. Transmission, distribution pipeline includes: Plastic pipe HDPE PN12.5 to 8 for transmission pipe; and DN700 – L=6803; DN600 – L = 1,909m; DN315 – L = 3,045m; DN250 – L = 5,794m; DN200 – L = 10,148m; DN150 – L = 20,731m; DN110 – L = 15,952m; DN75 – L=12,408; DN63 – L 8,063 m; and DN50 – L=15,180m for distribution pipeline. Transmission pipeline and main pipeline is constructed underground of road. The branch pipelines will be constructed underground of walk side.

**Impacts and Mitigation Measures**

10. The main benefits of the proposed project is a supply of water free from waterborne illnesses and a decreased supply costs to consumers as a result of shifting from non-piped sources to a piped water system under WASECO.

11. The Table below summarizes the potentially adverse environmental impacts of the project, mainly associated with construction works, and corresponding safeguards and mitigation measures.

| Potentially Significant Impacts of the Project | Summary of Mitigation Measures and Safeguards | Verification and Monitoring Means |
|---|---|---|
| *Construction*: Excavation work for the pipeline trenches will produce spoil; heaps of excavated soil beside the trench that could obstruct community access and erosion from spoil storage areas could silt up nearby streams and drains. Dry heaps could cause dust nuisance. | - Temporary heaps of excavated soil to be used to backfill the pipeline trench should not be left on the roadside for long periods, and should be watered regularly to prevent excessive dust.<br>- At excavation sites close to drains and streams, silt traps should be used to prevent excessive water turbidity.<br>- Storage or disposal areas for excess spoil should be sited so as not to be susceptible to flooding, and not located on steep slopes. Adequate drains/ditches should be installed around the area.<br>Tender documents for construction should require provisions for proper handling and disposal of spoil. Soundness of measures should be part of selection criteria for contract awards. | - Water quality at the PS intake and site at Thuong River to be monitored every 3 months throughout the duration of the construction. Include 21 criteria parameters under National technical Code QCVN 08:2008/BTNMT for surface waters.<br>- Groundwater quality to be monitored in three locations 2 times per year during project construction: 14 parameters based on Vietnamese Code QCVN 09:2008 for underground water.<br>- Bidding documents, contractor plans and compliance reports on the temporary storage and disposal of spoils. Also, criteria used by the PMB procurement committee in contractor selection.<br>Follow-up consultations and interviews with local residents, every 3 months during construction. (To be done after results of water and air sampling are completed.) |

| Potentially Significant Impacts of the Project | Summary of Mitigation Measures and Safeguards | Verification and Monitoring Means |
|---|---|---|
| - **Construction:** Obstruction to traffic flow during raw water pipeline construction, exacerbated by the narrow road and work spaces:<br>  - Local residents could be cut off from the road due to the trench-building<br>  - Increased traffic of dump trucks carrying spoils to and from storage areas<br>  - Air pollution from excavation and transport equipment<br>  - Traffic hazard to pedestrians, especially school children and elderly | - Excavation & transport equipment should be appropriately sized to fit the narrow road and limited work spaces. Impose speed limits.<br>- Durable wooden or steel plates/planks should be placed across open trenches and drainage ditches to provide temporary crossings.<br>- Check emissions from construction and transport equipment for compliance with standards, particularly for particulates.<br>- During dry weather, the construction transport route near residential areas should be sprayed with water to prevent excessive dust. Dump trucks loaded with dry earth should be covered. | - Air quality to be monitored in 3 locations and every 3 months along the pipeline construction route during construction; include 9 parameters based on QCVN 05:2009/BTNMT National technical regulation on ambient air quality |
| - **Construction:** Nuisance and public safety hazards caused by pipeline excavation and pipe-laying activities in urban areas | - Work schedules should be well-planned and activities during rush hours near schools and markets should be minimized; construction and materials storage sites should be adequately lighted at night; open trenches must be fenced and clearly marked; and adequate sanitation facilities for workers should be provided at the major work sites.<br>- Contractors must avoid activities producing loud noise and vibration if night time construction work is necessary.<br>- Ensure compliance with existing Vietnamese regulations and standards for managing pollution, nuisance effects, and public safety hazards related to construction works.<br>- Tender documents to require contractor to specify safeguards and compliance measures, which will be considered in awarding contracts. | - Bidding documents, contractor plans, and regulatory compliance reports.<br>- Criteria used by the PMB procurement committee in contractor selection.<br>- Follow-up consultations and interviews with local residents, every 3 months during construction. |
| - Operation: Hazard posed by water treatment process chemicals during operation, of which Chlorine is the most hazardous | - Clearly mark the chlorine storage house, storage containers, and associated process equipment, and keep Chlorine containers moisture-free and stored separately from other chemicals.<br>- Provide adequate personal | - Detailed design of the water treatment plant facilities, and operating rules for the handling of chemicals during commissioning and WTP operation. |

| Potentially Significant Impacts of the Project | Summary of Mitigation Measures and Safeguards | Verification and Monitoring Means |
|---|---|---|
| | protective equipment for workers handling chlorine. They should be trained on safe work practices and emergency steps in case of exposure. Adopt regular inspection and maintenance schedule for all chlorine storage and handling equipment. | |
| - Operation: Disposal of water treatment sludge and wastes from WTP operation | - The recommended design feature of the WTP is dewatering of sludge by sedimentation and drying beds so that it can be transported and disposed in controlled landfill.<br>- Proper procedures (during plant commissioning) for the disposal of test water, water used for disinfecting tanks, and other chemical wastes from the plant start-up and adjustment process will be incorporated into the contract specifications during the testing and commissioning stage of the WTP. | - Detailed design of the water treatment facilities, construction plan, commissioning plan and report. |
| - Operation: Increase in the volume of municipal wastewater generated. | - Feasibility study for solid waste treatment and landfill by these facilities have not been constructed yet; it therefore meet a lot of difficulties. | - Regular monitoring reports on wastewater treatment effluent with reference to standards set under TCVN 7222:2002 for the operation of municipal WWTPs, and TCVN 188:1996 on discharge standards for urban WWTPs. |

Table 1. Summary of environmental impacts, mitigation measurements and impact monitoring

**Information Disclosure, Consultation and Participation**

12. As regulation of Vietnamese law, to capacity over 50,000 m3/day to work using raw water like Phuc Ha WTP and per ADB Safeguard Policy Statement, it is necessary to conduct public consultation. As such, consultation on option of construction of WTP, technology processes, water supply alternatives, etc. is essential as a part of actual survey in project preparation. Therefore, public information and consultation activities were carried out as part of a baseline survey of local environmental conditions along the projects sites. In January 2011, 5 communes were met to expose the strategy. HHs near the pipeline route and WTP site, were covered.

13. Through environmental consultation, local leaders and some HHs were introduced about project, environmental impact and mitigation measurements, project implementation schedule and relevant environmental issues. Overall, there was no opposition raised against the proposed project.

14. Three-step complaints solving procedure will be established to handle environmental impacts and land occupation. As a guideline, any complaints to any project's aspects will be solved through negotiation to get agreement. Complaints will be submitted toward 3 levels of entities: First through commune/ward's PC, then the Town's PC and finally through PPC. If an agreement was not reach, then they will be law court as the final method. WASECO will bear all administrative and legal cost arising in such complaint solving processes.

**Environmental Management Set-up**

15. Institutional Arrangement: The project will be implemented under the Bac Giang People's Committee as the Executing Agency and the WASECO as the project implementing agency. A Project Management Unit (PMU) has been created to supervise the implementation, on behalf of WASECO.

16. The PMU will be responsible for fulfilling the environmental requirements of the project, particularly for incorporating the mitigation measures and safeguards identified in this report in the detailed engineering design of the pipeline, WTP and distribution network, as well as in the bid documents and construction contract documents. The PMU will also be responsible for commissioning water and air quality sampling activities, undertaking environment-related investigations that may arise during implementation (in coordination with the DoNRE's Environment Protection Center), and responding to environment or nuisance-related complaints from residents or businesses affected by the project works.

17. An environmental specialized firm will be requisitioned to provide environmental monitoring support during project construction (using as baseline the environment survey that was conducted as part of this IEE), and to conduct follow-up consultations and interviews with local residents to identify concerns or grievances arising during construction.

18. A sub-group under the PMU would be designated to handle environment and public safety concerns. Its main duties are to:

i. Oversee the implementation of the safeguards related to handling of spoils, water quality protection, public nuisance impacts, unexploded ordnance survey, and public safety;
ii. Coordinate with the DoNRE Environment Protection Center on regulatory compliance issues (for water quality in Thuong River affected by construction drainage or erosion from storage areas for excavated soil, noise and vibration from construction sites, sanitation in workers campsite, etc.);
iii. Check that the safeguards are adequately addressed in the bidding documents (instruction to bidders), and in the evaluation criteria for awarding contracts;
iv. Prepare terms of reference (TOR) for the survey of the pipeline route to detect unexploded ordnance (if present in the pipeline work areas);
v. Prepare TOR for the conduct of water and air quality sampling, including follow-up interviews with local residents on issues and concerns arising during project construction;
vi. Advise the PMU director on environment-related concerns arising during project construction, and recommend corrective measures;
vii. Disseminate to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among HHs or small businesses near the construction sites;
viii. Prepare a bi-annual status reports on environment and public safety protection to be submitted (through the PMU director) to the Bac Giang town PC.

19. Monitoring compliance with the safeguards in the construction phase - especially with the implementation of the safeguards provided in the construction contract, as recommended

in this report - will be put to task the construction supervisor which can be assigned to WASECO (and supervised by the PMU). The compliance monitoring and auditing will be fully documented, and the findings and recommendations will be sent immediately to WASECO. During the operation phase, WASECO will be responsible for the protection and monitoring of effluent, and the results will be reported to the Division of Environment and Natural Resources.

20. Bac Giang's DoNRE will conduct monitoring and random testing environment before, during and after construction, as well as in urgent cases. The division will also consider the monitoring report of Environmental specialized firm. If any unusual case found, Town's PC can ask for payment of fines and emit a suspension notice with a specific time limit to the responsible unit. If a complaint is formally received from the public through the PC's, the DoNRE will conduct verification.

21. Within three months after completion of construction or no later than a year, an environmental monitoring and audit report of the completion of the project's components will be prepared by an eligible environmental research institute, for example Environment and Natural Resource Engineering One member Co., Ltd. This report will be reviewed and approved by the Town's PC and submitted to ADB.

22. The environmental monitoring, including environmental benefits monitoring, will be included in the project preparation management system (PPMS) for the project. Backed by a local environmental specialist, the PMU will be responsible for analyzing and unified data through its information management system. The PPMS will be designed to allow adequate flexibility to adopt the remedial action regarding project design, schedules, activities and development impacts. Initially, the PMU and consultants will complete a comprehensive PPMS procedures to systematically generate data inputs and outputs of the project components and environmental agreements. Socioeconomic indicators concerned will be used to assess the impact of the project. PMU will refine the PPMS framework, confirm objectives achieved, set up detailed monitoring and recording arrangements, and establish systems and procedures no more than 6 months after loan's effect.

**Project Implementation Schedule**

23. The main project tasks are presented in the table belo**w**

| Tasks | Tentative schedule |
|---|---|
| Loan agreement negotiation and signing | 11/2014 |
| Establishment of PMU | Early 2015 |
| Preparation of detailed design, cost estimate and bidding document, procurement and selection of bidder. | 2nd Quarter 2015 |
| Update EMP and conduct consultation with downstream communities; | 3rd Quarter 2015 |
| Coordinate with the Environment Protection Center on regulatory compliance issues | All duration of the project |
| Construction duration (24 months) | Start Early 2016 |

24. Budget. The monitoring budget covers: (a) survey on awareness and following consultation with local residents conducted by assigned unit of PMU - Environment and Natural Resource Engineering One member Co., Ltd to serve preparation of IEE; (b) monitoring quality of surface water, ground water and air during construction; (c) survey pipe ditches to check materials which can be dangerous to workers; (d) local environmental specialist supporting PMU (in preparing of TORs, air and water sample test evaluation, draft safeguards regulations combined in bidding document and construction contract, preparation

of report of PMU) and (e) training for PMU's staff and community authorities on environmental impact management of construction of pipeline and related safeguard measurements (prepared by environmental specialist). The total estimated budget is $50,000 that will be taken from the ADB loan partly under the PMU incremental cost and Construction Supervision Consultant.

25. During the operation of the new water treatment plant, water quality monitoring of drinking water taps at various locations in the new or expanded WASECO service areas will be done routinely by the Environment Protection Agency of the DoNRE in compliance with Vietnam regulations and using the agency's own budget.

**Conclusion and Recommendation**

26. The proposed project will produce significant benefits for the population of Bac Giang, specifically by enabling HHs that are currently not served or only partially served by WASECO to shift from reliance on wells as a source of water (which has to be boiled or filtered) to more secure and safe piped water source.

27. The potential adverse environmental impacts of the project are mainly the consequences of construction activities, in particular the potential impairment of water and air quality in areas near the pipeline construction corridor, and nuisance and safety hazards posed to nearby HHs and small businesses. However, these impacts are temporary and can be mitigated.

28. HHs that will be affected by construction activities, either because of dislocation or damage to property, will be relocated and/or compensated in accordance with ADB guidelines. These measures are presented in a separate report focused on the project's resettlement and compensation aspects.

29. For purposes of compliance with ADB environmental assessment guidelines, no additional study or full environmental impact assessment is needed to further assess the potential environmental impacts of the project.

## I. BACKGROUND

1. Bac Giang town water supply project is part of the seven water supply subprojects that formed the third Periodic Funding Request (PFR-3) of the Multi-tranche Financing Facility (MFF0054-VIE) for Support of the Water Sector in Viet Nam. The tranche finances 7 water companies for urban water supply, including one economic zone (see Figure 1).

2. This project, classified as Environment Category B, is judged to have some potential adverse environmental impacts, particularly in relation to pipeline construction activities and, to a lesser significance, the disposal of sludge from the water treatment process. The unavoidable construction impacts are temporary and can be mitigated, whereas adverse impacts related to sludge disposal have been avoided by incorporating sludge dewatering in the design of the water treatment facility.

3. This report was prepared by the Bac Giang PMU with support from the Technical Resources and Environment Co. Ltd from August to April 2011. It was prepared in compliance with the ADB Safeguard Policy Statement (ADB SPS 2009). It follows the standard outline for environmental assessments: legal and administrative framework; description of the environment; description of the project and its significance; assessment of environmental impacts and mitigation measures, including alternatives considered; public consultation and information disclosure; and environment management plan.

4. The scope of this assessment covers: (a) new intake, pumping station and transmission by pipeline of raw water, (b) water treatment facilities, and (c) treated water distribution.

**Figure 1. PFR-3 Sub-Project Locations**

## A. Report's purposes and project's background

5. Bac Giang city is the economic, cultural and political centre of Bac Giang province, 50km North of Hanoi, is located on the very important traffic route (road and railway connecting with neighbours) connecting Hanoi capital with Lang Son city.

6. The locations of intake work and raw water pumping station, pre-sedimentation pond are in Bui village, Song Mai commune, Bac Giang city. The location of water treatment plant is in Phuc Ha village, Song Mai commune, Bac Giang city. In addition, the project also expand the water supply network for sub-areas in the west and south of Bac Giang city (namely Que Nham, Song Mai, Da Mai, My Do, Tan My, Dong Son, Song Khe, Hoang Ninh, Hong Thai and residential areas along National road 1A under Yen Dung and Viet Yen districts). The project boundaries are as follows:

- Bordering Tan Yen district in the North;
- Bordering Lang Giang district in the East;
- Bordering Viet Yen district in the South - Southwest;
- Bordering Viet Yen district in West.

The project area is in the Southwest of Bac Giang city with the following coordinate:

+ Longitude: $106^{0}07^{'}48^{"}$ E;

+Latitude: $21^{0}15^{'}06^{"}$ N.

7. The project is located in Bac Giang city well serviced in terms of road and railway, of which the main roads are National road 1A, road nos. 31, 37, and provincial road 398. Furthermore, in Bac Giang city there is waterway connecting the city with big industrial centres, trading and tourist areas such as Pha Lai, Con Son – Kiep Bac, Yen Tu and Hai Phong.

8. Since the project area is close to the key economic region in the North, the traffic routes have been expanded and are more convenient for business trading with the neighbouring provinces, particularly Hanoi city. The river network in Bac Giang is typical of Northern delta rivers, especially Thuong river flowing across the project area connects Bac Giang with its neighbours.

9. According to the site survey, the project is mainly in agricultural land of the local residents. The project owner will prepare a plan for compensation in compliance with the law. There are no pagoda, communal house, cemetery or spiritual areas, natural conservation areas and other historical places surrounding the project area.

## II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

10. Vietnam's Law of Water Resources was passed in June 2012. It establishes water as a resource to be managed as an economic good. Water resources boundaries are to be delineated according to hydrological rather than administrative boundaries. The law also gave strong institutional focus on creating a national apex body for water resources management, the setting up of river basin organizations, decentralization of management for water resources assets including infrastructure, and greater accountability for water services delivery.

11. The water law also provided for establishment of more effective regulatory institutions, including the use of abstraction licenses, discharge permits and more strengthened safety procedures for infrastructure development and operation. The Law was

not only intended to facilitate shift to more sustainable and economically efficient development of the country's water resources; it was also intended to support achievement of the country's broader imperatives of poverty alleviation, socio-economic development and environmental protection.

12. The Ministry of Agriculture and Rural Development (MARD) was originally responsible for implementing the water law; this responsibility was later transferred to the Ministry of Natural Resources and Environment (MoNRE). Subsequently, MoNRE was mandated to direct river basin management activities throughout the country.

13. Under the Law on Water Resources, the GoV issued Decree No. 201/2013/ND-CP: on stricter regulations for effective water resource management. Under this Decree, projects requesting water abstraction from underground or surface water or for discharging wastewater into water bodies have in particular to get permits and to collect opinions of representatives of local communities. The aforesaid projects include reservoirs and dams with a total capacity of at least 500 cubic meters and works using surface water with a total flow of 10 cubic meters per second, reservoirs and dams interrupting rivers' and streams' current for at least one kilometer, and works discharging wastewater into local water sources with a flow of 10,000 cubic meters per day.

14. The Law of Environmental Protection (LEP) was originally passed in 2003 and took effect in January 2004. Decree 175/CP issued in October 2004 provided implementing guidelines for (a) assignment of environmental management responsibilities among ministries, provinces and people's organizations; (b) an environmental impact assessment system; and (c) a regulatory permitting system based on standards. Chapter III of Decree 175/CP contains requirements for the submission of environmental impact assessments by investors and enterprises; the appendices to the Decree also contained detailed provisions prescribing the format and content of EIA reports. In 1998, Circular 490 was issued providing additional guidelines for the preparation and review of EIA reports.

15. In November 2005, the LEP was revised. Decree 80/2006, issued in August 2006, provided detailed implementation guidelines for the amended law, replacing Decree 175/CP. Decree 80/2006 was added in December 2008 by Decree No. 21/2008 of the Government. By June 2011, all provision relating to the EIA of the investment project were replaced by Decree 29/2011 dated 5/6/2011 of the Government. Then, the MoNRE issued Circular No. 26/2011 guiding the implementation of Decree 26/2011. The project-based EIA system was strengthened, and a new environmental management tool was introduced in the form of strategic environmental assessments (SEA) for national, provincial and inter-provincial development plans, policies and programs. Responsibility for conducting SEAs is assigned to the state agency responsible for formulating the strategy or plan. Environmental Impact Assessment is applied to the investment projects as specified in Decree 26/2011, whereby the agencies who appraise and approve the EIA report are MoNRE, Ministries made decision on investment and People's Committee of provinces and cities. The commitment to environmental protection made for small-scale projects is to be implemented in two forms: environmental protection commitment and NVMT commitment, simply with the approval of authorized DPC or commune/ward.

16. The National Assembly of Viet Nam approved a new Law on Environment Protection (LEP) on 23 June 2014. The Law will however be effective from 1 January 2015. Implementing guidelines and associated regulations are under preparation.

17. Environmental management in Viet Nam is administered on the national level by the MoNRE. The environmental arm of MoNRE, the National Environmental Agency (NEA), is

the body specifically tasked with environmental protection. Aside from MoNRE, environment divisions in the various line Ministries are tasked with environmental management functions related to the specific sectors.

18. At the provincial level, the relevant management authorities are the Departments of Natural Resources and Environment (DoNRE) which carry out their environmental protection activities through their respective environment divisions. In the case of Bac Giang DoNRE, an Environment Protection Centre is responsible for monitoring environment quality and providing technical solutions. The DoNREs come under the purview of the central MoNRE only in relation to administrative matters and technical guidance. For all other purposes, the DoNREs operate under the direct control of their respective provincial governments, through the People's Committees.

19. The Project required GoV approval through the Bac Giang DoNRE. Contractors have to comply with all statutory requirements set out by DoNRE for use of construction equipment, hazardous waste & chemicals management, and operation of construction plants, e.g., concrete batching. Permits and certificates need to be obtained from Bac Giang DoNRE for the Project. The delay for such approvals can take between 2 months to 3 months once the file is complete.

20. At district level, the relevant management agency is Division of Environment and Natural resources under District's PC. This division has qualified team responsible for environmental protection and consulting for District's PC leaders to make responding environmental decisions.

21. This project being funded in part by the ADB the Safeguard Policy Statement (SPS) applies and requires all the borrowers to identify project impacts and assess their significance; examine alternatives; and prepare, implement, and monitor environmental management plans. The SPS requires borrowers to consult people likely to be affected by the project and disclose relevant information in a timely manner and in a form and in languages understandable to those being consulted. Regarding IEE, SPS required the description of the environmental condition of a project, including potential impacts, the formulation of mitigation measures, and the preparation of institutional requirements and environmental monitoring for the project.

22. The ADB determined that the Project is Category B and subject to IEE. The ADB defines a Category B project as follows (ADB SPS 2009):

> *Category B. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.*

## B. Methodologies applied during the IEE

23. ***Methodology 1*** – Surveying, sampling and analysis in the lab: This method aims to identify the parameters on the current status and quality of the air, water, soil environments, noise, vibration, solid waste and toxic waste in the project area. The project owner in cooperation with the consultant conducted site inspection and took samples for analysis. The positions of sampling and analysis result are presented in the section "The current status of environmental components" (Chapter 2).

24. ***Methodology 2*** – Listing is the very effective method to point out impacts and is capable of forming sufficient statistics on the impacts that need to be concerned during the IEE process of the project. The advantages of listing method are simple, easy to carry out

and showing quite clear result. However, this approach also has its own disadvantage that it fails to assess the project's impacts quantitatively and in detail. Therefore, this method is used for primary IEE reports only, to localize or limit the scope of impacts to be assessed (The listing method is applied to list all the sources the impact to the project which will be shown in Chapter 3).

25. ***Methodology 3*** – Quick assessment: is carried out based on the pollution coefficients which were established and recommended to apply by international organizations (World Bank or World Health Organization), to quickly calculate demand or concentration of some pollutants in the environment. The advantage of this method is to show results quickly and rather accurately on demand or concentration of those pollutants. This method is used in the section "Environmental Impact Assessment of the project" (Chapter 3);

26. ***Methodology 4*** – Comparison: This method is used for the project's IEE by making comparison with Vietnamese standards, Vietnamese norms on environment for components of the air, water, soil environment, noise, etc. This method is applied the section "The current status of environment and the project's IEE" (Chapter 2 and 3 of the report).

## III. PROJECT DESCRIPTION

27. The proposed project consists in:

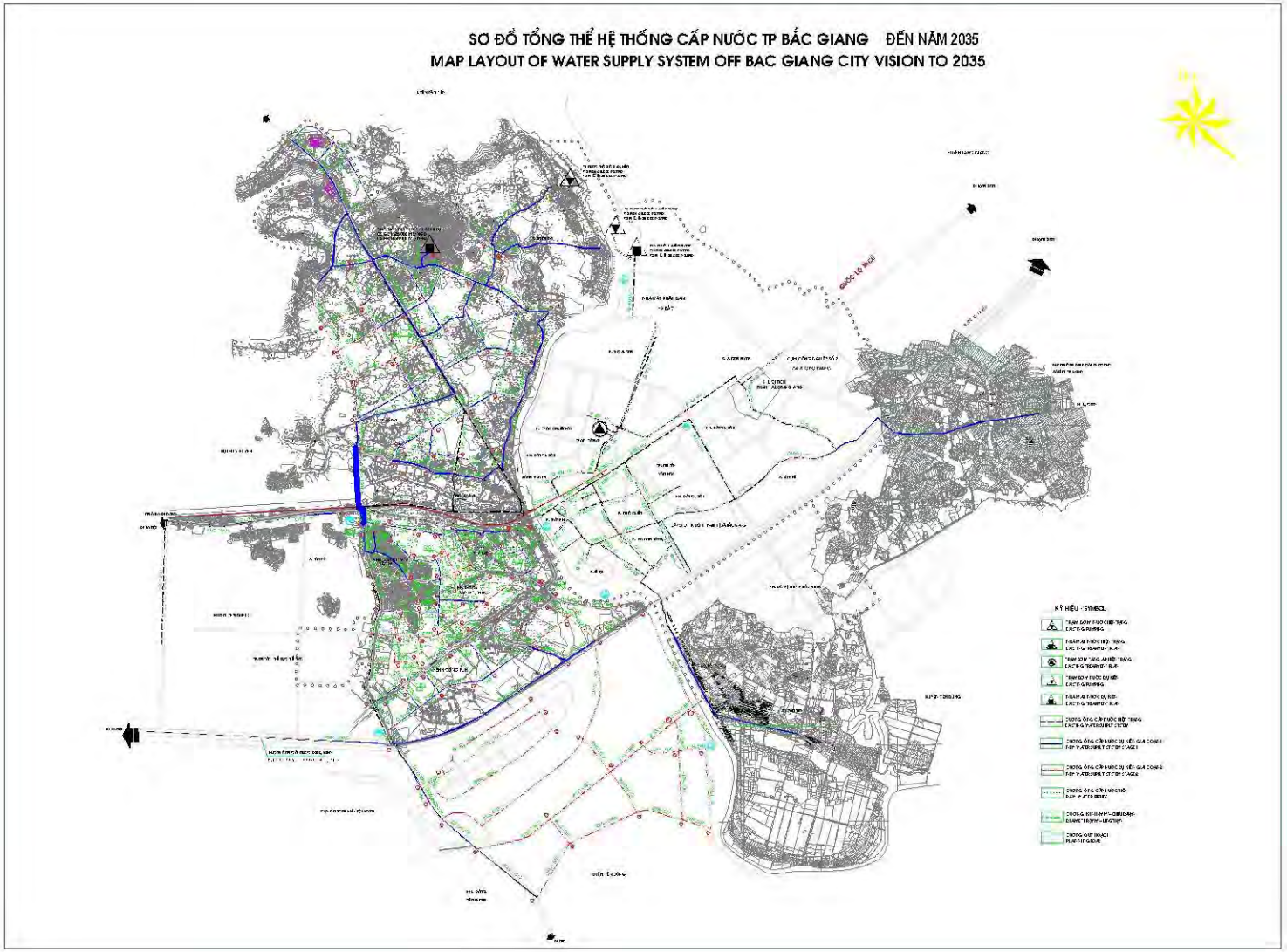
- Construction of intake, pumping station and 2.2 km D700 raw water pipe;
- Construction of a new Water Treatment Plant capacity 25.000$m^3$/day;
- Construction of 76 km transmission and distribution pipes D75-D700;
- Installation 16,000 meters;
- Support for the implementation and operation of the project.

28. The project will benefit over 30,000 households (HHs) with improved services and about 16,000 HHs receiving piped water for the first time, including 3,000 low income HHs.Water supply coverage target is over 85% by 2020.

29. The Project will only rehabilitate existing facilities (water treatment plant, pipeline network). The initial assessment did not identify any outstanding environmental issues related to the operation of these facilities. All mitigation measures defined in Table 31 pertaining to handling of chemicals, waste storage/stockpile, and / other storage in existing facilities will be followed.

**Figure 2. Existing Water Treatment Plant**

**Figure 3. Bac Giang distribution network in 2035**



## C. Classification for the project

30. Specific objectives of the project:

- Constructing a new water supply network with the capacity of 25.000 $m^3$/day for the Southern area of Thuong river and the communes which were newly merged into Bac Giang city; supplying more water for the city centre in the North of Thuong river as well as improving water supply safety for Bac Giang city; ensuring the water users in the project area is supplied clean and hygienic water.
- Investing in construction to be suitable and reasonable with the province's conditions, facilitating the expansion and development of water supply network in the following period.
- Improving the awareness on use and saving clean water of the people in the project area and surrounding areas.

31. Benefits from the project:

- People in Bac Giang city will live in a convenient and modern urban centre without lack of clean water for domestic, production and business activities and others.
- Raising the opportunities to assess hygienic water sources to bring benefit to the community's health, and indirectly reduce poverty. This makes lessen the alarming situation of using polluted water sources such as water from shallow wells, rivers and ponds with high risk of pollution.
- Meeting domestic and service demands is a basis of attracting and promoting investors and service providers.

32. Aiming to expand the distribution and service network for the areas where have not been accessed clean and hygienic water is one of the proper objectives in terms of environmental and community's health protection.

33. Under ADB classification, the Project is a Category "B" undertaking. The adverse impacts that will potentially arise from the implementation of the Project will generally be minor to moderate, and significant only for the land acquisition involved in the proposed WTP site. Measures to mitigate them can be designed, provided and/or instituted without difficulty. For Category "B" projects, the ADB requires an IEE. Regarding the GOV requirements, according to Circular No.05/2008/TT-BTNMT, dated December 8, 2008, water supply projects with design capacity less than 50,000m3/day are classified as Category "II" projects. A Category "II" project would require an Environmental Protection Commitment (EPC) for registration with, and certification by, the District People's Committee through its Natural Resources and Environment Office. The EPC for this Project will be prepared following the completion of this IEE.

## D. The necessity of the project

34. Since becoming the III Category urban centre in 2005 to present, Bac Giang city has developed quickly in terms of urban space. The areas in the West and South of the city are being urbanized, connecting with Industrial, Service and Urban areas along National Highway 1A in Viet Yen district which are being invested in, in which Dinh Tram and Dong Vang industrial zones were put into operation; Van Trung, Quang Chau and Song Khe – Noi Hoang industrial zones in Yen Dung district are under the construction; Viet Yen Industrial, Service and Urban area complex is under preparation for construction.

35. The master plan for Bac Giang city up to 2020 was established in 2004, and the adjusted planning in 2005 was approved by the PPC. According to the planning, the development strategy of Bac Giang city is a provincial city and the centre of administration,

politic, economy, culture, science and technology of Bac Giang province. The main development direction is to expand towards Da Mai, My Do and to limit industrial development in the city centre while focusing on the expansion of 3 main industrial zones, including Chemical, Fertilizer Industrial Zone (Central's Industrial zone), Dinh Ke, Tho Xuong Industrial Cluster and Da Mai Industrial Cluster (Local Industrial zones). The development of industrial and service sectors benefit the province's economy. As a result, the water demand and amount of water to be supplied in the period of 2010 - 2030 is as follow:

| No | Content | Unit | Year | | |
|---|---|---|---|---|---|
| | | | 2012 | 2025 | 2035 |
| 1 | Water demand | $m^3$/day | 31.000 | 60.000 | 91.000 |
| | Water supply capacity | | | | |
| 2 | Bac Giang water treatment plant | $m^3$/day | 25.000 | 35.000 | 35.000 |
| 3 | Water treatment plant no. 2 in Bac Giang city | $m^3$/day | 0 | 25.000 | 50.000 |
| 4 | Other sources | $m^3$/day | 0 | 0 | 0.000 |
| 5 | Missing capacity | $m^3$/day | 6.000 | 0 | 6.000 |

36. From the above table, it can be seen that currently, WS system in Bac Giang city will lack at least 6,000 m3/day until modification of the original WTP. The proposed capacity of WTP no. 2 of Bac Giang city in Phase 1 is 25,000 m3/day; therefore, its total capacity up to 2025 is 60,000 m3/day.

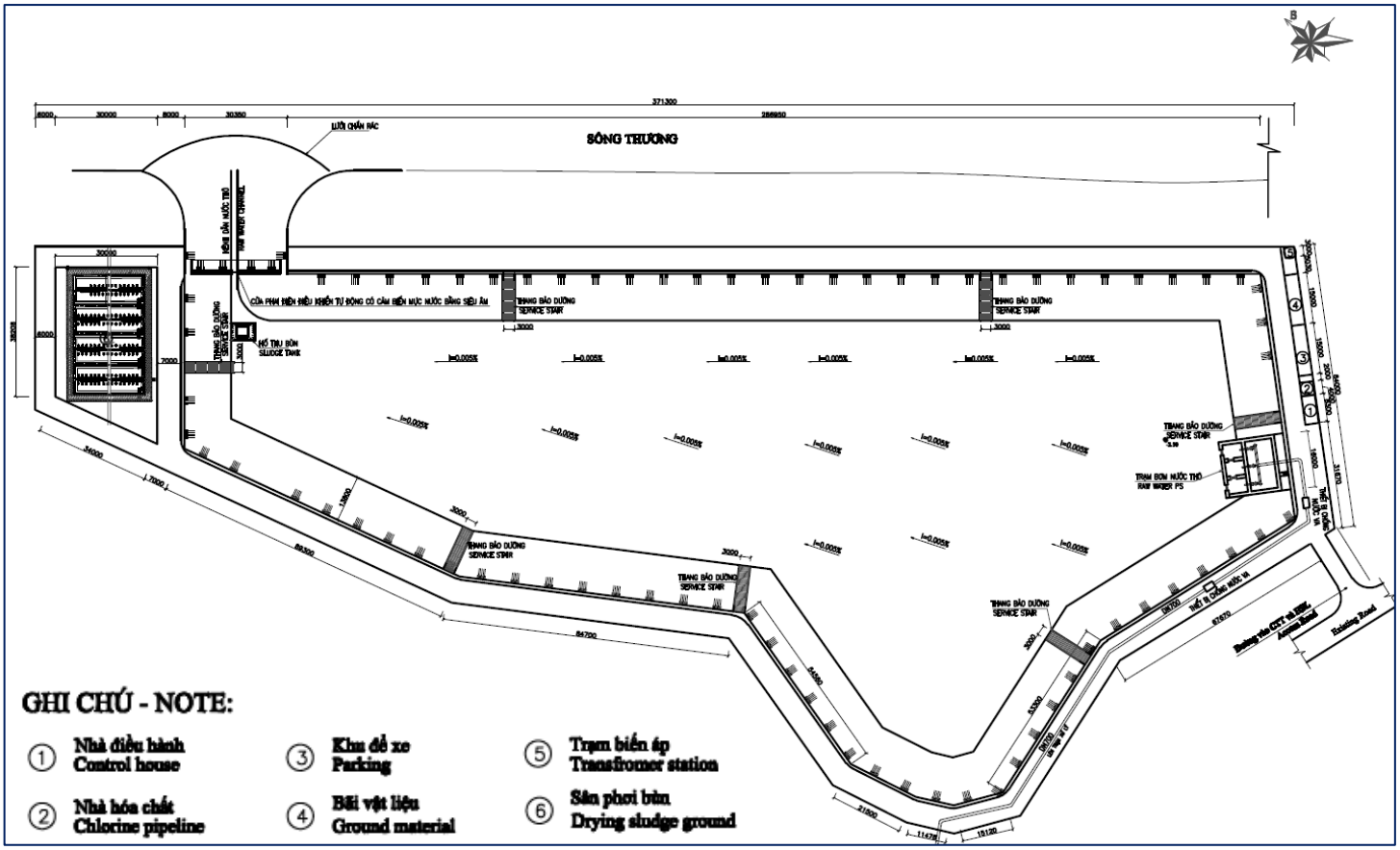
37. Hence, a supplement to the water supply for the city is to promptly meet the urgent demand in parallel with socio-economic development. Currently, there are two (2) separated water supply systems in the whole city, one of which supplies water for Ha Bac Fertilizer Factory and the other serves for the entire city. Bac Giang city WS system was built, expanded and completed in 2001 by the ODA fund of Australian Government. The design capacity of this system is 25,000m3/day. The quality of water supplied to the distribution network meets the standard on domestic water (Norm 01/2009/QĐ-BYT of the Ministry of Health: National technical norm on domestic water quality). Thus, with the current design capacity, the new WS should only meet the basic need of the population of the city, residential neighbourhood Bac Giang city and a number of industrial parks: Dinh Tram, Song Khe – Noi Hoang industrial zones, Que Nhan residential area (Tan Yen district), Tan An residential area (Yen Dung district), Dinh Tri residential area (Lang Giang district).

38. Consequently, after completion, the project on "Investment in construction of water treatment plant no. 2 in Bac Giang city, Bac Giang province" – phase 1 (2025) with the capacity of 25,000 m3/day will ensure to supply clean water to meet domestic and industrial demands in the studied areas to 2025. The project will contribute to attract investment and immigrants, step-by-step establishing and developing Bac Giang city in accordance with the instruction of the Government and leaders of Bac Giang province. Bac Giang Provincial People's Committee (BGPCC) assigned Bac Giang Water Supply and Sewage One Member Limited Liability Company (WASECO) to directly execute and manage the project.

### E. Description line technology, construction items of the project

39. After making comparison between advantages and inconvenient of the two design options, the project owner selected Option 1 for the treatment technology chain of WTP no. 2 in Bac Giang city as follows: water channel – pre-sedimentation pond – primary pumping station – reaction tank – mixing tank – sedimentation tank – filtration tank – reservoir – WS network in the Southwest, Northeast of Thuong river.

**Figure 4. Sedimentation basin, Raw water channel and Pumping station**

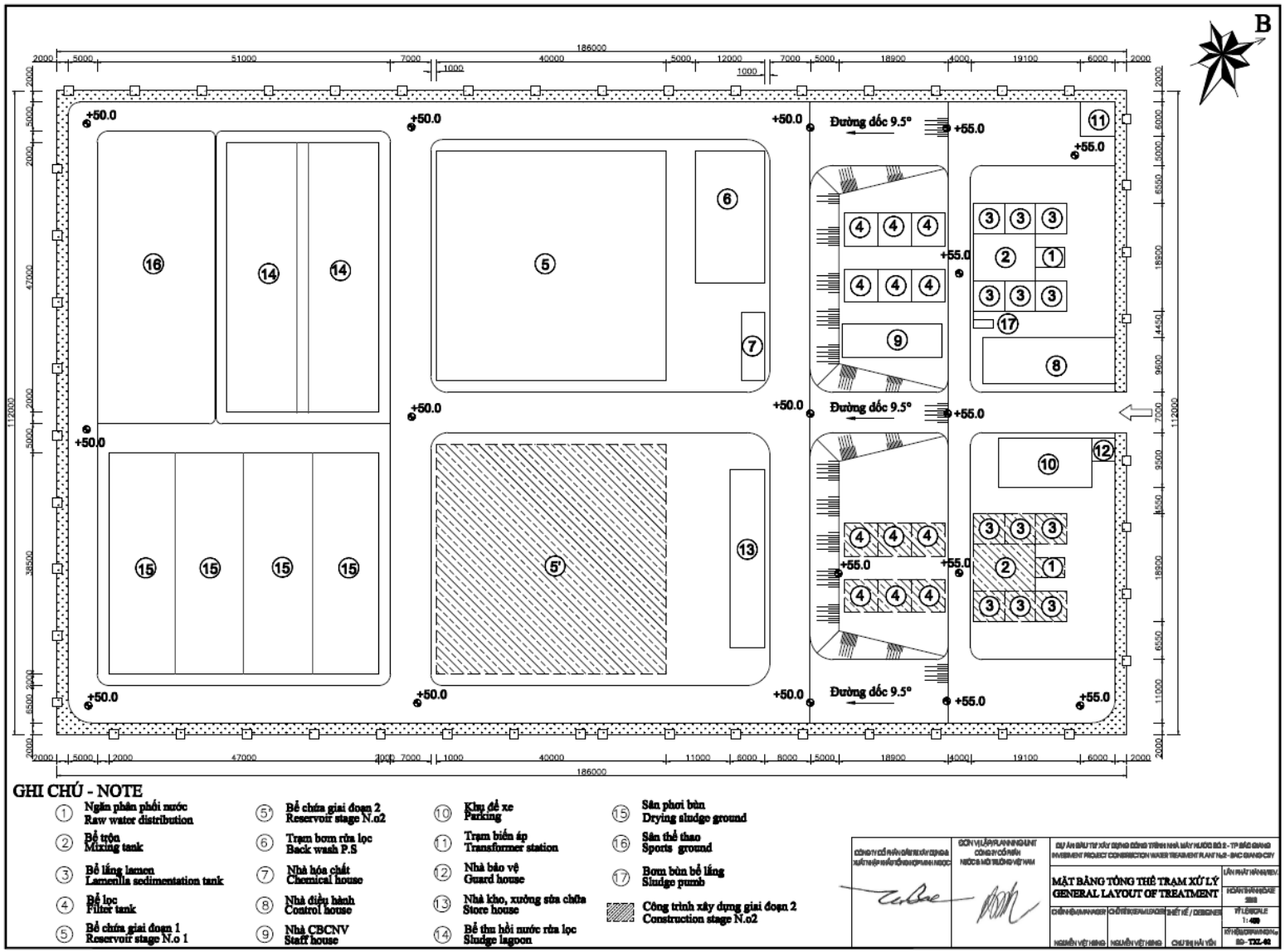



**a. Method statements, selection of technology**

40. Water from Thuong river flows through intake work to be sucked by a primary pump to raw water transmission pipe, and then to the treatment plant. The selected option is a combination between a physicochemical treatment method and a sterilization method. In the mixing tank, a soda ash in solution will be injected into raw water to adjust pH, ensuring the effectiveness of the physicochemical treatment process and alum will be added to create the flocculation reaction process. After that, the water flows into a reaction chamber. of Lamella sedimentation tank

41. In sedimentation tank, when water flows into sedimentation chamber, sediment will settle down to the tank's bottom after encountering the lamellas. The sediment is periodically discharged. During the sedimentation process, surface water is collected to flow into rapid filtration tank. Water flows by gravity through filtration material layer. The small sediments which do not settle down in the sedimentation process will be trapped in the sediments. After filtration, water flows to the reservoir. Liquid Chlorine is then injected into the reservoir for sterilization before secondary pump pumps water to the distribution network.

**Figure 5. Water treatment plant setup**



**b. Construction quantities of the project's works**

**Raw water pumping station**

- Capacity of raw water pumping station is calculated as below:

Q raw water = Q network + 8% Q network

Q raw water = 25.000 + 25.000 * 8% = 27.000$m^3$/day.

42. Since the capacity of primary pumping station is 27.000$m^3$/day; selecting 3 pumps, of which two (2) pumps operate and one is on stand-by for provision, the flow reduction factor when the two (2) pumps operate simultaneously is m =0,9; capacity of each pump Q=27.000/24/2/0,9 ≈ 620$m^3$/h, H=80m

- Pumping station is located next to the pre-sedimentation pond on a reinforce concrete base, size a x b = 15,9m x 15m.

**c. Raw water channel**

43. Design capacity for phase 2 is: 54.000 $m^3$/day, including consumption capacity of the network: 50.000$m^3$/day and water used for treatment plant (8% x 50.000$m^3$/day = 4.000$m^3$/day).

- Hydraulic calculation for open channel based on the formula: $Q = wC\sqrt{Ri}$ (please refer to the preamble to the basic design for further information)

+ Level of channel's bottom: - 3,00 m;
+ Lowest water level: - 0,18 m;
+ Average water level: + 4,04 m;
+ Highest water level: + 7,53 m;
+ Level of natural ground: + 5,00m;
+ Level of the channel's top and pre-sedimentation pond's top is equal to the irrigation channel's top: +9.30 m.

| Raw water intake site | Raw water pumping station & channel area sites |
|---|---|

**Figure 6**. **Raw Water Infrastructures Location**

**d. Pre-sedimentation pond**

44. Pre-sedimentation pond is located in Bui field, Dong village, Song Mai commune, Bac Giang city.

45. Design capacity for the phase 2: 54.000 m3/day, including consumption capacity of the network: 50.000$m^3$/day and water used for treatment plant (8% x 50.000 m3/day = 4.000 m3/day).

- Proposed time for storing water: 2 days.
- Surface of the pre-sedimentation pond: 3,3ha.
- The pond's walls are sloping. In the pond's bottom there is a sediment containing area. The slope of walls 1:1,5.

+ With the lowest water level: - 0,18 m;
+ With average water level: + 4,04 m;
+ With the highest water level: + 7,53 m;
+ Level of natural ground: + 5,00 m;
+ Level of the channel's top and pre-sedimentation pond's top is equal to the irrigation channel's top: + 9,30 m;
+ Level of the pond's bottom: - 3,00 m.

**Figure 7. Presedimentation basin site**

**e. Raw water pipeline**

Design capacity for the phase 2: 54.000 m3/day, including consumption capacity of the network: 50.000$m^3$/day and water used for treatment plant (8% x 50.000 m3/day = 4.000 m3/day).

- Length of raw water pipeline : 2.200m;
- Diameter of pipe : DN700 - PN 10;
- Velocity : V = 1,62 m/s ; 1000i = 4,51m/km;
- Head loss in the pipeline : Hw = 2162m x 0,00451 x 1,2 = 11,7m; k=1,2 factor taking into account internal head loss in the pipeline.

**Figure 8. WTP construction site**

**f. Chlorine house (Preliminary chlorination)**

- Design capacity: 27.000m3/day = 1.125 ($m^3$/h);
- Preliminary chlorination by active chlorine with the dose of 2mg/l;
- Chlorine dose for 1 day: 27kg;
- Chlorinator with capacity: 0-2kg/h, two (2) units;
- Technical pump: Q=1$m^3$/h, H=50m;
- 100kg chlorine container used within 1 month: six (6) containers;
- Preliminary chlorination house is located separately, its size: 4 x 4m.

**g. Water distribution chamber:**

The chamber is calculated based on the following parameters:

- Calculated capacity: 27.000m3/day = 1.125$m^3$/h = 0,3125$m^3$/s;
- Time for storing water 1-1,5 minutes;
- Dimension: 4,2 x 3 x 3,1m.

**h. Mixing tank and reaction tank**

- Calculated capacity: 27.000m3/day = 1.125m3/h = 0,3125m3/s;
- Mixing tank: is combined with reaction tank with triangle cross section, dimension: 2,2 x 2,2 x 5m. Time for storing water: 1-1,5 minutes, volume: 23,4$m^3$;
- Reaction tank: volume: 375$m^3$; time for storing water: 10-30 minutes; comprises 2 chambers, dimension of each chamber: 5,1m x 3,8 m x 5m;

**i. Lamella sedimentation tank**

- Calculated capacity: 27.000m3/day = 1.125$m^3$/h = 0,3125$m^3$/s;
- Lamella plate with standardized height is 1,04m, equivalent to sedimentation height H = 0.91m (dimension of the Lamella plate: 18mm x 70 x 1040mm), placing Lamella plate leaning 60$^o$;
- Area of Lamella sedimentation tank: 161,6 $m^2$, comprises 2 blocked tanks, size of each: 5,1m x 15,9 = 81$m^2$;

**j. Rapid gravity filters**

- Calculated capacity: 27.000m3/day = 1.125$m^3$/h = 0,3125$m^3$/s;
- Filtration material is quartz sand with the size: dtd=0,9 ÷ 1 ,6mm;
- Height of quartz sand layer: H1 = 1,2 m;
- Height of gravel layer: Htd = 0,1 m, diameter of gravel: dtd =0,6÷0,65mm;
- Average filtration velocity: VTB= 5,5m/h;
- Area of filter: 215,54 m2;
- Build six (6) filters, dimension of each: 6,8 x 6,8 x 4,4m.

**k. Reservoir**

- Calculated capacity: 27.000m3/day = 1.125$m^3$/h = 0,3125$m^3$/s;
- Volume of reservoir: W=4500m3;
- Dimension of reservoir: 40 x 40 x 3,2m.

**l. Tank containing backwashing water**

- Calculated volume of the tank containing backwashing water and water with sediment for 3 working days of the treatment plant: 6% Q day x 3 day ≈ 4.800$m^3$;
- Build 1 sedimentation tank with 2 chambers with dimension AxBxH =49mx49m x 2m;
- Backwashing water and water after washing sedimentation tank flow into this tank through a brick channel with the size of B x H = 800 x 500, having cover slab;

- Water after sedimentation is pumped into distribution tank. Using a submerge pump to collect backwashing water with Q=50m$^3$/h, H=20m and 1 sludge pump with Q=60m$^3$/h, H=10m to suck out sludge on the sludge drying bed.

**m. Drying bed**

- Calculated capacity: 27.000m3/day = 1.125m$^3$/h = 0,3125m$^3$/s;
- Amount of sludge rejected daily in the treatment plants: 7533kg;
- Time for storing sludge: 30 days;
- Size of drying bed: 28 x 47m.

**n. Cleaning pumping station**

- Cleaning pump: traverse centrifugal pump – Q= 1090m$^3$/h, H=18m;
- Cleaning wind pump: Q= 40m$^3$/ph, H=18m;
- Structure of pumping house is reinforced concrete, half of the house is underground, its size: 23 x 12m.

**o. Water supply network**

- Transmission and distribution pipeline

  Transmission pipe has diameter from DN600-DN700, using ductile iron PN8; distribution pipe has diameter from DN110 - DN315, using uPVC-PN8; service pipe has diameter from DN50-75, using HDPE PN8. Length of transmission, distribution and service pipes as follows:

**Table 1. Summary of pipe quantities**

| No | Pipe's diameter | Length (m) | No | Pipe's diameter | Length (m) |
|---|---|---|---|---|---|
| 1 | DN700 | 6803 | 6 | DN150 | 20731 |
| 2 | DN600 | 1909 | 7 | DN110 | 15952 |
| 3 | DN315 | 3045 | 8 | DN75 | 12408 |
| 4 | DN250 | 5794 | 9 | DN63 | 8038 |
| 5 | DN200 | 10148 | 10 | DN50 | 15180 |

46. The average depth of pipe to top of the pipe is 0,7 ÷ 1m. Average chain is 1m.

47. Waste purge should be installed at the lowest points of distribution/ transmission pipeline, and air release valve chambers at the highest points. Construct supports, braces at the positions of tees, stick, vial, etc. It is necessary to provide protection solutions for pipes crossing asphalt road, national road, and provincial road by using a bigger pipe covering the pipes or with a protection cover slab.

48. Service pipeline

Using HDPE-PN8 pipe for service pipeline with the following types and length of pipe:
+ D75-L = 3235m;
+ D63-L = 8038m;
+ D50-L = 15180m;
+ D40-L = 29825m;
+ D32-L = 37123m ;

49. Service pipes are calculated based on the chart of flow distribution, depending on number of users. Identifying the service pipeline depends on the location of population, density of residential areas. Service pipes are mainly in pavement, road's shoulders and 0,5-1,5m on average from HHs. Average depth of the pipe is 0,5-0,8m.

# IV. DESCRIPTION OF THE ENVIRONMENT

## A. Physical resources

### a. Geographical conditions

50. Bac Giang city is the centre for economy, culture and politics of Bac Giang province, 50 km North of Hanoi, is located on the very important traffic routes) connecting Hanoi capital with Lang Son city. Its boundaries are below:

- Bordering Tan Yen district in the North;
- Bordering Lang Giang district in the East;
- Bordering Viet Yen district in the South - Southwest;
- Bordering Viet Yen district in West.

51. The investment project to build the water plant no. 2 in Bac Giang city is implemented in the following areas:

- Collection works and raw water pump stations are located at km 31 +500 on the left dyke of Thuong River, approximately towards the upstream 800m far from the location of the current collectors of the operating water plant.

- The handling area is located at elevations no.+55 and no+50 in the hill of pine trees (in the mountainous areas of Quang Phuc) on Song Mai commune, Bac Giang city.

### b. Geological conditions

i. Conditions of topography in the project area

52. Since Bac Giang is the transition between mountainous area and delta, its topography is quite complicated and diverse. The terrain is divided into small sections, where there are both mountains and hills, forming the areas with higher hills and lower hills. Natural river system gradually slopes to the directions of Northwest – Southeast. Average elevation of the province compared to the surface seawater varies from 10m to 1000m. Bac Giang can be divided into two big regions: mountainous area, including Yen The, Luc Nam, Luc Ngan, Son Dong districts; hilly area and delta, including the remaining districts.

53. The low mountainous area is in the North, East and South with average elevation of 300-500m, the highest peak is Yen Tu mountain peak (1086m) in the Southeast, bordering Quang Ninh with the slope of over 250.

54. Low hilly area is next to the mountainous area, occupying 1/3 area of the province. There are continuous hills, forming the terrain similar to mountainous area. Elevation is not big, usually from 100-150m.

55. The hills side slopes gently. The valleys are narrow, usually are covered by agglomerate material. The terrain comprises valleys and unsettled warps which change in accordance with flooding. The diverse terrain is good condition for Bac Giang to develop agro-forestry with the direction of diversification, by growing various kinds of plants, breeding animals with high value to meet the market's demand.

56. (Source: Project's topographic survey, 2010).

ii. Geological conditions of the water treatment plant site

- Layer 1: clay in combination with weathered brown-yellow gravel, average thickness: 1,3m;
- Layer 2: weathered grey, brown-purple clay powder, rarely is chapped, Rqd =40-45%, average thickness: 7,5m;

- Layer 3: weathered grey, brown-purple clay powder, rarely is chapped, Rqd =80-85%, average thickness: 18,7m;
- Through the geotechnical survey result at the water treatment plant, it can be seen that the layers 2 and 3 have very good load supporting ability.

iii. Geotechnical features at intake work and raw water pumping station

- Layer 1: grey-brown clay in combination with clay mud, average thickness: 1,8m;
- Layer 2: grey-brown, grey-yellow, grey-red clay, plastic and hard – half hard status, average thickness: 2,2m;
- Layer 3: Gary clay and organic substance, gravel in somewhere, plastic and soft status, average thickness: 2,2m;
- Layer 4: Gary, grey-yellow, grey-red clay and gravel, plastic and hard – half hard status, average thickness: 1,7m;
- Layer 5: Gary clay and gravel, hard – half hard status, average thickness: 2,6m;
- Layer 6: Gary-brown, grey-black clay and organic substance, plastic and soft status, average thickness: 5,7m;
- Layer 7: Gravel, grey-brown, grey sand, soft and quite tight status, average thickness: 3,9m;
- Layer 8: Weathered grey, grey-brown, grey-green clay powder, rarely is chapped, hard structure Rqd = 55%, average thickness: 5,3m;

57. According to the result of geotechnical cross section at drilling hole NT2, the foundation is put on the layer 5, following the layer 5 is layer 8. These are good ground, ensuring load supporting ability for the work. The foundation is designed as concrete grade B22,5, underneath is compacted sand layer (k=0.95) in layer 5Thickness of the bottom and walls are calculated to avoid buoyancy.

*(Source: Project's topographic survey, 2010).*

**c. Seismic conditions**

58. According to Q.Z Nguyen of the Vietnamese Academy for Science and Technology in 2007, the North-western region of Vietnam is the most active for earthquake. This condition is due to a grid of multiple faults running on two general axes, SE-NW and SW-NE. The most active location is 320 km west of Bac Giang in the Dien Bien province. In this area, earthquakes of magnitude 6.8 on the Richter scale, and recurrent smaller ones, were reported twice in the last 50 years. The area has multiple seismic recording devices located in a grid pattern throughout the northern region.

***d.*** **Meteorological conditions**

- ***Temperature***:
  Average air temperature: 23,8°C
  Highest average annual air temperature: 29,5°C
  Lowest average annual air temperature: 14,2°C
- ***Sunlight:*** Total average sunny hour number in 2012: 1.235 hours, largest sunny hour number in August, 2012: 193,0 hour; lowest sunny hour number in January, 2012: 4 hours.
- ***Humidity:***
  *Average humidity of year 2012: 83%*
  *Highest humidity in January 2012: 86%*
  *Lowest humidity in October: 80%.*

- ***Rain***:
  Average rainfall of year 2012: 124.7 mm
  Highest average rainfall in July: 472.2 mm
  Lowest average rainfall in February: 10.7 mm
  The rainy season lasts from April to October each year; in which rainfall is most accumulated in July, August, and September (accounting for 70% of annual rainfall).
  The dry season starts from November to March of the following year. In the months of January, February often with small rains and extended freezes due to the influence of the North-East monsoon.
- ***Wind and storm***: Prevailing wind directions are East and North-East (from November to March of the next year); summer prevailing wind is South-East (from April to October). Highest wind speed is at 34 m/s. Typhoons usually occur in the months July, August, and September, causing heavy rain.
  (Extracted from Statistical Yearbook of Bac Giang province, year 2012).

iv. Climate change

59. Expected climate change impacts in the North of Vietnam include a potential increase in frequency and/or intensity of tropical cyclones; an observe constant increase in rainfall since 1960 and the run-offs that comes with them; an expansion in flooded areas and a rise in annual flood levels. Although the intergovernmental panel for climate change (IPCC) does not forecast any great changes in the timespan of the project 2025-35 but more in the years 2060 to 2090, punctual events due to climate change, notably recurrent flash floods could affect the intake infrastructures. As such, climate change impacts will be considered during detailed design, especially the water intake section laying in the river and in the flood plain. Also, drought events aggravated by climate change could also occur during the same period. A sedimentation basin holding 2 days of water will be put to profit then.

60. Measures to protect infrastructures (in particular water intake) from disaster risk (flash flood, drought etc.) will be identified during the detailed design.

61. The above measures will contribute to the safety of water supplies during such events (flood, drought etc.). This will also help to implement the Water Safety Plan to be implemented in parallel with the support of the World Health Organization (WHO).

62. Preliminary Climate Risk Screening Checklist has been filled and is presented in a separate document. Results from this screening shows medium risk for the Sub-Project.

**e. Hydrography**

63. Thuong river running through the city of Bac Giang, has hydrological regime affecting Bac Giang city as well as the project area, and serves as the water supply for the project. Thuong river has the surface of 150m wide, 11m deep, which is influenced by the tide in Bac Giang city but never salinity. The city has few urban ponds, with small surface, hollowness and limited water ventilating capability.

64. According to the data from the Approved Interpretation on General Planning of Bac Giang city until 2020 and with vision towards 2050, Thuong river has a number of hydrological characteristics as follows:

+ Maximum water level: +7.49 m (1971) with repeated frequency of P = 5%;

+ Average water level of many years: + 4.04 m with repeated frequency of P = 99%;

+ Minimum water level: - 0.36 m;

65. Residue concentration increases from the dry season to rainy season, and descends from upstream to downstream. Largest residue levels happen in July, August, and September, with full residues of 1.800mg/l. In dry season sediment concentrations decrease gradually, in March and April about 70mg / l.

66. According to data from the environmental status report of Bac Giang province in 2010 Thuong river has a number of hydrological characteristics as follows:

67. Flow in rainy seasons: from June to September, the amount of water in the rainy season accounts for about 75-85%. Highest flow measured in Cau Son is 1830m3/s.

68. Flow in dry seasons: from October to April of the following year, the amount of water in the dry season only accounts for 20-25% of the total flow in the year. Lowest flow measured is 9.3 m3/s. Average flow of Thuong river is 46.5 m3/s.

69. According to data from the Hydro Meteorological Center of Bac Giang province. Phu Lang Thuong hydrological station is the one affected by the tide of Tonkin gulf under the diurnal regime. The flow at the station is divided into two distinct seasons:

70. In rainy seasons: from June to September, in this season the river water regime is influenced by the upstream water, and small amplitude tide. The line of water level is flat, prolonged, and mixed with rainy seasons and weak tidal.

71. In dry seasons: From October to April of the following year, in this season the river water regime is influenced by the Tonkin gulf tide, diurnal tidal regime, which appears peak and trough once in a day.

+ Range: tide is by average from 30 cm to 50 cm. Large tidal amplitude on flood tide days is up over 5.0 m.

+ High tide time within the day from 6 pm to 8 pm, the others are low tide time.

+ Maximum water level: + 7.53 m (July 24,1986), with tracking time from 1980 to 2010.

+ Average water for many years: + 5.38 m, with tracking time from 1980 to 2010.

+ Minimum water level: - 0.18 m (February 22, 2010), with tracking time from 1980 to 2010. *(data provided by the Bac Giang hydrometeorology station in 2011).*

72. Flood risks in Bac Giang city is a recurrent problem along the banks. Populations have adapted and planning has been set to assess the situation. Although floods are recurrent, the projected infrastructure, except for the water intake that will be design accordingly to its situation, are located in flood safe environments.

**f. Current status of physical environment's components**

73. In order evaluate the current status of environment in the area serving for preparation of IEE report of construction investment project on water treatment plant no. 2 in Bac Giang city, Bac Ninh province, Consultancy unit, Minh Ngoc Construction Investment and Export & Import JSC in cooperation with the Institution of Science and Environmental Technology – Hanoi University of Science and Technology working with the project owner conducted site survey to measure, take samples and analyze the current status of environment on 10$^{th}$ January 2011. Results of measuring, surveying the current status of environment in the project area are considered the basis to assess and compare with the future operation of the project. The results are shown as below:

i. Current status of the air environment

74. Through the results of studying topographic drawings (topographic features, structures, weather characteristics) and surveying the project area, positioning sampling points, measuring the current status of the air environment at 10 positions are presented as follows.

**Table 2.Sampling points for the current status of the air environment**

| No | Code | Geographic coordinate | | Position description |
|---|---|---|---|---|
| | | Longitude | Latitude | |
| 1 | BGK01 | $106^0 17' 00''$ | $21^0 15' 08''$ | Tree group at the foot of Sat bridge, Bac Giang city |
| 2 | BGK02 | $106^0 17' 10''$ | $21^0 15' 12'$ | In front of Toan Chien shop, group 9, area 4, My Lo ward |
| 3 | BGK03 | 106017'08'' | $21^0 15' 23''$ | Ngo Quyen Ward People's Committee |
| 4 | BGK04 | $106^0 17' 19''$ | $21^0 15' 05''$ | Bac Giang Tuberculosis Hospital in Song Mai commune |
| 5 | BGK05 | $106^0 17' 15''$ | $21^0 15' 18''$ | Residential area in alley 95, next to social labour education centre of Bac Giang province in Song Mai commune |
| 6 | BGK06 | $106^0 17' 21''$ | $21^0 15' 24''$ | The hill where locates water treatment plant in Song Mai commune |
| 7 | BGK07 | $106^0 17' 17''$ | $21^0 15' 10''$ | Gate of Tan My Ward People's Committee |
| 8 | BGK08 | $106^0 17' 09''$ | $21^0 15' 16''$ | Location of raw water pumping station and pre-sedimentation pond in Song Mai commune |
| 9 | BGK09 | $106^0 17' 14''$ | $21^0 15' 09''$ | Gate of Song Khe Ward People's Committee |
| 10 | BGK10 | $106^0 17' 25''$ | $21^0 15' 14''$ | Gate of Dinh Tri Ward People's Committee |

ii. Measuring, analyzing parameters

**Table 3. Measuring, surveying parameters for the air environment**

| No | Parameter | Standards to be applied |
|---|---|---|
| 1 | Temperature, moisture, wind velocity, pressure | **QCVN 05:2009/BTNMT** National technical norm on quality of surrounding air. |
| 2 | CO, $SO_2$, $NO_2$, Total dust (TSP), Dust PM 10 | |
| 3 | $NH_3$ | **QCVN 06:2009/BTNMT** National technical norm on some toxic substances in the surrounding air. |
| 4 | Noise | **QCVN 26:2010/BTNMT** National technical norm on noise. |

iii. Sampling method

75. The sampling method for the current status of the air environment is carried out based on the instructions of Standard TCVN 6192:2000 (ISO 10396:1993) Emission of non-mobile sources – Sampling to automatically measure the concentrations of air.

iv. Results of measuring, analyzing

**Table 4. Result of air environment**

| No | Criteria | Unit | Result | | | | QCVN 05:2009/ BTNMT | QCVN 26:2010/ BTNMT |
|---|---|---|---|---|---|---|---|---|
| | | | BGK1 | BGK2 | BGK3 | BGK4 | | |
| 1 | Temperature | $^oC$ | 15 | 15 | 14,5 | 14 | - | |
| 2 | Moisture | % | 66,7 | 59,8 | 71,2 | 65,2 | - | |
| 3 | Wind velocity | m/s | 0,97 | 2,01 | 2,83 | 0,95 | - | |
| 4 | Noise $L_{eq}$ | dB | 73 | 69 | 65 | 44 | | 70 |
| 5 | Noise $L_{max}$ | dB | 66 | 60 | 62 | 58 | | 70 |
| 6 | Noise $L_{min}$ | dB | 48 | 77 | 71 | 39 | | 70 |
| 7 | Suspended dust | $\mu g/m^3$ | 119 | 202 | 196 | 170 | 300 | |
| 8 | Dust PM 10 | $\mu g/m^3$ | 101 | 123 | 117 | 96 | - | |
| 9 | CO | $\mu g/m^3$ | 1.645 | 2.115 | 1.993 | 2.300 | 30.000 | |
| 10 | $SO_2$ | $\mu g/m^3$ | 68,95 | 71,22 | 120,76 | 31 | 350 | |
| 11 | $NO_2$ | $\mu g/m^3$ | 53,67 | 56,27 | 68,91 | 28 | 200 | |
| 12 | $NH_3$ | $\mu g/m^3$ | 73 | 85,8 | 105,7 | 95 | 200* | |

| No | Criteria | Unit | Result | | | | QCVN 05:2009/BT NMT | QCVN 26:2010/BT NMT |
|---|---|---|---|---|---|---|---|---|
| | | | BGK5 | BGK6 | BGK7 | BGK8 | | |
| 1 | Temperature | $^oC$ | 15,3 | 14,6 | 15,1 | 13,9 | - | |
| 2 | Moisture | % | 71,6 | 68,3 | 73,5 | 70,4 | - | |
| 3 | Wind velocity | m/s | 2,11 | 1,98 | 2,21 | 1,57 | - | |
| 4 | Noise $L_{eq}$ | dB | 58 | 61 | 65 | 48 | | 70 |
| 5 | Noise $L_m$ | dB | 62 | 71 | 75 | 54 | | 70 |
| 6 | T Noise $L_m$ | dB | 27 | 40 | 28 | 43 | | 70 |
| 7 | Total dust | $\mu g/m^3$ | 135 | 166 | 157 | 182 | 300 | |
| 8 | Dust PM 10 | $\mu g/m^3$ | 79 | 82 | 94 | 103 | - | |
| 9 | CO | $\mu g/m^3$ | 3.100 | 4.200 | 3.800 | 2.600 | 30.000 | |
| 10 | $SO_2$ | $\mu g/m^3$ | 64 | 76 | 103 | 26 | 350 | |
| 11 | $NO_2$ | $\mu g/m^3$ | 79 | 88 | 93 | 25 | 200 | |
| 12 | $NH_3$ | $\mu g/m^3$ | 106 | 120 | 90 | 89 | 200* | |

| No | Criteria | Unit | Result | | QCVN 05:2009/ BTNMT | QCVN 26:2010/ BTNMT |
|---|---|---|---|---|---|---|
| | | | BGK9 | BGK10 | | |
| 1 | Temperature | $^oC$ | 15 | 14,4 | - | |
| 2 | Moisture | % | 69 | 66,4 | - | |
| 3 | Wind velocity | m/s | 2,6 | 0,92 | - | |
| 4 | Noise $L_{eq}$ | dB | 50 | 45 | | 70 |
| 5 | Noise $L_{max}$ | dB | 74 | 65 | | 70 |
| 6 | Noise $L_{min}$ | dB | 38 | 41 | | 70 |
| 7 | Total dust | $\mu g/m^3$ | 203 | 142 | 300 | |
| 8 | Dust PM 10 | $\mu g/m^3$ | 83 | 86 | - | |
| 9 | CO | $\mu g/m^3$ | 2.700 | 3.300 | 30.000 | |
| 10 | $SO_2$ | $\mu g/m^3$ | 87 | 94 | 350 | |
| 11 | $NO_2$ | $\mu g/m^3$ | 57 | 37 | 200 | |
| 12 | $NH_3$ | $\mu g/m^3$ | 96 | 83 | 200* | |

**Note**:

- QCVN 05:2009/BTNMT: National technical norm on the average quality of the surrounding air environment in 1 hour;
- (*) QCVN 06:2009/BTNMT: National technical norm on some toxic substances in the surrounding air;
- QCVN 26:2010/BTNMT: National technical norm on noise;
- (-): Value not to be regulated;

**Observation:**

76. From the above air environment result, we can see that the analyzed criteria are under the allowed norms. Therefore, the air environment in the project area during the time of the survey respects the norm.

v. Current status of the water environment

77. Based on the geographical features, structures, characteristics of hydrographic network (river, lake, channel) in the project area, positions of sampling, measuring the current status of the water environment is shown as below:

- Surface water environment

a) *Samples location*

**Table 5. Sampling points of surface water environment**

| No | Code | Geographic coordinate | | Position description |
|---|---|---|---|---|
| | | Longitude | Latitude | |
| 1 | BGNM1 | $106^0$17'24'' | $21^0$15'03" | Thuong river, raw water pumping station in Song Mai, Bac Giang city |
| 2 | BGNM2 | $106^0$17'08'' | $21^0$15'12" | Thuong river, Sat bridge, Bac Giang city |
| 3 | BGNM3 | $106^0$17'16'' | $21^0$15'09" | Da Mai canal, Da Mai commune |
| 4 | BGNM4 | $106^0$17'21'' | $21^0$15'10" | Lim Xuyen bridge, Road no. 398, Song Khe commune |
| 5 | BGNM5 | $106^0$17'27'' | $21^0$15'19" | Water channel, Xuong Giang paper factory and Bac Giang Store |
| 6 | BGNM6 | $106^0$17'09'' | $21^0$15'14" | Park lake the city centre, Nghia Long road, Tran Phu ward |
| 7 | BGNM7 | $106^0$17'20'' | $21^0$15'18" | The lake opposite Bac Giang bus station, Xuong Giang road, Bac Giang city |

b) *Measuring, analyzing parameters*

**Table 6. Measuring, analyzing parameters of water quality**

| No | Parameter | Standards to be applied |
|---|---|---|
| 1 | pH; temperature; Turbidity; TDS; EC | **QCVN 08:2008/BTNMT** National technical norm on quality of surface water |
| 2 | SS; COD; $BOD_5$; DO; $NH_4^+$; $NO_3^-$,$NO_2^-$ total P; Total N; $Cl^-$ | |
| 3 | Fe; Pb; Cd | |
| 4 | Oil; total Coliform | |

c) *Sampling method*

- TCVN 5992:1995 (ISO 5667-2: 1991) – Water quality – sampling. Technical instructions to sampling;
- TCVN 6663-3:2008 - Water quality – sampling: instructions to storing and treating samples;
- TCVN 5994:1995 - Water quality – sampling: instructions to take samples at natural and artificial lake, pond;
- TCVN 6663-6:2008 - Water quality – sampling: instructions to take samples at river and stream.

d) *Measuring, analyzing results*

**Table 7. Results of surface water environment**

| No | Parameters | Unit | Measuring, analyzing result | | | QCVN 08:2008/BTNMT Column B1 |
|---|---|---|---|---|---|---|
| | | | BGNM1 | BGNM2 | BGNM3 | |
| 1 | pH | - | 7,8 | 7,24 | 7,02 | **5,5-9** |
| 2 | Temperature | $^0$C | 25,4 | 29,8 | 25,2 | **-** |
| 3 | Turbidity | NTU | 61 | 42 | 59 | **-** |
| 4 | Electric Conductivity EC | µS/cm | 765 | 744 | 861 | **-** |
| 5 | TDS | - | 411 | 367 | 323 | **-** |
| 6 | $BOD_5$ (20$^0$C) | mg/l | 12 | 8 | 11 | **15** |
| 7 | COD | mg/l | 22 | 19 | 28 | **30** |
| 8 | DO | mg/l | 0,75 | 4,02 | 4,6 | **≥4** |
| 9 | SS | mg/l | 19 | 34 | 32 | **50** |
| 10 | $NH_4^+$ | mg/l | 0,058 | 3,077 | 0,35 | **0,5** |
| 11 | $NO_3^-$ | mg/l | 0,23 | 1,126 | 0,006 | **10** |
| 12 | $NO_2^-$ | mg/l | 0,321 | 0,155 | 0,002 | **0,04** |
| 13 | Total Nitrogen | mg/l | 6,55 | 6,67 | 5,89 | **-** |
| 14 | Total Phosphorus | mg/l | 4,73 | 4,84 | 2,63 | **-** |
| 15 | Chlorine | mg/l | 61 | 14,181 | 17 | **600** |
| 16 | Fe | mg/l | 0,42 | 0,5 | 0,422 | **1,5** |
| 17 | Pb | mg/l | 0,011 | 0,094 | <0,0001 | **0,05** |
| 18 | Cd | mg/l | ND | ND | 0,0001 | **0,01** |
| 19 | Total Coliform | MPN/100ml | 4.750 | 4.530 | 1.500 | **7.500** |
| 20 | Oil | mg/l | 0,021 | 0,028 | 0,171 | **0,1** |

ND: Not Detected

| No | Parameters | Unit | Measuring, analyzing result | | | | QCVN 08:2008/BTNMT Column B1 |
|---|---|---|---|---|---|---|---|
| | | | BGNM4 | BGNM5 | BGNM6 | BGNM7 | |
| 1 | pH | - | 6,85 | 6,38 | 6,78 | 7,23 | **5,5-9** |
| 2 | Temperature | $^0$C | 25,6 | 23,9 | 14,3 | 31,6 | **-** |
| 3 | Turbidity | NTU | 88 | 60 | 36 | 55 | **-** |
| 4 | Electric Conductivity EC | µS/cm | 721 | 605 | 613 | 799 | **-** |
| 5 | TDS | - | 401 | 389 | 251 | 334 | **-** |
| 6 | $BOD_5$ (20$^0$C) | mg/l | 31 | 28 | 11 | 35 | **15** |
| 7 | COD | mg/l | 61 | 65 | 25 | 49 | **30** |
| 8 | DO | mg/l | 5,02 | 4,89 | 5,62 | 4,55 | **≥4** |
| 9 | SS | mg/l | 59 | 61 | 44 | 54 | **50** |
| 10 | $NH_4^+$ | mg/l | 0,7 | 1,1 | 0,47 | 0,9 | **0,5** |
| 11 | $NO_3^-$ | mg/l | 0,973 | 0,316 | 0,157 | 0,234 | **10** |
| 12 | $NO_2^-$ | mg/l | 0,19 | 0,5 | 0,005 | 0,311 | **0,04** |
| 13 | Total Nitrogen | mg/l | 6,35 | 7,26 | 1,71 | 6,01 | **-** |
| 14 | Total Phosphorus | mg/l | 3,59 | 4,27 | 0,85 | 3,36 | **-** |
| 15 | Chlorine | mg/l | 58 | 23 | 10 | 34 | **600** |
| 16 | Fe | mg/l | 0,65 | 0,387 | 0,393 | 0,518 | **1,5** |
| 17 | Pb | mg/l | <0,0001 | <0,0001 | 0,0028 | <0,0001 | **0,05** |
| 18 | Cd | mg/l | 0,004 | 0,003 | 0,0013 | 0,006 | **0,01** |
| 19 | Total Coliform | MPN/100ml | 2.100 | 1.300 | 930 | 1.450 | **7.500** |
| 20 | Oil | mg/l | 0,087 | 0,05 | 0,092 | 0,07 | **0,1** |

**Note:** QCVN 08:2008/BTNMT: National technical norm on quality of surface water (Column B1 is used for irrigation).

**Observation:**

78. The above tables show that, in general, environmental parameters in water exceed standards for domestic purposes (QCVN 08:2008/BTNMT column A1). The criteria pollutants mainly organic ingredients exist suspended in water are typical targets: COD, BOD5, SS, NH4, NO2, and grease… beyond the allowed limits. The Water should be treated before being used for domestic purposes.

- Underground water environment

a) *Sample locations*

**Table 8. Sampling points of underground water environment**

| No | Code | Geographic coordinate | | Position description |
|---|---|---|---|---|
| | | Longitude | Latitude | |
| 1 | BGNN1 | $106^0$17'20'' | $21^0$15'18'' | At the well of Mr. Hoang Van Thinh, Ngo Quyen ward |
| 2 | BGNN2 | $106^0$17'23'' | $21^0$15'12'' | At the well of Mrs. Vu Thi Phuong, Tan My commune |
| 3 | BGNN3 | $106^0$17'26'' | $21^0$15'22'' | At the well of Mr. Le Duc Thuan, Dong Son commune |
| 4 | BGNN4 | $106^0$17'12'' | $21^0$15'17'' | At the well of Mr. Quach Van Han, Song Khe commune |
| 5 | BGNN5 | $106^0$17'24'' | $21^0$15'19'' | At the well of Mr. Bui Van Hoang, Da Mai commune |

b) *Measuring, analyzing parameters*

**Table 9. Measuring, analyzing parameters of water quality**

| No | Parameters | Standards to be applied |
|---|---|---|
| 1 | pH; Hardness; TSS; $Cl^-$; $F^-$; $NO_2^-$; $NO_3^-$; $SO_4^-$ ;$CN^-$; phenol | **QCVN 09:2008/BTNMT** National technical norm on quality of underground water |
| 2 | As; Cd; Pb; $Cr^{6+}$; Cu; Zn; Mn; Hg; Fe; Se; | |
| 3 | Coliform | |

c) *Sampling method*

- TCVN 5992:1995 (ISO 5667-2: 1991) – Water quality – sampling. Technical instructions to sampling;
- TCVN 6663-3:2008 - Water quality – sampling: instructions to storing and treating samples;
- TCVN 6663-11:2011 - Water quality – sampling - Part 11: Instructions to take samples of underground water;

d) *Measuring, analyzing result*

**Table 10. Result of underground water quality**

| No | Parameters | Unit | Result | | | QCVN 09:2008/BTNMT |
|---|---|---|---|---|---|---|
| | | | BGNN1 | BGNN2 | BGNM3 | |
| 1 | pH | - | 6,75 | 7,2 | 6,9 | **5,5 - 8** |
| 2 | Hardness $CaCO_3$ | mg/l | 109 | 302 | 120 | **500** |
| 3 | Total solid | mg/l | 360 | 609 | 230 | **1.500** |
| 4 | Chlorine (Cl-) | mg/l | 40,77 | 101 | 14 | **250** |
| 5 | Fluor (F-) | mg/l | 0,23 | 0,46 | 0,12 | **1,0** |
| 6 | Nitrite $NO^-_2$ | mg/l | 0,0015 | 0,019 | 0,002 | **-** |
| 7 | Nitrate $NO^-_3$ | mg/l | 2,551 | 1,65 | 0,172 | **15** |
| 8 | Sulfate ($SO_4^{2-}$) | mg/l | 40.7 | 65.34 | 22.58 | **400** |
| 9 | Cyanide (CN-) | mg/l | ND | <0,005 | <0,005 | **0,01** |

| No | Parameters | Unit | Result | | | QCVN 09:2008/BTNMT |
|---|---|---|---|---|---|---|
| | | | BGNN1 | BGNN2 | BGNM3 | |
| 10 | Phenol | mg/l | <0,001 | <0,001 | <0,001 | **0,001** |
| 11 | Arsenic (As) | mg/l | ND | 0,0025 | 0,0017 | **0,05** |
| 12 | Cadmium (Cd) | mg/l | ND | 0,003 | 0,0002 | **0,005** |
| 13 | Lead (Pb) | mg/l | ND | 0,008 | 0,0012 | **0,01** |
| 14 | Chrome VI ($Cr^{6+}$) | mg/l | 0,026 | 0,045 | 0,012 | **0,05** |
| 15 | Bronze (Cu) | mg/l | 0,035 | <0,001 | <0,001 | **1,0** |
| 16 | Zinc (Zn) | mg/l | 0,014 | <0,001 | <0,001 | **3,0** |
| 17 | Manganese (Mn) | mg/l | 0,208 | 0,018 | 0,005 | **0,5** |
| 18 | Mercury (Hg) | mg/l | 0,021 | <0,001 | <0,001 | **0,001** |
| 19 | Iron (Fe) | mg/l | 0,656 | 3,306 | 2,297 | **5** |
| 20 | Selenium (Se) | mg/l | 0,001 | 0,008 | 0,001 | **0,01** |
| 21 | Coliform | MPN/100ml | 0 | 0 | 0 | **3** |

| No | Parameters | Unit | Result | | QCVN 09:2008/BTNMT |
|---|---|---|---|---|---|
| | | | BGNN4 | BGNN5 | |
| 1 | pH | - | 7,3 | 6,63 | **5,5 - 8** |
| 2 | Hardness $CaCO_3$ | mg/l | 130 | 285 | **500** |
| 3 | Total solid | mg/l | 316 | 449 | **1.500** |
| 4 | Chlorine (Cl-) | mg/l | 51 | 169 | **250** |
| 5 | Fluor (F-) | mg/l | 0,08 | 0,87 | **1,0** |
| 6 | Nitrite $NO^-_2$ | mg/l | 0,019 | 0,017 | **-** |
| 7 | Nitrate $NO^-_3$ | mg/l | 0,03 | 2,34 | **15** |
| 8 | Sulfate ($SO_4^{2-}$) | mg/l | 43.02 | 203 | **400** |
| 9 | Cyanide (CN-) | mg/l | <0,005 | <0,005 | **0,01** |
| 10 | Phenol | mg/l | <0,001 | <0,001 | **0,001** |
| 11 | Arsenic (As) | mg/l | 0,0016 | 0,001 | **0,05** |
| 12 | Cadmium (Cd) | mg/l | 0,0007 | 0,0009 | **0,005** |
| 13 | Lead (Pb) | mg/l | <0,0001 | 0,0076 | **0,01** |
| 14 | Chrome VI ($Cr^{6+}$) | mg/l | 0,024 | 0,039 | **0,05** |
| 15 | Bronze (Cu) | mg/l | 0,01 | 0,28 | **1,0** |
| 16 | Zinc (Zn) | mg/l | 0,029 | <0,001 | **3,0** |
| 17 | Manganese (Mn) | mg/l | 0,009 | 0,077 | **0,5** |
| 18 | Mercury (Hg) | mg/l | <0,001 | <0,001 | **0,001** |
| 19 | Iron (Fe) | mg/l | 2,397 | 3,699 | **5** |
| 20 | Selenium (Se) | mg/l | 0,002 | 0,008 | **0,01** |
| 21 | Coliform | MPN/100ml | 0 | 0 | **3** |

**Note:**

- QCVN 08:2008/BTNMT: National technical norm on quality of surface water (Column B1 is used for irrigation purpose);
- QCVN 09:2008/BTNMT: National technical norm on quality of underground water;
- (-): value not to be regulated.

**Observation:**

79. The above analysis result reflects quite clearly about the quality of underground water in the project area. All criteria of the underground water meet the allowed standards (QCVN 09:2008/BTNMT). Therefore, the quality of underground water is acceptable and pollution levels are low.

vi. Current status of soil, sediment environment

80. Based on the geographical features, structures in the project area, field technicians took samples of soil, sediment environment as follows:

a) *Sample locations*

**Table 11. Sampling points of soil environment**

| No | Code | Geographic coordinate | | Position description |
|---|---|---|---|---|
| | | Longitude | Latitude | |
| 1 | BGĐ1 | 106$^0$17'09'' | 21$^0$15'17'' | Soil sample at location of raw water pumping station and pre-sedimentation tank, Song Mai commune |
| 2 | BGĐ2 | 106$^0$17'21'' | 21$^0$15'14'' | Soil sample at location of treatment plant, Song Mai commune |
| 3 | BGTT1 | 106$^0$17'26'' | 21$^0$15'13'' | Sediment sample at location of, raw water pumping station, Song Mai commune |
| 4 | BGTT2 | 106$^0$17'19'' | 21$^0$15'09'' | Sediment sample of Da Mai canal, Song Mai commune |
| 5 | BGTT3 | 106$^0$17'17'' | 21015'21'' | Sediment sample at the lake in the city centre, Nghia Long road, Tran Phu ward |

b) *Measuring, analyzing parameters*

**Table 12. Measuring, analyzing parameters**

| No | Parameter | Standards to be applied |
|---|---|---|
| 1 | Pb; Cd; As; Zn; total N; total P | **QCVN 03:2008/BTNMT**: National technical norm on the allowed limit of heavy metal in soil. |
| 2 | Remaining amount of pesticides | |

c) *Sampling method*

81. Samples were taken to identify heavy metal criteria stipulated in the following standards: TCVN 5297:1995 – Soil quality - sampling: Specification; TCVN 7538-2:2005 - Soil quality - sampling - Part 2: Technical instructions to sampling.

d) *Measuring, analyzing result*

**Table 13. Result of soil quality in the project area**

| No | Parameter | Unit | RESULT | | | | | QCVN 03:2008/BTNMT |
|---|---|---|---|---|---|---|---|---|
| | | | BGĐ1 | BGTT1 | BGĐ2 | BGTT2 | BGTT3 | |
| 1 | Cu | mg/kg | 46.827 | 37.308 | 36.719 | 29.081 | 41.299 | **50** |
| 2 | Pb | mg/kg | 59.166 | 56.49 | 43.789 | 49.2 | 66.27 | **70** |
| 3 | As | mg/kg | 8.779 | 8.808 | 7.913 | 9.001 | 10.911 | **12** |
| 4 | Zn | mg/kg | 88.085 | 91.161 | 86.512 | 106.222 | 123.783 | **200** |
| 5 | Total N | % | 0,82 | 0,67 | 0,79 | 1,34 | 1,15 | **-** |
| 6 | Total P | % | 0,16 | 0,19 | 0,22 | 1,29 | 1,46 | **-** |
| 7 | Remaining levels of pesticide | µg/kg | ND | ND | ND | ND | ND | **-** |

**Note:**

- QCVN 03:2008/BTNMT: National technical norm on the allowed limit of heavy metal in soil;
- (-): Value not to be regulated;
- ND: Not Detected.

**Observation:**

82. Analysis result shows that soil and sediment environment in the project area, in general, is acceptable.

## B. Ecology environment

83. According to the land statistics in 2010 of afforestation yards, the forest area of Bac Giang is 140.192 ha (not counting 34.000 ha of fruit tree in the agricultural area). This area is divided between forest protected areas t 20.492 ha, occupying 14, 62% of the province's total forest area; special-use forest area is 13.799 ha, occupying 9, 82% and the productive forest area is 105.849 ha, occupying 75, 56% of the total forest surfaces.

84. The flora in the forests is rather diverse and the main botanical region consists of the Southern China & Northern Vietnam that lay under tropical and subtropical forest regions. There are 276 types of timbers, 452 types of medicinal trees belonging to 53 herb families, liana, etc. in Bac Giang province. Forest resources in Bac Giang are quite plentiful with many precious kinds with high economic value such as teakwood, bassia, bamboo pine, bead-tree, green ironwood, etc.

85. Fauna in the Bac Giang province forests is quite abundant. According to the statistics in the province, there are about 226 species in which there are many precious animals such as langur, pangolin, wolf, Tibetan bear, panther, chamois, black – white flying squirrel, pig-tail monkey, golden monkey.

86. A freshwater environment defines the aquatic ecosystem in this area. The types of freshwater fauna found in the area are mainly shrimps, crab fish, a variety of freshwater fish and frogs.

87. The terrestrial ecosystems have been modified a lot over the years in the region: The flora system is distributed mainly in the surroundings of the food crops. In the project area, there are no rare animals and plants identified in the Red Book, while the provincial fauna is diverse; the regional fauna is poor consisting mainly of insects and birds including the stork.

88. The ecology environment of the main components are described below:

- Raw Water Pumping station, Pre-sedimentation basin & Raw Water Pipeline

  The raw water PS is located in Song Mai commune (Bac Giang City) along the Thuong River (see photos p 11). The area is mainly under agriculture (rice fields and vegetables). The banks of the Thuong River are unused land covered by grass and shrubs with some trees. The pre-sedimentation basin (see photo p 12) is located on agriculture land also on Song Mai commune. The raw water pipeline will cross mainly agriculture land.

- Water Treatment Plant

  The new WTP is located in Phuc Ha village, Song Mai commune. The area is under forest cover (see photos p 12). The forest is not a natural forest. It is mainly planted by eucalyptus (E. camaldulensis). Eucalyptuses are growing in dry and poor soil. Eucalyptus is used for pulpwood or timber. No rare or endangered fauna and flora is present in the WTP area.

- Distribution area

  The distribution area is located in existing urban areas of Bac Giang City. The area is fully urbanized.

## C. Socio-economic conditions

### a. Socio-economic conditions of Tan Tien commune

vii. Economic conditions

89. Agricultural growth: In the first six months of 2011, the total area of rice field in the whole commune was 387,2 ha, in reduction of 0,1 ha compared to 2010., The average productivity is 58 quintal/ha showing an increase of 3 quintal/ha compared to 2010. The total food yield for 2011 was 2.245 tons, increasing by 129 tons compared to 2010.

90. Breeding, veterinary, aquatic products: In the first six months, the commune people's committee focused on livestock disease prevention and instructed to establishment of a preventive injection for poultry. Also, 850 pigs, 215 buffaloes and cows, 158 dogs, 28,000 water birds were injected. Ratio of preventive injection is low. All aquaculture productions kept stable at 62 ha with a production rate of 3, 5- 4 tons/ha.

91. Irrigation: By the beginning of the year 2011, the commune people's committee developed a plan for dredging irrigation channels, cleaning flows to ensure serving for production. Ong Lua, Ben Thanh pumping stations were dredged at cost of 15 M dong. The quantity of soil embankment for reservation as assigned by the DPC was completed also.

92. Mining: Regarding mineral resources of Bac Giang, 63 mines with 15 different types of mineral, including: coal, metal, industrial mineral, construction material. Besides, the province also has coal mines in Yen The, Luc Ngan, Son Dong with the following types of coal: anthracite, thin coal, muddy coal, etc.

viii. Cultural, social conditions

- Education and training

93. Lower high school has 16 classes with 535 students. In 2009-2010, 136 out of 142 (96%) students attending lower high school graduated.

94. Primary school has 23 classes with 579 pupils. In 2009-2010, 177 out of 179 pupils (99.8%) passed the lower high school entrance exam.

95. Semi-public kinder garden has 14 classes with 345 children in total.

### b. Socio-economic conditions in Dong Son commune

i. Economic conditions

96. Planting: the total cultivated area in the first 6 months of the year, the average yield is estimated at 59.2 kg / ha, in which:

- Spring rice crop: Area 324 ha, yields of 59.2 kg / ha, output of 1,982 tons.
- Vegetables of all types: in the total area of 15 ha, nuts, onions and some other vegetables are mainly grown,

- Livestock: Animal Health has taken the 4-phase vaccination with the results as follows: the number of pigs have been injected periodically is 2,557 reached at 50.12%; buffaloes and cows have 175 accounting for 41.17%; dogs have 457 about 37.06%, and poultry is 4975 accounting for 48.17%.
- Forestry: The total number of 120 hectares is forest land, including 24 hectares of fruit trees. Completion of the planting plan in 2009 was 6.2 hectares, making new fire blocking trail of 1.5 km, strengthening the forest protection groups, communicating and encouraging people to implement good forestry practices for the year four and five with 15 ha and implementing forest fire prevention.

ii. C.3.2.2. Social conditions

97. For health, family population and children

- For health: The health care serving the people and treatment at the communal health centers achieved 3,700 cases accounting for 90% assigned plan.
- For Population, Family and Children: The total population of the commune is 9,154; the natural population growth is at 0.44%. Taking care of children's health is properly concerned; there are 250 children who are provided with free medical care cards.

98. For policy, and social welfares

- Continue to care the family within the policy, the objects served for the revolution. It ensures monthly the care for 173 subjects.
- Document specific instructions the elder people at the age of 85 or older to be entitled to state subsidies, the low income HHs and lonely elderly people.
- Working to create jobs for people going abroad continue receiving attention in the first 6 months of 2010; the commune has 12 labor migrants working abroad and issued and instructed the procedures for the related people according to state regulations.

**c. Socio-economic conditions in Song Khe commune**

iii. Economic conditions

- Agricultural Production

99. Cultivation: The entire area for spring rice in the commune is 230 ha = 100% of the plan. In which, the area of 41 ha is transplanted hybrid rice accounting for 18% of the commercial transplanted paddy area was 35 hectares, accounting for 15%.

100. The area of rice is well-developed, the average yield is reached at 57.33 kg / ha equivalent to 206 kg / acre, the output reaches 1318 tons, an increase of 55 tons over the same period in 2009.

101. Livestock Veterinary: the herd of cattle in the commune as 240 heads, of which 60% crossbred sin cows. The total number of pigs is 1,157, which accounted for 40% of the total meat production and the poultry herd includes 10,795. The vaccination in the first 6 months of 2010: the number of pigs injected the cholera dose is 700, similarly 60%; 130 cows and buffaloes were vaccinated accounting for 54%; the number of cats and dogs vaccinated was 250 doses of rabies reaching 18%, poultry vaccinated in the 2nd period was 10,000, equivalent to 98%.

- Industrial Production

102. Handicraft industries: the commune has 67 manufacturing handicraft facilities, 56 commerce and services trading enterprise, 19 transport vehicles, and the estimated income in the first 6 months is about ~ 5 billion dong.

iv. Social conditions

- Education

**Secondary School:**

103. End year sorting: Excellent level was reached 123 students accounted for 55.5% up by 5.9%; Good level is quite 96 at 38.1% with 0.61% decrease; Average level is 29 students accounted for 6.4% down by 5, 29% (compared with the same period of school year 2008 - 2009)

**Elementary School**:

104. Year-end learning outcomes and cultural classification: 67 students achieved excellent level equivalent to 26.9% up by 7.8%; the good level has 119 student accounting for 48.8% increased by 2.6%; Average level includes 72 students accounted for 28.9% down by 2.1%; the school 01 students with bad results, similarly 0.4% decreased by 0.7% (compared with the same period of school year 2008-2009)

**Kindergarten:**

105. The total number of teachers is 14, opening 7 classes in the year and mobilizing 141 students to go to the school, which reached 100% of the plan.

- Population, Family and Children

106. Always ensure the direct medical schedule for people. Implemented the examination and treatment for 2391 visits.

107. Organized the propaganda on birth plan - gender balance between men and women in the community. The total commune's population is 1,370 HHs with 4,560 people.

108. Coordinated strictly with all the levels and industries for propaganda on humanitarian, and charity, giving gifts to the objects on the occasion of lunar New Year with total 660 packages worth of 135.400.000VND. Survey and suggestion to the State was in order to grant three wheelchairs for those in the commune. Implemented the New Year fund campaign for the poor, disabled, orphans, victims of Agent Orange, and so on.

**d. Socio-economic conditions in Tan My commune**

v. Economic conditions

- Agricultural Production

109. Planting: Average food production is estimated at 320 kg / person / year; the crop tree area: 105 ha (achieved 95% of the plan).

110. Livestock: The commune has a total pig population of 42 248 (12.6% increase over the year 2010); poultry, and waterfowl are estimated to have 49,500, up by 8% increase over the 2010; Cows and buffalos have 562 increased by 29.8% compared to the 2010.

111. In 2010, the aquaculture area in the commune has been reduced by a number of HHs to the illegal land dumping for building houses, with the remaining area with the income from fisheries in the commune was estimated at 50-60 million VND / ha.

- Industrial Production

112. The commune has twenty-two companies and four government agencies for land investors with a total capital of 100 billion VND, the businesses have attracted more than 800 employees as local people to work. Total annual income per capita is about 176.5 Billion VND with the average income of 15.7 million / person / year.

vi. Social conditions

113. Social life of the people has gradually improved. 11/11 villages in the commune have the radio system; many villages along the rural roads with street lighting and all the HHs have visual auditory system. The campaign for building cultural family reached 2.236/2.703 HHs accounting for 82.7%

114. For education: In the academic year 2009 - 2010 all three level of schools including kindergarten, elementary and secondary have 56 classes with 1,815 students and 139 staff officers.

115. Health: Having examined and treated for 8,850 visitors 95% of the plan was reached. In-house patient treatment was 186 cases achieving 98% for the plan. Outhouse patient treatment was 766 accounting for 82% for the plan.

116. Population, family and children: the population growth rate was 0.53% on average year, the prevalence of malnutrition was 14.3%.

**e. Socio-economic conditions in Dinh Tri commune**

vii. Economic conditions

117. Agriculture: in the spring crop in 2010 the whole commune planted the entire hectares of 303.6 ha (including 32.45 ha of hybrid rice) reached 99.86% of the plan, reduced by 3.4 ha and equivalent to 98.9% of that of the same period. Rice productivity accounted for an average of 55.16 kg / ha, down by 0.4 kg / ha compared to the planned, down by 1.64 kg / ha and similarly 103.06% of that in the same period. Food production was 1674.8 tonnes, down by 277 tonnes equivalent to 98.4% compared with the plan, increased by 318 tons, similar to 101.9% of that of the same period last year.

118. Livestock: cows and buffaloes = 1,500 reached 100% of the year plan, 25,000 poultry reached 62.5% of the year plan; the number of pigs is 8,537 and reached 71.4% of the year plan.

viii. Social cultural conditions

- For education

119. Kindergarten: The school Year 2009 - 2010 includes 12 class groups: 10 kindergarten classes and two groups of collative kids with a total of 305 children reached 96.8% of the year plan. The quality of the education on virtues-knowledge-body-beauty: 100% satisfactory, of which 85% have excellent and good levels.

120. Total number of students in Elementary school: 718/25 classes achieved 100% as planned.

121. Secondary School: Total number of students in the school year 2009 – 2010 is 669 children with 21 classes achieving 100% target.

- For health

122. Communal health center ensured 24/24h mode. Completed 100% of the expanded injection plan, as well the health care for mothers and children. Clinical results: 4080 visitors reached 51% compared with the year plan.

**f. General socio-economic issues**

i. Unexploded ordnances

123. More than 35 years after the war ended, Vietnam is still contaminated with hundreds of thousands of tons of UXOs scattered all over the country. During earth work and especially for the raw channel and pipeline excavation corridor, survey for UXOs prior to construction work has to be conducted by a specialized agency.

ii. Cultural, historical and religious chance finds

124. Working in an urban environment also increases greatly the risk of digging through unrevealed and unknown potential historic and/or religious artefact or remains. But, the sites foreseen for the trenches and the construction site have, for most of them, been worked on before or are in low potential value for historical finds. Nonetheless, chance find of unknown

potential historic and/or religious artefact or remains could still be possible because the depth of the work to be done in previously unworked soil. Therefore, if it does happen, work should be stopped at first sight of the find and specialist should be contacted before work could be restarted.

iii. Competition for water resource

125. Flow rate of Thuong river section passing Bac Giang town can ensure exploitation of water for domestic use with total capacity upon project's completion of 90.000 m3/day (by 2035). The exploitation of water does not make any negative impact on flow rate, 1,041 $m^3$ per second in this 80 m wide river nor raise any conflicts on water use at upstream and downstream of Thuong River.

# V. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

## A. Area of influence of the Project

1. The area of influence of the project includes the water intake area including, the downstream user, the area along the raw water pipe and around the WTP and the area served by the new pipe network. It includes the following 9 communes of Bac Giang City: Song Mai, Tan Tien, Dong Son, Song Khe, Tan My, Dinh Tri, Que Nham, Da Mai and Xuong Giang communes.

## B. Design and Location Consideration

2. Location of the WTP has been chosen due to its low impacts on human activities (forest on public land planted with eucalyptus). The area is also not subject to flooding and the risk of seismicity is low.

3. Climate change impacts will be considered during detailed design. If necessary, proposed adaptation measures will be identified and included in the detailed design (i.e. increase of road elevation, increase of drainage pipe diameter to accommodate more extreme flooding; etc.).

## C. Potential environmental impacts

### g. Concerned issues regarding the selection of the locations

126. The activities during the preparation for the project's construction consist of counting, compensation for site clearance, land acquisition and preparing ancillary work items such as road for construction, temporary houses, material storing houses, etc. The main impacts in this stage include: impacts to production activities, daily life of the residents because of acquiring agricultural land, forestry land, housing land; impacts due to dust, toxic gas and solid waste from the transportation. After the project's completion, the project owner will reinstate the site for the treatment plant.

i. <u>The project areas need to make compensation for site clearance</u>

127. The construction of water supply system requires the site clearance for the following positions:

- Area of construction of water channel, pre-sedimentation pond and raw water pumping station;
- Area of construction of raw water pipeline;
- Area of construction of treatment plant;
- Area of construction of transmission, distribution and service pipelines;

128. However, for the project on construction of water treatment plant no. 2 in Bac Giang city, it is not requested to remove houses and to take into account resettlement plan. On the other hand, distribution pipeline is constructed along traffic routes, path at edge of rice field, alleys. Thus, during the construction, there is no need to permanently acquire agricultural land; furthermore, the pipeline construction will only affect agricultural land temporarily. In the project area, there is no effect on natural conservation areas, temples, pagodas, or other sensitive places.

ii. Use demand of the project

129. The total area of permanently acquired land to implement the project is public land, hilly land for growing trees; besides, the area is under the management of Bac Giang PPC. Thus, the compensation for site clearance is quite convenient. Furthermore, during the construction, some areas need to be temporarily acquired (in short time) to serve for trench excavation, construction site, etc. The area of acquired land (both temporarily and permanently) is shown below:

- Permanent land acquisition:

+ For construction of water channel, sedimentation pond, raw water pumping station: 4,23ha;

+ For construction of treatment plant: 2, 4 ha;

+ Total area of permanently acquired land**:** 6,63ha;

Area of temporarily acquired land will be confirmed after detailed design.

iii. Unexploded Ordnance

130. Since excavation related infrastructure development is one of the main causes of the sudden explosion of UXO in Vietnam, and habits of pipe installation roadwork is to put them close to densely populated areas, the need for a survey for the detection of UXO before the excavation take place is highly important. If such explosives are detected and verified, the demining work would need to be made, and be subject to the procedures established by the competent bodies, before any civil work could be performed. A budget for the pre-construction survey could not be provided in the environmental management plan since analysis of the site need to be made by the military experts.

## h. IMPACTS BY INCIDENTS, AND RISKS

i. Impacts due to the risks and incidents in the construction phase

Explosion Incidents

131. ***Fire incidents that may occur in the construction phase of works due to:***

- The temporary fuel storages for machinery, technical equipment during construction (paint, gasoline, or diesel oil) are one of the possible sources of ignition. When incidents occur, they can cause serious damage to human, material and surroundings;
- Temporary power supply system for machinery, and construction equipment may cause convulsions, shock, fire, explosion, and so on causing huge economic losses, even labor accidents for operators;
- The use of heating equipment in construction (soldering, heating, for examples) can cause fires, burns or labor accidents without timely awareness and preventive measures;
- The habits of careless use of fire among workers and staffs during construction (smoking, or cooking) could cause a fire, causing very serious consequences for people and property;

132. In general, fire incidents rarely occur in the construction process. However, if an incident occurs, it will cause great impact on people, property and environment sectors. Therefore, it is required to comply strictly with safety regulations for workers and works.

Incidents of flooding, landslides caused by abnormal torrential rains

133. During the construction process, excavation, trench digging for installing water distribution piping, or using pumps to suck and conduct construction will likely cause collapses. On the other hand, extraordinary floods and rains during the construction period are possible to cause the unusual incidents and accidents: breaking of protection dykes, local flooding, rapid water rise affecting the safety of workers and machinery on construction sites, and causing electrical fires, damage to construction equipment, or prolonged construction time, which all may affect project implementation progress and economic damage.

Incidents of traffic accidents and occupational accident

- Traffic accidents

134. Due to the relatively heavy load of vehicle operation on construction site, on the other hand the project construction area near the new and old highways no.1A, it is more likely for incidents of traffic accidents to occur without good management methods.

- Occupational accidents

135. Overall, occupational incidents or accidents may occur unexpectedly in many situations during the construction phase of the project. Construction workers are subject to the risk of occupational accidents in the construction site. It can be caused by objective or subjective causes. Safety insurance issues for construction workers must be taken special consideration and preventive measures by the investor.

Incidents due to chances finds of historical, religious and cultural elements

136. Although the different construction sites do not represent the typical environment for findings of social value two mains impacts are possible due to chance finds. First, there are the delays. The project could be postponed or modified in some areas if a find of social value is discovered. Work could also be postponed during unfavourable periods (social events, unfavourable meteorological period, and delay for subsequent phase of the project). Second, more positive, the digging of the trenches could lead to discovery of significant elements of historical, cultural and social value for the people of Vietnam. Either way, from buildings to unsuspected burial sites, all work will be stop and create a lag in the work calendar.

ii. Impacts due to the risks and incidents in the operation phase

During the operational phase 1 of water treatment plant no. 2 the following risks may occur:

Explosion Incident

137. During operation of the plant with large water pump capacity serving the communes in Bac Giang city, it is probable to happen electrical fires, caused by use of electrical equipment overload, short wire or technically improper wiring, due to the negligence of plant and mechanical workshop workers, operators and technicians such as smoking, cooking, wrong machinery operation process can cause up huge consequences for people and property, however, this type of incident can be prevented and minimized.

Chemical leakage and broken pipes

138. **-** A chemical leak may be due to carelessly improper operation of warehouse workers not complying with safety procedures, carelessness during opening the valves, pipelines or chemical leaks that have happened for long time, have not been previously detected.

139. - Incident of breaking in connection pipelines to the treatment works: the cause of the malfunction is caused by the improper installation, construction techniques or using unguaranteed transmission pipelines in terms of the quality requirements on engineering, stability and durability.

Incidents of flooding, and drought

140. Incidents of flooding: During abnormal rains and flooding, rapid water surges cause flooding in the factory area. Without corrective measures, it will cause huge economic damage and affect demand for using clean water among the local people.

141. Drought is the problem to be most concerned. When a drought is prolonged, the Thuong River becomes dry, which will cause a shortage of water for the WTP leading to a lack of clean water used in manufacturing, and daily life, causing major damages to the province's economy and people's lives.

Competition for water resources

142. Considering the extraction site and the communities living upstream and downstream, the removal of 1, 05 $m^3$ per second in the river by 2035 creating a depression of less than 1 cm. The importance of the body of water, although it can even be dry during important drought, will be insignificant. The downstream population could be affected if the sanitary outcome of the project is not properly managed. The waste water treatment plant should be designed or modified to absorb the addition of water from the project.

**i. Technical options for the selection**

- Technical options for WS system

143. Based on the selection of water source for the project, the technical options for WS system will determine the selection of location of intake work – primary pumping station, water treatment plant and transmission and distribution network. On the basis of studying and planning, topographic features, site survey for WS objects, expected locations of intake works, the Consultancy unit proposes two technical options for WS system to analyze, compare and selection the optimal option as follows:

144. Option 1: Constructing water channel from Thuong River to flow into pre-sedimentation tank built in Bui rice field, Dong village, Song Mai commune, Bac Giang city by gravity. At the position of pre-sedimentation pond, constructing a raw water primary pumping station after pre-sedimentation process to pump water to treatment ponds in water treatment plant no. 2 which is located at Bach Dan hill, Phuc Ha village, Song Mai commune, Bac Giang city at level +50.0m. From there, treated water flows to almost all users in the project area and the users who are far away from the water treatment plant (i.e. Dinh Tram, Viet Han, and Song Khe – Noi Hoang industrial zones, urban areas in the South and Northeast of Thuong river).

145. Option 2: Constructing intake work – raw water pumping station on one side of Thuong river, close to irrigation pumping station in Dong village, Song Mai commune to exploit raw water directly from Thuong river. Raw water is directly pumped into sedimentation pond in the treatment plant no. 2 which is expected to be located in the rice field of Luong village, Song Mai commune, Bac Giang city. From there, raw water is treated to meet the standard of domestic water and pumped (by various speed pump) into transmission and distribution network (no need to build booster pumping station).

146. After analyzing pros and cons of the two above options, the project owner selected the first option.

- Option of constructing intake work, raw water pumping station and pre-sedimentation pond

147. The location of intake work – raw water pumping station and pre-sedimentation pond affects the location of treatment plant and alignment as well as length of raw water and clean water transmission pipeline; determines the total investment. Location, convenience in construction, management and operation, construction costs of intake work – raw water pumping station and pre-sedimentation pond were studied, analyzed and compared carefully through the options by the Consultancy unit.

148. Through site surveys, with the introduction to some locations made by technical staff of Bac Giang Water supply and sewerage One member limited liability company in the project area in some communes, Bac Giang city, Bac Giang province, the Consultancy unit proposes two options on the locations of intake work – raw water pumping station as below:

- Option 1: intake work – raw water pumping station and pre-sedimentation pond are located in one area in Dong Bui rice field (outside the dyke), Dong village, Song Mai commune, close to the irrigation pumping station.
- Option 2: intake work – raw water pumping station is located on one side of Thuong river, close to the irrigation pumping station in Dong Bui, Dong village, Song Mai commune.

149. Option 1 has more advantages than option 2; in addition, investment cost is lower since the construction cost of a pumping station to exploit raw water and saving operation and maintenance cost. Thus, the option 1 is selected for further calculation.

- Option of constructing treatment plant

150. After studying the collected documents, and site surveys in Bac Giang city, the project proposes the technology chain for Nam Song Thuong water treatment plant (water treatment plant no. 2 in Bac Giang city) as follows:

- ***Option 1:*** Water channel – Pre-sedimentation pond – primary pumping station – reaction tank – mixing tank – sedimentation tank – filtration tank – reservoir – WS network. The treatment plant is constructed on a hill which is 2, 2 km far from the pre-sedimentation pond.

- ***Option 2:*** Water channel – primary pumping station - Pre-sedimentation pond – raw water pumping station –mixing tank – reaction tank – sedimentation tank – filtration tank – reservoir –pumping station no. 2 – WS network. The treatment plant will be located in rice field which is about 1km far from the primary pumping station. Comparing pros and cons with option1.

**j. Issues/ concern/ impact during the construction**

i. Impacts in terms of pollution

a. Impacts on the air environment

- Impact sources

151. Dust, exhausted gases (CO, NO2, SO2…) directly arisen from the excavation, backfilling, levelling, loading and unloading and gathering construction materials;

152. Dust, exhausted gases (CO, NO2, SO2…) arisen from vehicles transferring soil, and, stone, cement, etc. on roads;

- Objects to be impacted

153. The directly affected objects are workers participating in construction on the site during the construction;

154. Residents living surrounding the project area, particularly people living on two sides of roads which the vehicles run on;

- Forecasting load and impacts

155. Dust from the excavation, backfilling, levelling of construction site, including dust directly arisen from the excavation, backfilling, levelling, loading and unloading and gathering construction materials (primary dust).

**Table 14. Summary of excavation and backfilling quantities**

| No | Work item | Unit | Quantity | |
|---|---|---|---|---|
| | | | Excavation | Backfilling |
| 1 | Raw water channel | m3 | 12.399 | 3.700 |
| 2 | Pre-sedimentation | m3 | 261.536 | 0 |
| 3 | Treatment plant | m3 | 10.416 | 62.496 |
| 4 | Raw water pipeline | m3 | 4.519 | 4.067 |
| 5 | Transmission and distribution pipelines | m3 | 39.725 | 35.752 |
| 6 | Service pipeline | m3 | 31.831 | 28.648 |
| | Total | | 360.426 | 134.663 |

156. Operation of vehicles transferring construction materials and excavator, bulldozer on internal road and other roads in this area often causes dust from surface road (since vehicles running makes dust unsettled) remarkably increases the concentration of dust in the air.

157. Pollution caused by dust and toxic gases depends much on quality of road, density and flow of vehicles, quality and technique of vehicles, and amount of fuel consumed. To estimate the content of dust and toxic gases arising, we can use the method of pollution coefficient prepared by US Environmental Protection Agency (USEPA) and World Health Organization (WHO) as stated below:

**Table 15. Pollution coefficient for trucks on road**

| Pollutant | Pollution coefficient in accordance with truck's load (g/km) | | | | | |
|---|---|---|---|---|---|---|
| | Truck's load < 3,5 tons | | | Truck's load 3,5 ÷ 16 tons | | |
| | In the city | Outside the city | Highway street | In the city | Outside the city | Highway street |
| Dust | 0,2 | 0,15 | 0,3 | 0,9 | 0,9 | 0,9 |
| $SO_2$ | 1,16 S | 0,84 S | 1,3 S | 4,29 S | 4,15 S | 4,15 S |
| $NO_2$ | 0,7 | 0,55 | 1,0 | 1,18 | 1,44 | 1,44 |
| CO | 1,0 | 0,85 | 1,25 | 6,0 | 2,9 | 2,9 |

*(Note: S – proportion of sulphur in petrol, oil: S =500mg/kg according to Vietnamese standard 01:2007/BKHCN)*

158. The project will use roads to transport construction material and soil waste. If we consider the total amount of material and soil waste of the project being transported by the same type of truck with load 7-10 tons and use diesel, and if the estimated density of material is 1m3 = 1,3 tons, we can estimate the total times for truck transporting material and soil waste during the construction.

159. From Table 19, we apply for the truck with load of 3, 5 – 16 tons and running outside the city; consider the average length of each time is 3km; we are able to calculate the total emission of dust and exhaust fumes. From the calculated emission, when applying SUTTON

model, we can identify the average concentration of pollutants at a certain time based on the following formula:

$$C = \frac{0{,}8 \times E \times \left\{ \exp\left[ \frac{-(z+h)^2}{2\sigma_z^{\,2}} \right] + \exp\left[ \frac{-(z-h)^2}{2\sigma_z^{\,2}} \right] \right\}}{\sigma_z \times u} (mg/m^3)$$

160. In which: C: Concentration of pollutant in the air (mg/m$^3$).

E: Emission of pollutant from the exhausting source (mg/s).

z: Height of the calculated point (m).

h: Height of surface road compared to surrounding ground (m).

u: Average wind velocity in the area (m/s).

$\sigma_z$: Diffusion coefficient of pollutant with vertical direction z (m).

161. Diffusion coefficient of pollutant σz with vertical direction (z), atmosphere stability in the studied area is category B, is identified based on the following formula:

$$\sigma_z = 0{,}53.x^{0{,}73} \text{ (m)}$$

162. In which: x is the distance from the calculated point and exhausting source, down away the wind direction. The method for calculation is to divide points' coordinates according to the horizontal axis (x) and vertical axis (z). Selecting the main wind direction that should be Northeast in winter and Southeast in summer. Average wind velocity of the region is 1,7m/s. Atmosphere stability is category B. Using the above parameters for the brief calculation module, we have the calculation result of concentration of pollutants.

163. Emission of pollutants from exhausting source is calculated based on the following formula:

$$E = \frac{f}{L_h} (mg/m.s)$$

164. Where: f is pollution coefficient for the pollutants arising from trucks, Lh is density of trucks within 1h in the project area.

165. According to the summary of excavation and backfilling quantities in Table 18, the amount of transferred construction soil in this stage is 451.491 m3 and material is 20.763 tons. Construction duration is expected to be 24 months. Hence, the average density of trucks within 1h into and out of the project area is 10,95 (truck/h). From Table 19, when applying for the truck with load of 3,5 – 16 ton and running in the road outside the city, average length of each truck in the project area is 3(km/turn), the emission of the pollutants will be: Edust = 8,22 (mg/s); ESO2 = 18,94 (mg/s); ENO2 = 13,14 (mg/s); ECO = 26,47 (mg/s).

166. When applying the above parameters into the brief calculation model, we are able to calculate the concentration of pollutants. Calculation result of concentration of pollutants according to height and distance from the exhausting source to the calculated area is presented in the following table:

**Table 16. Calculation result of concentration of pollutants in the air**

| Calculation parameters | Symbol | Unit | Pollutant | | | |
|---|---|---|---|---|---|---|
| | | | Dust | $SO_2$ | $NO_2$ | CO |
| Emission of pollutant | E | mg/m.s | 8.22 | 18.94 | 13.14 | 26.47 |
| Height of the calculated point | z | m | 1 | | | |
| Height difference with surface road | h | m | 1 | | | |
| Distance towards two sides of road | c | m | 25.0 | | | |
| Average wind velocity in the area | u | m/s | 1.7 | | | |
| Diffusion coefficient of pollutant | $\sigma_z$ | - | 5.556 | | | |
| **Concentration of pollutant** | C | $mg/m^3$ | 1.348 | 3.108 | 2.157 | 4.344 |
| **Vietnamese standard QCVN 05:2009/BTNMT** | **C** | $mg/m^3$ | **0.3** | **0.35** | **0.2** | **30** |

**Table 17. Calculation pollutants' concentration based on the distance**

| No | Distance x (m) | Pollutants' concentration ($mg/m^3$) | | | |
|---|---|---|---|---|---|
| | | **Dust** | **$SO_2$** | **$NO_2$** | **CO** |
| 1 | 25 | 1.348 | 3.108 | 2.157 | 4.344 |
| 2 | 50 | 0.813 | 1.874 | 1.300 | 2.619 |
| 3 | 100 | 0.490 | 1.130 | 0.784 | 1.579 |
| 4 | 200 | 0.295 | 0.681 | 0.473 | 0.952 |
| 5 | 500 | 0.151 | 0.349 | 0.242 | 0.488 |
| **Vietnamese standard QCVN 05:2009/BTNMT** | | **0.3** | **0.35** | **0.2** | **30** |

167. According to the above calculations, the concentration of pollutants in the exhaust of motor vehicles in operation during the project construction at a distance of 25m from the sides of the road has exceeded the allowable limits. The concentration of CO emissions from motor vehicles is relatively high, but still within the regulations 05:2009 / BTNMT.

168. However, at a distance of 500 m, the concentration of dust, SO2, CO is within the permitted limits for the ambient air environment, except for NO2 which has exceeded its own limits as per the standards no. QCVN 05:2009 / BTNMT with 0.042 mg/m3. On the other hand, the project area is located primarily on the agricultural land, away from residential areas, so the concentration of pollutants was calculated as negligible for affecting the health of the people.

b. Impacts on water environment

➢ Sources of impacts

- Rain water flowing through the project area;
- Wastewater of construction workers;
- Industrial waste water: oil from engineering and maintenance process.

➢ Objects affected

- The quality of surface water, groundwater, soil in the project area.
- The aquatic organisms living in the aquatic environment.

- Load forecast and impact assessment

For domestic wastewater:

169. If the estimated average number of construction workers is 60 working for 24 months. The amount of waste water is estimated at 70% of water supply for domestic purposes (120litre/person/day). Therefore, with an average of 60 workers frequently working on site, the amount of wastewater generated each day is expected to be about 5,040 liters / day equivalent to 5.04 m3.

170. Major components of wastewater mainly contain bacteria, organic matters, and suspended solids. According to some documents, the domestic waste water usually includes the following components:

**Table 18. Typical components of domestic waste water**

| Pollutants | Unit | Concentration | | |
|---|---|---|---|---|
| | | Weak | Average | Strong |
| Total solid waste<br>- Dissolved<br>- Suspended | mg/L | 350<br>250<br>100 | 720<br>500<br>220 | 1.200<br>850<br>350 |
| $BOD_5$ | mg/L | 110 | 220 | 400 |
| COD | mg/L | 250 | 350 | 500 |
| TOC (Total organic carbon) | mg/L | 80 | 160 | 290 |
| Total nitrogen (calc. based on N)<br>- Organic<br>- Free Amoniac<br>- Nitrite<br>- Nitrate | mg/L | 20<br>8<br>12<br>0<br>0 | 40<br>15<br>25<br>0<br>0 | 85<br>35<br>50<br>0<br>0 |
| Total phosphate (calc. based on P)<br>- Organic<br>- Inorganic | mg/L | 4<br>1<br>3 | 8<br>3<br>5 | 15<br>5<br>10 |
| Total coliform | No/100 mL | $10^6$ - $10^7$ | $10^7$ - $10^8$ | $10^8$ - $10^9$ |
| Volatile organic carbon | mg/L | <100 | 100÷400 | <400 |

*(Source: Wastewater Engineering Treatment, Disposal, Reuse)*

171. According to the study by the World Health Organization - WHO, loads of several pollutants from waste water (calculated for a person in a day-night) are shown in the table below:

**Table 19. Loads of pollutants from domestic waste water**

(*Estimated volume for one* person)

| No. | Pollutants | Unit | Load |
|---|---|---|---|
| 1 | $BOD_5$ | g/ person/day | 45 ÷ 54 |
| 2 | COD | g/ person/day | 72 ÷ 102 |
| 3 | TSS | g/ person/day | 70 ÷ 145 |
| 4 | Total nitrogen | g/ person/day | 6 ÷ 12 |
| 5 | Total Phosphate | g/ person/day | 0,8 ÷ 4 |
| 6 | Coliform | MPN/100ml | $10^6$ ÷ $10^9$ |

172. On the basis of the load of pollutants in domestic waste water according to WHO and the guidelines in the curriculum on wastewater treatment - professor. Hoang Van Hue - Hanoi Architectural University, can estimate the concentration of pollutants in the domestic waste water by the construction workers at the project through the following formula:

$$C_{SH} = \frac{A \times 1.000 \times n}{q} \text{ (mg/l)}$$

173. In which:

- A: Load of pollutants in waste water for one person/per day/night
- n: The number of workers at the site
- q: Total amount of domestic waste water per one day/night

174. The results forecasting the concentration of untreated pollutants in domestic waste water by the construction workers are shown in the below table:

**Table 20. Concentration of some pollutants in domestic waste water**

| No. | Pollutants | Maximum load (g/ person/day) | Concentration (*mg/l*) | QCVN 14/2008/BTNMT | |
|---|---|---|---|---|---|
| | | | | A | B |
| 1 | $BOD_5$ | 54 | 643 | **30** | **50** |
| 2 | COD | 102 | 1214 | **-** | **-** |
| 3 | TSS | 145 | 1726 | **50** | **100** |
| 4 | Nitrate $NO_3^-$ | 12 | 143 | **30** | **50** |
| 5 | Coliform (MPN/100ml) | $10^9$ | $11x10^9$ | **3.000** | **5.000** |

175. Comparison with the Standard 14:2008 / BTNMT national technical s-standards on domestic wastewater, the concentration of pollutants in domestic waste water is beyond the permissible limits many times. Without measures to collect and handle the waste, but direct disposal into the environment, it will cause significant impacts on the environment and human health.

176. Characteristic of domestic wastewater is to contain large amounts of suspended solids (SS), organic matter (BOD5) and Coli bacteria. If this wastewater is collected and treated but then discharged directly into the environment, it will cause pollution and affect the ecology of receiving waters and people's health when being used contaminated water sources.

177. The high concentration of organic matters (BOD5) in waste water will reduce the amount of free oxygen in the water (DO) due to the decomposition of the organic matters. It also promotes the growth of algae in surface waters and can cause the phenomenon of "algal blooms", also known as eutrophication.

178. Besides, the presence of a large number of coli bacteria and some pathogenic intestinal bacteria in the water can enter into the food supply, such as vegetables and fruits when being irrigated or washed by the water contaminated by bacteria, from which go into the human bodies and cause dangerous diseases such relatively acute diarrhea, cholera and so on.

179. Apart from the two above main sources of waste water into the surrounding environment, during the construction, there is also the wastewater aroused from the process of building such as water washing of construction equipment, concrete scattering water, and so on. However, the water does not cause a great impact on the surrounding environment.

- Impacts of industrial sewage

180. Arising from the operation of the ancillary works for the project, lubricant waste comes from maintenance and repair of machinery, and motorcycles. The number of oil is used for an average replacing time instead of 18 liters / vehicles. The average number of times is 4 times / car. This effect will be small if operating personnel is aware of environmental protection and does not dump indiscriminately, freely the oil into the environment, greatly affecting the water environment.

- Impacts of rainwater runoff

181. The amount of surface storm water runoff is calculated on the basis of average annual rainfall. The amount of surface runoff accounts for approximately 75% of the total.

182. Therefore, the following formula is proposed:

- Storm water runoff volume = area construction area (m2) x average annual rainfall (mm / year) / 12 (months) x number of months of construction (month) / 1000 x 75%;
- Average annual rainfall is 1.500mm/year;
- The construction area is about 193.677m2;
- Construction period is 24 months;

183. The total amount of water on the surface of the execution time is determined to be 774.7 m. The water volume is relatively large; however, it is scattered during the execution time, if there is a prolonged heavy rain which can create low areas, the water holes the risk of local flooding and impacting with living activities of the people in the area and people participating in traffic. The process of pumping storm water from the construction site works will contaminate surface water due to high suspended solids levels. There should be a reasonable construction plan and appropriate construction methods to minimize pollutants before discharging storm water runoff to the receiving sources.

c. The impact of solid waste

➢ Sources of impact

184. Solid waste resulting from the activities of excavation, leveling and transporting construction materials and construction, such as waste rocks, bricks, wood, iron and steel scraps, packages, plastic bags and so on.

185. Daily living activities of construction workers, such as mops, food packaging containers, leftover rice, removed vegetable, fruit and so on.

➢ Objects of impact

- The quality of surface water, groundwater, and soil environment.
- The landscape of the surrounding environment.

➢ Load Forecast and impact assessment

- *Solid waste due to project construction activities*

186. Solid waste from construction includes from the rocks from the ground leveling, foundation making such as bricks, cement, steel, wood, and paper packaging and so on; from finishing, installation of machinery, equipment and installation of distribution pipe network.

187. During transport, it is inevitable to avoid rocky drop on the roads (mainly in the construction sector). The amount of solid waste can cause impacts to the surrounding waters, increase the turbidity in the waters, affecting the lives of aquatic species. In addition, the amount of solid waste spilled during transport also affects the surrounding atmospheres and landscapes. Without timely measures to collect construction waste, it will cause clogging the flows of the drainage culverts, bringing out water pollution.

188. However, this type of waste does not contain hazardous materials and is easy to be collected and made use of on-site; re-use does not pollute the environment.

- *Domestic solid waste*

189. Solid waste of human life, including left vegetables, fruits, rice etc. and other components such as plastic bags, rags, waste paper and so on., is emitted during the staying of workers in the field. Based on the calculation results of the actual investigation, and survey, domestic solid waste generated in one day by one person is 0.3 to 0.5 kg / person / day. With the number of regular workers on the construction of 60 people, the generated amount of domestic solid waste in one day for the project is estimated is 18-30 kg / day.

190. Almost all HH waste can be collected, and sorted to handle sanitarily; some wastes can be re-used or used for other purposes, such as fertilizer for crops and biogas, and so on. But if the wastes are not collected and properly and scientifically managed, they will cause certain effects on the environment because domestic waste is an ideal development environment for insects, flies, mosquitoes, disease causing virus and cause bad odors, and damage the beauty of the region.

ii. Impacts related to noise and vibration

a. Impacts of noise – vibration pollution

191. During the construction phase of the project, in addition to the possible sources of air pollutants listed above, noise is also a factor affecting the environment and human health. Noise arises mainly from the transport vehicles, construction machinery and so o n. The noise level of some equipment, construction machinery is identified as follows:

**Table 21. Noise caused by the construction machines and equipment**

| No. | Construction equipment | Noise level measured at the distance of 1,5m from the source |
|---|---|---|
| 1 | Bulldozer | 93 |
| 2 | Drilling machine | 87 |
| 3 | Diesel compressor | 80 |
| 4 | Concrete piling machine 1,5T | 90 |
| 5 | Concrete mixture machine | 75 |
| 6 | Trucks | 75 |
| 7 | Boom crane, crane | 85 |
| 8 | Concrete compact machine | 80 |

*(Source: US noise environment protection agency: the noise from construction equipment and machines NJID, 300.1, 31-12-1971)*

192. The likelihood of the noise in the construction area spreading to the surroundings is defined as the following formula:

$$L_i = L_p - \Delta L_d - \Delta L_c \text{ (dBA)}$$

193. In which: $L_i$: The noise level at the calculated location is far from the source of noise in the distance of d(m); $L_p$: the noise level is measured at the source of noise (far from 1,5m); $\Delta L_d$ : the noise level in decrease with the distance d at the I frequency.

$$\Delta L_d = 20\lg [(r_2/r_1)^{1+a})]$$

194. Where: r1: the distance to the noise source corresponding with the Lp (m), r2: Distance to calculate noise level reduction in the distance based the Li (m) a: specific absorption coefficient of the local noise with the ground graphic (a = 0); ΔLc: the noise level reduction over obstacles. The project area is wide, open terrain and no obstructions, so ΔLc should be zero.

195. From the above formulas, it can be computed the noise level of these types of construction equipment on the construction site at a distance of 100m and 150m; the results are presented in the following table:

**Table 22. Noise of some construction equipment (dBA)**

| TT | Construction equipment | The distance from the source to the surrounding (m) | | |
|---|---|---|---|---|
| | | ***1,5*** | ***100*** | ***150*** |
| 1 | Bulldozer | 93 | 57 | 53 |
| 2 | Drilling machine | 87 | 51 | 47 |
| 3 | Diesel compressor | 80 | 44 | 40 |
| 4 | Concrete piling machine 1,5T | 90 | 54 | 50 |
| 5 | Concrete mixture machine | 75 | 39 | 35 |
| 6 | Trucks | 75 | 39 | 35 |
| 7 | Boom crane, crane | 85 | 49 | 45 |
| 8 | Concrete compact machine | 80 | 44 | 40 |
| | **TCVN3985-1999** | **85** | **-** | **-** |
| **TCVN 5949-1998** | | **-** | **75** | **75** |

*(Source: US noise environment protection agency: the noise from construction equipment and machines NJID, 300.1, 31-12-1971)*

Notes:

- TCVN 3985-1999: The noise standards for the production areas;
- TCVN 5949-1988: The noise standards for the residential areas;
- (-): The unregulated values

196. Calculation results show that the noise generated by the transportation vehicles, construction machinery and equipment on site is ensured to be within the permitted limits for construction sites and within the permissible limits for the residential area as per the standard TCVN5949- in 1998 at a distance of 100m - 150m from the noise source. However, when the machinery operation will be the same time causing resonance phenomenon, which results in the noise level to rise and may exceed permitted standards, therefore, it is necessary to also take measures to prevent and minimize noise levels during the construction period.

b. Social impacts

197. The impacts on the economic and social life of the project are both positive and negative for locals and workers, direct construction engineers.

198. The negative effects are included as the appearance of conflicts between social workers and engineers and even with local communities on construction issues, and solutions. In addition, the large concentration of personnel in a given area may cause adverse social impacts such as fighting, gambling and so on., disorderly regional security and the risks to spread diseases affecting the health of workers, engineers and local communities, such as influenza, and diarrhea. These issues require the owners as well as contractors to take early prevention measures, regular communication and to give satisfactory answers to the questions, as well as to unnecessary controversies, in order to ensure construction quality and minimize the negatively social impacts.

199. Positive aspects of the impacts on economic and social life during construction as mentioned are the emergence of demands for sales, service, eating, shopping, leisure and entertainment and so on., of engineers and workers. And that contributes to promoting locally social and economic development in the area of construction.

c. Impact on ecosystem

200. For the construction of water transmission and supply pipelines,: because the construction site is narrow, located along the roads and if any, there is just some plants, small shrubs removed and therefore, it will cause no negative impact on the ecosystem, and the ecosystem around the project area will be kept completely intact after the finish.

201. For reservoir areas (accumulated lakes) and the plant: living population is mainly rice, vegetables and Eucalyptus Hills without residents, when the project is completed, this area will be surrounded by planted old flora unaffected both making landscapes, regulating the microclimate and processing the environment involved.

202. Because they are the animals and plants that are affected by the project activities do not belong to any form of rare species, low levels of diversity, therefore, we can say the impact is not large and is considered to be ineffective significantly.

**k. Issues / Concerns / Impacts during Operation**

i. Pollution related impacts

- Source of impacts
- Domestic Solid Waste- factory management personnel;
- Solid waste generated during plant operation (sludge, sediment);
- Hazardous solid waste.
- Objects of impacts
- The quality of soil, water and air;
- Ecosystem in the project area;
- Environment and landscape of the project area;
- Load forecast and impact assessment

- *For domestic solid wastes*

203. The main components of the domestic solid wastes include: the type of biodegradable solid wastes (vegetables and fruits, and so on.), persistent solid wastes (plastic bags, pieces of porcelain, ceramic, plastic bottles, bones of animals and so on.)

204. When the project is put into operation, in order to manage and operate the plant it needs about 15 officers and staff to take turns on watch. The daily average amount of solid waste discharge is about 0.5 kg / person / day. Therefore, the total amount of solid waste generated in this activity is about 7.5 kg / person / day, equivalent to about 225 kg / person / month. However, the actual amount of solid waste may be lower because the staff employed is mostly local people, often living in the area of the plant all day.

205. It can be seen that in the course of operation, the amount of solid waste generated by the officers and employees is negligible. However, if the amount of solid waste is not collected and handled properly, it will cause a negative impact on the environment.

- *For the solid waste generated by the o*perations of the plant

206. Solid waste is generated primarily from plant foods, paper, packaging containing alum, NaOH and so on., and the amount of sludge generated after processing. Water after treatment will create a sludge volume and the sludge from the process of rinsing, sanitizing the system. This sludge will be collected and transfered in the sludge treatment sector within the water plant.

207. Apart from the potential hazard associated with handling of treatment chemicals, disposal of sludge and wash water from the treatment process is the most important aspect of the WTP operation that can cause adverse impacts, specifically on the surrounding land and waterways. Sludge is a product of the sedimentation and filtration processes, and it consists of chemical floc, fine particles and reservoir-derived algae removed from the raw water through flocculation. The sludge contains the aluminium-based flocculating agent but is not toxic. The quantity of sludge produced from the Thuong river WTP is not estimated to be large since the raw water goes into a sedimentation basin in which the natural gravity process will have already removed most of the turbidity.

208. The clarified sludge (produced as batch discharges from the plant operation) will have few potential beneficial uses, and provision needs to be made for disposal. There are two options for dealing with the sludge: (a) dewatering so that it can be handled easily and disposed as solid waste in a controlled landfill, or (b) discharge in liquid form into the river or spreading on open land.

209. Sludge treatment method of WTP is proposed to be sludge settling tank, sludge after settling will be collected and transferred to permitted empty land (due to no toxic elements owning) or buried in town's landfill.

- *For hazardous solid waste*

210. Hazardous solid wastes including sludge, mud and sticky rags generated during the operation, routine maintenance of machinery and equipment. However, this large amount of waste, can be controlled, project management unit shall coordinate with the functional units of the hazardous waste management to collect and properly handle the waste.

a) Impacts on aquatic environment*:*

➢ Source of impacts

- Domestic waste water by plant management personnel;
- Waste water from the operation of the plant (from the filter tanks, treatment tanks, and so on.)
- Storm water runoff.

➢ Objects of impacts

- Ecosystem in the project area;
- Environment and landscape in the project area.

➢ Load forecast and impact assessment

- *For domestic waste water*

211. The amount of domestic waste water is estimated to be 80% of water supply for domestic purposes (standard is 120 liters / person / day). Therefore, with 15 operation staff and workers in the plant, the amount of wastewater generated per day is estimated to be at 1,440 liters / day (equivalent to 1.44 m3).

212. According to the study by the World Health Organization - WHO, several loads of pollutants from waste water (calculated for a person in a day) is shown in the table below:

**Table 23. Load of pollutants in dometic waste water**

(*Nominated level for one* person )

| No. | Pollutants | Unit | Load |
|---|---|---|---|
| 1 | $BOD_5$ | g/ person/day | 45 ÷ 54 |
| 2 | COD | g/ person/day | 72 ÷ 102 |
| 3 | TSS | g/ person/day | 70 ÷ 145 |
| 4 | Total Nitrogen | g/ person/day | 6 ÷ 12 |
| 5 | Total Phosphate | g/ person/day | 0,8 ÷ 4 |
| 6 | Coliform | MPN/100ml | $10^6 \div 10^9$ |

On the basis of the load of pollutants in waste water by WHO and the guidelines in the curriculum of wastewater treatment - professor. Hoang Van Hue - Hanoi Architectural University, can estimate the concentration of pollutants in the waste water of the staff - workers according to the following formula:

$$C_{SH} = \frac{A \times 1.000 \times n}{q} (mg/l)$$

In which:

A - Load of pollutants in dometic waste water for a person in a day/night;

n – the number of people;

q – the total volume of domestic waste water in a day/night;

The results forecasting the concentration of pollutants in domestic waste water originated from the construction workers before treatment system are shown in the following table:

**Table 24. Concentration of pollutants in dometic waste water**

| No. | Pollutants | Maximum load (*g/ person /day*) | Concentration (*mg/l*) | QCVN 14/2008/BTNMT | |
|---|---|---|---|---|---|
| | | | | A | B |
| 1 | $BOD_5$ | 54 | 562,5 | **30** | **50** |
| 2 | COD | 102 | 1.062,5 | **-** | **-** |
| 3 | TSS | 145 | 1.510,4 | **50** | **100** |
| 4 | Nitrate $NO_3^-$ | 12 | 125 | **30** | **50** |
| 5 | Coliform (MPN/100ml) | $10^9$ | $10,4x10^9$ | **3.000** | **5.000** |

213. Comparison with the Standard 14:2008 / BTNMT national technical standard on domestic wastewater, the concentration of pollutants in waste water is beyond the permissible limits many times. Without the measures to collect and handle the waste water, but discharge directly into the environment, it will cause significant impacts on the environment and human health. However, the majority of workers and plant operators are very few local people living all day, so the amount of waste water is also significantly reduced.

214. Characteristic of domestic waste water is to contain large amounts of suspended solids (SS), organic matters (BOD5) and Coli bacteria. If this waste water is collected and treated but discharged directly into the environment, it will cause pollution and affect the ecology of receiving waters and people's health when contaminated water sources are used.

215. The high concentration of organic matters (BOD5) in the waste water will reduce the amount of free oxygen in the water (DO) due to the decomposition of the organic matters. It also promotes the growth of algae in surface waters and can cause the phenomenon of "algal blooms", which is also known as eutrophication.

216. Besides, the presence of a large number of coli bacteria and some pathogenic intestinal bacteria in the water can enter the food supply, such as vegetables and fruit when

being irrigated or washed by the water contaminated by bacteria, which then go into the human bodies and cause dangerous diseases such relatively acute diarrhea, cholera and so on.

- *For the waste water from the o*perations of the plant

217. Wastewater serving the processes such as waste water from the chemical house , the laboratories after the analysis and testing of the water level indicator mixed with chemicals, is mainly used for washing testing apparatus, measurement equipment being diluted with chemicals, and so on., the maximum load: Qmax = 5 l / s. However, the components of the wastewater do not contain hazardous materials and are not continual, so the volume of the waste water is negligible, so that the water will come from the lab into the general collection system for domestic waste water.

218. Waste water is from the processes of washing, filtration, sanitation and the water from drying mud yard. The composition of the wastewater mainly contains sediment particles and an excess amount of acid remaining in the sediment at concentrations of about 5 ÷ 8% use of alum. By design, the wastewater from the process is recycled to the mixing tank to re-treat with raw water, but is not exhausted into the environment.

- *For stormwater runoff*

219. In the rainy season, rainwater runoff through the area will bring within the soil, rocks, residue dropping into the water. If rainfall is not well managed, it will cause negative impacts to the surface water, groundwater and aquatic systems in the region. Through local materials, it can be estimated the concentration of pollutants in stormwater as follows:

Total nitrogen: 0.5 ÷ 1.5 mg / l

Total Phosphorus: 0.004 ÷ 0.003 mg / l

Chemical oxygen demand (COD): 10 ÷ 20 mg / l

Total suspended solids (TSS): 10 ÷ 20 mg / l

Compared to the waste water, the rainwater is relatively clean, so it can be separated the stormwater drain from the wastewater one and let the rainwater to penetrate into the soil.

b) Impacts of air exhaust

220. Emissions and noise are caused by transport vehicles and the vehicles of plants: Going out and in the plant of the vehicles will reduce the environmental quality due to emissions and noise. The transit time for the chemical treatment system is fixed for 30 minutes / day and consumption of fuel (diesel oil) of about 4.91 liters / car. Pollution loads from the transport by the vehicles in the table are calculated as:

**Table 25: pollution load of chemical carrying vehicles into the plant**

| No. | Pollutants | Load coefficient (kg/ton of oil) | Exhaust load (kg/day) |
|---|---|---|---|
| 1 | dust | 0,28 | 0,00896 |
| 2 | $SO_2$ | 20 S | 0,19200 |
| 3 | $NO_2$ | 2,84 | 0,09088 |
| 4 | CO | 0,71 | 0,02272 |
| 5 | VOCs | 0,035 | 0,00112 |
| 6 | Dust | 0,28 S | 0,00268 |

*(Source: WHO, 1993)*

ii. Impacts of noise and vibration pollution

a) Impacsts by noise and vibration

➢ Source of impacts

- The operation process of engines of pumps and mechanical shops;

➢ Objects of impacts

- Direct pump operators;
- The local people around the plant;

➢ Forecasts on impact assessment

- For noise polluttion

221. Noise directly affects the human health, and psychology, especially those of the workers operating machinery and people living around the project area. Noise generated at the plant is at the largest level during the pump operation. When all the units operate, the noise levels which are measured in the plant can range from 80-90 dBA, exceeding the permitted standards. The possibility of noise transmission from the plant to the surrounding residential area is determined by the following formula:

$$L_i = L_p - \Delta L_d - \Delta L_c \text{ (dBA)}$$

222. In which:

- $L_i$: The noise level at the calculation place far from the noise source at the distance d(m);
- $L_p$: The noise level is measured at the source of the noise (at the distance of 1,5m);
- $\Delta L_d$ : The noise level decreases with the distance d at the frequency of I;

$$\Delta L_d = 20\lg [(r_2/r_1)^{1+a})]$$

- $r_1$: The distance to the noise source with $L_p$ (m);
- $r_2$: the distance to calculate the noise reduction together with the distance $_{Li}$ (m);
- a: The specific absorption coefficient of the noise in the terrain surface (a=0);
- ΔLc: The noise reduction through the obstacles (no obstacle, so ΔLc = 0);

223. From the above formulas, we can compute the noise level during te operating stations to the surrounding environment at the distance of 100-150m (far from the source of the ambient noise), the results are shown in the following table:

**Table 26. Forecast on the noise spreading in the environment**

| Distance | Calculated noise level (dBA) | QCVN 26:2010/BTNMT |
|---|---|---|
| Noise level at the distance of 1,5m far from the machine | 93 | - |
| Noise level at the distance of 100m | 71 | **70** |
| Noise level at the distance of 150m | 63 | **70** |

Notes:

- QCVN 26:2010/BTNMT: National technical standards on noise

224. Calculation results show that the noise produced during the operating stations is ensured within the limits for residential areas; as per NTR 26:2010 / BTNMT at a distance of 100-150m from the noise source, the impacts of noise into the people is negligible.

- For vibration level

225. Because it is a large capacity engine which will cause vibration affecting human health and longevity of machinery and specific works as follows:

- Impacts on human health: Depending on a number of factors such as duration of exposure, impact location, source characteristics and values of kinetic energy. In general, the impacts of vibration to the human body is divided into two main categories: Full body vibration and local vibration. For the plant, vibration is mainly due to pump operation. During the operation, workers have little or no direct contact with the source of vibration, therefore, the impacts on human health is very low or almost none.

- The impacts of the vibration for machinery and equipment: they are in general very complex and diverse such as: Reduction in durability, longevity and quality of working as well as precision, causing dangerous incidents in the machines, even causing the accidents for people and the environment, such as flying flywhee due to imbalance, broken bearing rolls and so on.

- Impacts of vibration for construction works: When pumping operation will generate vibration transmission in heterogeneous environments (concrete floor) in the form of waves causing the phenomenon: cracking, flaking plaster of the walls, or ceilings and so on., shortening the life of works due to the fatigue phenomenon of the bearing structure.

226. According to the selected plan, the water plant is located relatively far from residential areas, so noise and vibration do not affect people's lives.

b) Impacts on social, economic aspects

227. When the project is put into operation, local people will be able to access clean water, contributing to improving their present lives and living conditions, gradually changing people's perceptions of the use of hygienic water;

228. Moreover, some workers will be added to the operation and maintenance of the water plant, maintenance of the transmission, distribution and services network, promotion of investment and trade development. Therefore, the impact on economic and social life is seen as a positive impact.

## D. Mitigation of Environmental Impacts

### a. Mitigation Measures during Designs

229. During this period, the main work to be done is land clearance for serving the construction works of the project including compensation, site clearance, clearing, leveling and temporary roads.

230. The land which is expected for construction of receiving works, raw water pumping stations and treatment plants is outside the dike and hilly with no residents, there is no permanent construction works, which is convenient for site clearance and compensation with the low cost. Compensation should be around 24,000 m2 of project area for receiving works - and about 34,000 m2 of the area for treatment plants. The most concerned impact is with the human impact on the land compensation due. However, this level of impact is not significant, the investor simply is required to negotiate to get the highest agreement for the individual victims involved. This work should make thoroughly and quickly in order to deploy better the later stage.

231. The transmission and distribution pipelines mostly are placed on the sidewalk or on the small concrete road in the villages. There are some points of the pipelines crossing the

streets, across the fields and gardens of the local people. So, in order to recover the issues, there must be achieved the agreement with the organizations and individuals involved.

232. For the site clearance period, the mentioned mitigation are the measures to reduce recovered land area and the mechanisms and policies on compensation, support and resettlement (if any ) in compliance with applicable laws and policies by the donors; the public consultation and notes of the proposals and aspirations of affected / displaced people are also very important. The receipt of compensation, and reasonable and satisfactory support will help them to restore economic conditions at least equal to or better than the presence of the project.

**b. Mitigation Measures during Construction**

233. One of the main source of emission in the air, water and even soils itself if some of them are contaminated is the managment of spoils throughout the entire project. Use of temporary spoil storage sites for extended periods should be avoided, and the mounds should be watered regularly to prevent excessive dust production. At construction areas close to streams, silt traps should be used to prevent sediment build-up and excessive water turbidity. The use of plastic tarps to avoid soil erosion from the spoils should also be implemented to reduce the need to water down the spoils. It provides a block from the rain and reduces the wind capacity to dry the soil and lift some of the dust.

234. A large fraction of the excavated material will be used to backfill the trenches after the pipes are laid. As such it is not expected that an excessive amount of spoils from the pipeline construction will need to be disposed. In any case, the final disposal areas for the excess spoils should be carefully sited so that these are not vulnerable to flooding, and are located on stable slopes to prevent slumping. If possible, the disposal areas should be covered by topsoil and re-vegetated. Around the disposal areas, adequate drains should be installed. The excavation spoils should be treated as a resource and their possible beneficial uses maximized-for instance, as base material if suitable for raising road-top levels in flood-prone sections and for filling in of areas being developed for settlement use.

235. Tender documents for the pipeline construction should include provisions to prevent improper handling of spoils. Contractors should explain the excavation methods to be used and the measures for handling spoils. Before areas are designated for spoils temporary storage or final disposal, the contractor should examine the physical suitability of the sites and also assess alternative beneficial uses of the material. The soundness of the measures should be part of the selection criteria for awarding construction contracts***.***

iii. <u>Mitigation measures for air pollution</u>

236. Sources of air pollution mainly come from the construction phase of the project which are born from soil dust, road dust arising from construction materials and air emissions, noise generated from construction equipment and vehicles transporting construction materials. To minimize the impact of these sources, the project owner will implement the following measures:

a) <u>Mitigation of air pollution by dust</u>

237. Investors should coordinate with the contractor units to minimize dust during construction, transportation of materials, the following specific measures:

- All the vehicles transporting raw materials (soil, sand, and cement, stone and so on.) will have the trunks covered to prevent dust emissions into the environment;

- Establishing and developing a plan for excavation and transportation, choosing the right kind of vehicles as per the standards. The floor of the vehicles is closed on the top with a lid to reduce spillage on the roads during transportation;
- The dust generated during the construction will be minimized to the lowest level by the solutions, such as watering along the transportation land route of waste rock and construction materials; moistening the surface of the disturbed areas for construction of works at the most appropriate time. Average frequency of watering is 2 times / day;
- There should be the priority for selection of materials supplies near the project to reduce transport costs and maintenance operations in order to minimize dust and waste generated as well as reduce the risk of transport accidents and incidents;
- In case of gathering at the site for materials and fuels such as cement, steel, oil, and so on. they should be carefully preserved in storage in order to avoid the effects of rain, sunshine and wind causing being damaged, at the same time, to minimize the potential for dust emissions and other pollutants into the environment;
- The types of materials such as bricks, stones cause less pollution and less impact on the natural environment, which may be left outdoors without storage method.

b) Mitigation of air pollution

238. The means of transport, machinery and equipment used will be checked air emissions in accordance with Vietnam standards for CO, hydrocarbons and dust (TCVN 6438-2001). All the equipment used for construction of this project must be allowed by the Vietnam Register or the Department of Natural Resources and Environment in Hanoi on the emissions limits;

239. Do not use the facilities, equipment (vehicles, construction machines are too old) which have the invalid registration period or not licensed by Register stations as emissions exceed permitted standards;

240. Vehicles and equipment must adhere to the maintenance standards and schedules to reduce air pollution;

c) Mitigation of noise and vibration

241. Noise arises primarily from transportation vehicles and machinery, construction equipment. In order to reduce the effects of noise and vibration during construction to the surrounding neighborhood, the investor will require contractors to adopt the following measures:

- Piling work on the construction site must be done in accordance with using advanced procedures, and equipment to make poles;
- Reduce noise during transition by greenery landscaping around the project area, ensuring both a clean environment has been a part and reduction in noise transmission to the surrounding environment;
- Do not use old, outdated machinery, which results potentially high noise;
- Equip the workers with the means of labor protection against noise, to ensure the health of workers;
- Locate the sources of the strong noise: All the major sources of noise (such as concrete mixers, generators, and so on.) will be located away from residential areas above 200m;
- Regulate the speed of vehicles and machinery operating in the project area, on the

roads running through residential areas, public parks, schools, and so on.

- The machinery causing noise and vibration during construction such big piling machines, compactors, and excavators will only be allowed to work during the day time, not counting lunch breaks, and limiting the loud noise at night (from 22 pm to 6 am);
- Check whether the level of noise, vibration from the equipment serving the construction works is within the allowed noise, vibration level by the standard no 26:2010 / BTNMT and Standard no. 27:2010 / BTNMT, from which set out the construction schedule accordingly.

iv. Mitigation measures to water pollution

242. The sources of waste water pollution during site clearance and construction mainly: Stormwater runoff, domestic and construction sewage. Measures to control water pollution which are proposed for application as follows:

a) Measures to rainwater runoff and construciton sewage drainage

- Use of the existing irrigation systems in the project area, dredging of the water canals to serve drainage during construction and routing drainage lines. The drainage lines are ensured to have thorough drainage without causing flooding during the construction process and do not affect the ability of the sewer disposal into the outside of the project area;
- Regularly check, dredge, clean the flows in order to prevent the construction waste from entering the drains to clog the flows, causing environmental pollution;
- Do not collect the types of materials left near the edge of the water line to prevent leakage into the sewer lines;
- Strictly control the process of equipment maintenance, ensuring hazardous wastes such as oil and grease not entering the construction waste water, the rags containing oil should be collected and treated as per the regulations;
- Raw materials are gathered in camps must be shielded permanently, during the transit it is required to avoid dropping out of the project area. When there is heavy rain, the investor will suspend construction and clean the surface in order not to let the rain wash away the building materials to the surrounding watershed.

b) Mitigation measures of domestic waste water

243. For the convenience of living of workers and reimbursement of the ground after completion of project construction, during the site clearance and construction, the management unit will use three portable toilets to collect domestic wastewater and rent the other parties for shipping and handling. Toilets will be installed in accordance with the standards, rules and regulations of the Ministry of Health Sanitation and the Ministry of Construction (BC 51:2008). Toilets will be located far away from the places of the workers at the site and the surrounding residential area, and far away from the used water sources. The following measures are taken to minimize the impacts of waste water:

- Reducing the waste water by enhancing recruitment of local construction workers. After working hours, they will return to their families and living at home. Therefore, it is possible to minimize the amount of waste water generated;
- The common rules should be applied and mandatory for construction workers on site.

v. Mitigation measures of the impacts of solid waste

a) For construction solid waste

244. According to the calculation results of the environmental impact assessment in Chapter 3 of the report, the composition and volume of solid waste generated during construction include rock from arising excavation works, iron and steel, wood chips generated during construction; construction materials (sand, stone, brick, and so on.) spillage or carton containing materials, and so on.

245. Solid waste in the construction process, has the characteristic of the inorganic waste, less toxic to the environment and to human health; so, the suggested measures to control, collect and manage the kind of solid waste include:

- For the waste of rock, crushed brick, they can be collected and re-used for the leveling, and land covering;
- For wastes such as scrap metal and cardboard packaging can measure the workers assigned to the collection, reuse or resell for scrap procurement facilities locally;
- Regularly check the economical use of fuel resources for construction works to avoid waste and minimize impacts on the surrounding environment.

b) For domestic solid waste

- Implementing well the classification of domestic solid waste. Limiting waste during construction activities. Domestic waste and construction scrapes will be accumulated at the separate dumping areas;
- Construction of temporary camps with portable toilets, water supply and temporary drainage system, to avoid stagnant water, and ensure hygienic environment for workers and staff, building hygiene rules at camps, educating for workers the sense of hygiene keeping and environmental protection;
- There are domestic waste bins for each camp, waste collection and disposal in accordance with the regulations on environmental sanitation, contracting with waste collection units in the area.

c) For mud waste

246. For the volume of mud waste during foundation excavation works, excavation and installation of water distribution pipes, the management board will have the option to utilize a portion of land for leveling and road filling, ditch planning to recover the area when construction is complete. In addition, the amount of remaining land will give local residents who want to have this for leveling or pond dumping. For the rest of sludge land, not being taken advantage of, the investor will have plan to coordinate with the functional environment units to collect, and transport to the appropriate disposal areas. During construction, transportation and disposal, the investor also should have plans to monitor the environment at this disposal to assess the impact of disposal operations to the surrounding environment.

vi. Measures for labor safety and accident prevention

247. In addition to the measures to reduce environmental pollution, the measures to ensure the labor safety and hygiene are also essential, particularly for public servants who work directly on the site and surrounding residential area. Measures to ensure the occupational safety and sanitation as follows:

- Making Safety Board at the site and appoint person in charge; building and issuing mandatory regulations at construction enforcing workers to strictly implement the working rules at the site, including the rules of the workplace work, the rules about

protective equipment, the rules on equipment use and regulations on electrical safety, and fire safety regulations;
- Periodic inspection and maintenance of construction machinery, operation machinery to avoid the accident cases for construction workers and operators occurred due to old, broken machinery;
- Make sure the lighting system for construction to serve the places to work at night. Design, build barricades, and warning signs in the places with the likelihood of fall-down, or electric shocks.

vii. Measures to recover the surface

248. After completion of the project, there is a need to clean up all materials and waste, dismantle temporary works such as houses, sheds, storage on site, leaving the foundation for the construction sector:

- Leaving the construction site neat and clean, moving all of fuel, materials, excess waste in designated places;
- It is strictly forbidden to dump solid waste by cleaning out into the neighborhood, the amount of solid waste should be dumped at the right places;
- For lots of land, garden land temporarily occupied, the construction company will clean up space, surplus materials, removal of surface work leaving the surface for agricultural production by HHs.

viii. Measures to prevent diseases and social issues

249. Because the lives of the workers on the construction site are only temporary, so the hygiene is not considered carefully, this is very easy to generate major outbreaks of diseases such as malaria, diarrhea and so on. The project owner will have plan for health care for workers and public employees through the following specific measures:

- To coordinate with the local health centers to take measures to prevent and combat common diseases such as malaria, normal fever, diarrhea, influenza A/H1N1, dengue fever, and so on.;
- In conjunction with local health centers to have health examination plans for construction workers and staff, spray the epidemic prevention drug, build up the mobile medicine cabinets in the units involved in the construction;
- Regularly inspect and guide how to prevent some common diseases for personnel on site;
- Implement food safety policy for workers in the field by setting the cafeteria, appointing a skilled and experienced person in charge to serve workers the clean meals with full of nutrients ensuring working health at site;
- Increased use of labor resources in place: the local labor with full capacity at the request of the contractor and have the desire to be employed will be maximally hired by the contractor;
- Incorporate strictly with the concerned local authorities in order to implement the management of migrant workers in the area for the construction of the project (registering the temporary staying in accordance with local laws).

ix. Mitigation measures for traffic jams and labor accidents

250. As mentioned above, in the course of construction, the main transport road for the project is highway 1A and the system of inter-district roads. These are all the routes with relatively high traffic density, when the project starts, the traffic density in the area will increase (due to transportation activities of the project). Besides, the vehicles are all trucks

with 7-10 tons capacity, so there is a high risk of bottlenecks and traffic accidents. Therefore, the project owner will arrange the appropriate schedule, in order to avoid focusing trucks with large density at peak time endangering travelers in the same direction.

251. Strengthen monitoring safety factors of vehicles transporting materials for construction in order to prevent the unfortunate accidents. In the process of transporting, the vehicles are required to be ensured not to be covered for avoiding small sized materials falling along the roads that will cause the accidents to travelers in the back.

**c. Mitigation Measures during Operation**

x. Mitigation Measures of impacts by solid wastes

a) For domestic solid waste

252. Domestic solid waste is generated by operating activities of management and operation officers and staff of the project. Management Unit will arrange the collection bins of solid waste in appropriate locations, such as management houses, pumping stations and contract with functional units for collection, transportation and processing of this solid waste in accordance with the regulations.

b) For solid waste from the operations of the plant

253. The waste is separated from the trash but, the types of sludge, or mud from sediment tanks, sludge treatment tanks at raw water collecttion works, clean water treatment systems must be disposed appropriately, organic mud can be utilized as fertilizers, the remaining non-degradable residue of rock and soil must be disposed at prescribed places, or treated by the rented environment unit- Urenco Bac Giang city. The places of gathering dried sludge and drying mud yard must be covered by a roof to avoid the impacts of rain and wind.

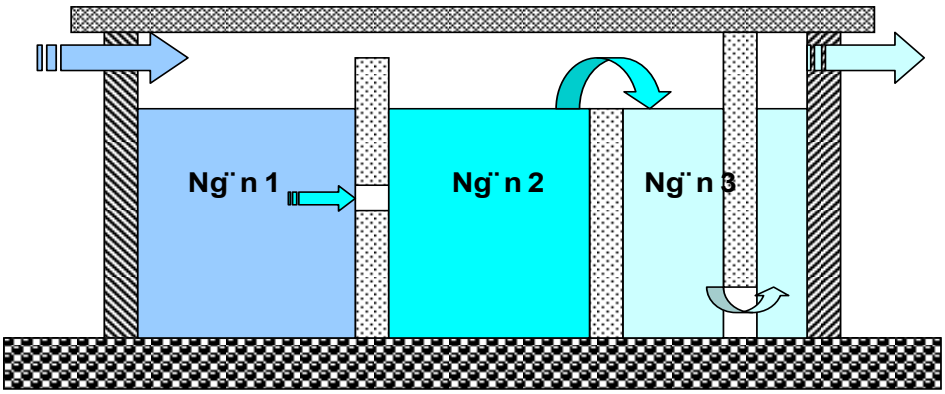
xi. Mitigation Measures for water environment

a) For domestic waste water

254. Waste water from the water plant operators is one of the sources of water pollution. The owner should arrange toilets in the campus of the factory, and educate people's awareness about personal hygiene and environmental protection;

255. In the construction works (administrative buildings, guard houses, warehouse, chemical house, clean water pumping stations) they are arranged the facilities using water and sanitation facilities, with 3 compartment septic tanks meeting design standards. The septic tanks have two functions at the same time: sediment deposition and degradation.

**Table 27: Common structure of 3 compartment septic tanks**




256. In the septic tanks, sediment is kept in the tanks from 6 ÷ 12 months, under the action of anaerobic microorganisms, organic matters (dirt) can be partially decomposed to form

gases and partly create dissolved inorganic substances. The waste will be decomposed, and water is also cleaned partly and be led through an aerobic biological treatment tank before self-absorbing, and sediment will be pumped regularly.

257. Main sewage drainage pipelines are located on a stretch of land separated from the surface water drainage system. At the end of the pipelines there is self-absorbed trench around with rockfill 4x6 arranged and mixed rock 2x3. Water will penetrate into the rock layer and into the natural soil, growing grass on the surface of the trench.

b) For the waste water from the operations of the plant

258. The wastewater during the operation of treatment complex is discharged with various kinds including: waste water with many sludges, alkaline waste water (containing lime sediments), and acidic waste water (alkaline solutions). If this waste water is discharged directly into the environment, this action will cause pollution. However, in the process of design calculations, the total amount of waste water will be treated through the lamellae settling process - filtration - sedimentation sludge drying lakes. The sludge will be settled to the bottom and surface water is periodically drained, mud will be dried and dumped in landfill.

259. Reduce the risk of contamination of receiving water by sewage from wash process and from the supply water treatment system. Waste water after washing should be gathered at the sedimentation lakes, clean water will be returned to the raw water tanks and sludge will be collected periodically.

c) For rainwater runoff

260. In the entire area of the plant, the area of process technology works accounts for 60% of the total area of the factory, so the rain water flow is calculated on 40% of the remaining area, mainly drainage from the roof and internal roads, and flow of the remaining 60% will fall naturally into the production line.

261. The rainwater drainage of the plant is divided into small streams based on the internal roads of each drainage basin into a drainage ditch along the roads. Drainage Ditch is 30 cm wide, 30 cm deep along the fence line of the plant and located on the back of the plant where there is free water way along the trails and then being self-absorbed into the soil.

xii. Mitigation measures for noise pollution

- Equip with noise buffers, mounted at the base of the pumps and electric motors;
- Check the balance of the machines during installation, check the detailed;
- Periodically inspect and maintain, put lubrication for machines to ensure that machines are operating well, increase life expectancy, and reduce noise and vibration;
- For workers directly working in the pumping chamber areas with high noise must be equipped with protective clothes, especially earplugs or earmuff hats;
- To reduce the impact of noise on surrounding residential areas, the proposed measure is to increase the planted area with trees around the project area. Rows of trees with broad leaves likely prevent the spread of noise into the surroundings very well.

xiii. Measures to cope with the breaking incidents of the water pipelines

262. Clean water in the transmission, distribution and service pipelines of water supply systems does not have fundamentally affect the natural environment, except for the leaks from joints, or welded pipe, the clean water then will carry the pollutants to penetrate and affect the groundwater.

263. The risk of clogged pipes is due to the sediments sticking inside the pipes, obstructing the flow of water. In addition, it is required to regularly check the pressure gauge on the water supply line in order to monitor the flow of water and to get preventive and remedial measures promptly when there are any incidents of leak, or burst in the pipeline happening.

264. There is a need to control the flow of raw water into the water plant, in order to avoid chasing revenue, but not to pay attention to the quality of treated water. In case of accidents, the station must be shut down, at that time it is prone to the phenomenon the untreated water is pumped into the system and sent to the clean water distribution network, therefore, the design is required to consider the waiting capacities for important items such as pumping stations, and storage tanks with automatic lock valves.

# VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

## A. Consultation Process

265. The community consultation for the construction investment project to build water plant No. 2 city in Bac Giang city, Bac Giang province has been implemented strictly by the project owner Bac Giang Water Supply, Drainage One Member Company Limited in combination with the consultancy party as per the current regulations.

266. Under Clause 8, Article 20 of the Laws on Environmental Protection and Decree 80/2006/ND-CP dated 09 January 08, 2006 issued by the Government on specifying and guiding the implementation of some articles of the Law Environmental Protection; Decree No. 29:2011 / ND-CP dated on April 18, 2011 on Regulations on strategic environmental impact assessment, environmental impact assessment, environmental protection commitments; Circular no. 26/2011/TT-BTNMT by the Ministry of Natural Resources and Environment specifying a number of articles of Decree No. 29:2011 / ND-CP dated 18/4/2011 by the Government on the regulations on strategic environmental impact, assessment environmental impact assessment, environmental protection commitment. The project owner has submitted the documents to the People's Committee and Fatherland Front Committee to inform the community about the basic content of the project, the adverse impacts of the project on the environment, these measures mitigating adverse impacts which are expected to apply and ask the agencies for their comments in writing.

4. Consultation was held in area where the project is implemented, including the communes in Bac Giang city as follow: Song Mai (WTP, pre-sedimentation basin, water intake & PS), Tan Tien, Dong Son, Song Khe, Tan My, Dinh Tri, Que Nham, Da Mai and Xuong Giang communes.

267. Participation in activities by the representatives of the investor, design consultancy party, environmental experts, representatives of local and regional communities in the project area. The documents and meeting minutes are shown in the annex of the report.

268. The PMU and the consultation unit prepared and managed public information and consultation activities that were carried out as part of a baseline survey of local environmental conditions along the ram pipeline corridor, the WTP plant site and the distribution network.

269. Five communities were visited over 3 days in January 2011 (see Table 28). Residents and local leaders were informed about the project, the input and the ouput of the project while focusing on the direct effect of construction in their territory.

**Table 28: Date of Consultation Activities**

| Commune | Date | Commune | Date |
|---|---|---|---|
| Tan My | 10 January 2011 | Dinh Tri | 11 January 2011 |
| Song Khe | 10 January 2011 | Dong Son | 12 January 2011 |
| Tan Tien | 11 January 2011 | | |

270. Overall, all CPC, Fatherland Fronts and PC representative attending the meetings agreed to the WS project. The representative all suggested project management unit, construction and operation contractors to comply with the mitigation measures of environmental pollution as outlined in the consultation meeting; and agreed with solutions to minimize environmental pollution in the project area interviewed in greater depth for their views and concerns regarding the potential effects of the project on the community. People

present at the Tan My meeting requested that the PMU facilitate local labor recruitment for creating jobs in the local area. More interventions are stated in the section below.

271. The official information on environmental impact assessment report, and mitigation measures have been provided by project owner and Consultancy to the people of communal authority and to the society in the community consultation meeting. Upon ADB's approval, a copy of the report on environmental impact assessment will be kept at the CPCs so that the government and people can participate in related environmental protection supervisory activities of the project.

272. Annex 2 presents pictures and minutes of meetings of public consultation.

**B. Opinion from the Stakeholders and Persons Met**

273. After receiving a letter from the project owner, the PC's of Dong Son, Dinh Tri, Tan My, Song Khe and Tan Tien commune met local authorities and the communities in the project areas, fully agreed with the contents and measures to minimize the impact of the Project. Opinion of the People Committee, Fatherland Front; representatives of the communities commune as follows:

<u>The Communes People's Committee's similar opinions</u>

- Agreed to invest in building water supply system because it will bring in the ability of better water supply for organizations, individuals and families living in Dong Son commune;
- Encouraged the application of methods to minimize environmental impacts in a short time;
- Agreed on the environmental impacts: The risks and incidents of environment, labor safety, traffic congestion and accidents;
- Approved the mitigation measures of environmental pollution in the project area that environmental consultants provide and support implementation in the area;

<u>The Communes Fatherland Front's similar Comments</u>

- Agreed with the project;
- Agreed on the environmental impacts: The risks and incidents of environment, labor safety, traffic congestion and accidents;
- Proposed that the project management unit would select construction contractors with the full capability of finance, human, equipment and machinery for construction to comply with set schedules, in order to avoid prolonged influence on people and ensure quality of works;

<u>The various communities of the commune Comments</u>

- Agreed with the project;
- To promote the full implementation of mitigation measures;
- Proposed that management unit to require construction and operation contractors and of water supply systems to comply with the mitigation measures and pollution prevention as outlined in the public consultation today;
- Time schedule of the project must be publicly announced so that people can know and help support to the project;

<u>Other opinions were heard such as :</u>

- Proposed fast execution, no delay to avoid damage on the beauty of the landscape and life of the people

- To have community supervision during construction and operation;
- Adequate compensation, support for people suffering the acquisition of land, buildings, crops and so on.;
- It is proposed that the project management unit facilitates employment of local people for creating jobs in the project area
- Given the strong sanctions against the construction contractors for non-compliance with the requirements specified in the contracts;
- Public consultation must be carried out regularly to check the incidents, the status and progress of the system construction and operation

**C. Feedback from the project owner**

274. Director of Project Management Unit, representative of the project owner thanked the presence of local authorities, Fatherland Front Committee and HHs in the communes of Dong Son, Dinh Tri, Tan My, Song Khe , and Tan Tien to have attended at the meeting. Also, they would accept and agree to the opinions of the local authorities and pledged to strictly implement environmental protection rules in the local area during the construction and operation of the project.

**Table 29: Summary Matrix on Public Consultation**

| Issues Raised | Project's Answers |
|---|---|
| a) Information on the project schedule; | – Public announcement on the project schedule will be made; |
| b) Adequate compensation for assets affected | – Covered under the Resettlement Plan |
| c) Employment of local people for civil works; | – Under responsibility of contractor; PMU can suggest; |
| d) Regular public consultation to identify and discuss incidents; | – Regular public consultation will be made; a grievance redress mechanism will be in place. |
| e) Traffic congestion during construction; | The following measures will be undertaken:<br>– Schedule of construction adapted to traffic periods.<br>– Traffic detours, and sufficient signage & warning lights at all construction locations. |
| f) Safety issues | – Additional pedestrian crossings will be installed in dangerous locations;<br>– Trenches will be fenced; |

D. **Consultation with downstream communities**

280. The Government approval process for raw water intake will include public survey of dowmstream users. Results of the surveys will be documented and sent to ADB during detailed design.

**E. Disclosure for information**

281. IEE and Environmental Management Plan will be translated in Vietnamese and will be made available at the office of the People's Committees (PC) of the the following 9 communes of Bac Giang City: Song Mai, Tan Tien, Dong Son, Song Khe, Tan My, Dinh Tri, Que Nham, Da Mai and Xuong Giang communes. Residential areas along National road 1A under Yen Dung and Viet Yen districts will also be covered. The disclosure will be made prior to tender.

## VII. GRIEVANCE REDRESS MECHANISM

282. During project operation, the Project Owner shall comply with the provisions of the law on environmental protection, construct treatment facilities, limit the negative impacts on environment and protect community health. The company should be proactive to reserve sufficient water source in the raw water sedimentation pond to ensure that water is still produced during prolonged drought condition. The company must be absolutely committed to not allowing the water source disputes.

283. The mechanism described below is to solve claims related to relocation and resettlement of project's community. As a guideline, any complaints to any project's aspects will be solved through negotiation to get agreement. Complaints will be submitted toward 3 level of entities: First through commune/ward's PC, then the City's PC and finally through PPC. If an agreement was not reach, then they will be law court as the final method. WASECO will bear all administrative and legal cost arising in such complaint solving processes.Complaints will conducted through 3 steps before they will be law court as the final method. WASECO will be bear all administrative and legal cost arising in such complaint solving processes.

284. The first stage venue for raising and resolving complaints and grievances is the Commune People's Committee (CPC). An aggrieved party may bring its complaint or petition before any member of the Commune People's Committee, either through the village chief or directly to the CPC, in writing or verbally. Grievances may also be raised during follow-up consultations and interviews with local residents during construction. It is incumbent upon said member of CPC or the village chief to notify the CPC about the complaint. The CPC will then meet personally with the complainant and will have 15 days after the lodging of the complaint to resolve the complaint. The committee may obtain the assistance of the Nghe An Environmental Protection Agency in evaluating the technical basis of complaints related to environmental impacts. The CPC secretariat will be responsible for documenting and keeping a record of all complaints that are lodged with the committee.

285. If not resolved in the first stage above, the second venue for grievances is the District People's Committee (DPC). That is, if after 15 days the aggrieved party or complainant does not hear from the CPC, or if the complainant is not satisfied with the decision taken on the complaint, the affected party may bring the case, either in writing or verbally, to any member of the DPC or the District CRC. The DPC in turn will have 15 days following the lodging of the complaint to resolve the case. The DPC secretariat is responsible for documenting and keeping a record of all complaints that are lodged with the district committee.

286. The third stage is the Provincial People's Committee (PPC). If after 15 days the aggrieved and affected party does not hear from the District People's Committee, or if the complainant is not satisfied with the decision taken with regard to the complaint, the case may then be brought, either in writing or verbally, to any member of the PPC or the Provincial CRC. The PPC has 15 days within which to resolve the complaint to the satisfaction of the concerned parties. The PPC secretariat is responsible for documenting and keeping a record of all complaints lodged with the committee.

287. In the event that the grievance remains unresolved even after being raised at the level of the Provincial People's Committee, the final resort is the Court of Law Arbitrates. Specifically, if after 15 days following the lodging of the complaint with the PPC, the aggrieved party does not hear from the Provincial CRC, or if the complainant is not satisfied with the decision taken on the complaint, the case may then be brought to a court of law for adjudication.

## VIII. ENVIRONMENTAL MANAGEMENT PLAN

288. The environmental impacts and mitigation measures for the proposed project were described in Section D.2 above. This section summarizes the significant impacts and mitigation measures with attention to key items to be monitored, the implementation set-up and assignment of responsibility, and the required budget.

### A. Institutional Arrangement and Responsibilities

289. The project will be implemented under the Bac Giang People's Committee as the Executing Agency and the WASECO as the project implementing agency. A Project Management Unit (PMU) will be created to supervise the implementation, on behalf of WASECO, of the capital investments related to the water supply project. The creation of the PMU will follow regulation of NAPC. Circular 03/2007/TT-BKH issued in March 2007 provides guidelines on the organizational structure and function of the PMU.

290. The PMU will have two main operating groups: one for technical and administration matters, and another for planning and finance. The technical and administration group will be responsible for the detailed engineering and preparation of construction plans, and for construction monitoring. The planning and finance group will be responsible for overseeing the overall procurement process (starting from preparation of bid documents for specific works, to bid evaluations and recommendation of award, and up to payment for completed works) as well as for the overall financial monitoring of the project.

291. The PMU will be responsible for fulfilling the environmental requirements of the project, in particular for incorporating the mitigation measures and safeguards identified in this report in the detailed engineering design of the pipelines, WTP and distribution network, as well as in the bid documents and construction contract documents. The PMU will also be responsible for commissioning water and air quality sampling activities, undertaking environment-related investigations that may arise during implementation (in coordination with the DoNRE's Environment Protection Center), and responding to environment or nuisance-related complaints from residents or businesses affected by the project works.

292. Key duties of the PMU are summarized as follows:

- With Detailed Design & Supervision Consultant (DDSC), review and update the EMP during detailed design and engineering phase to ensure EMP meets detailed subproject designs;
- As part of the EMP update, ensure that public consultations that continue through subproject implementation document concerns of stakeholders situated downstream of intake points or in-stream construction sites;
- Ensure safeguard requirements of the final EMP are adequately described in the bidding documents (instruction to bidders) so that contractors can prepare their respective site-specific CEMP[1] based on the final EMP, and ensure criteria for evaluating contractor bids and awarding construction packages include relevant safeguard requirements of the final EMP;
- Ensure construction contractors successfully implement impact mitigation measures of EMP as part of their CEMPs ;
- Coordinate with the DoNRE Environment Protection Center on regulatory compliance issues (e.g., for water quality in rivers affected by construction

[1] Contractors Environmental Management Plan

drainage or erosion from storage areas for excavated soil, noise and vibration from construction sites, sanitation in workers campsite, etc.);

- Prepare terms of reference for the military to conduct surveys to detect unexploded ordnance, and ordnance disposal if necessary;
- Advise the PMU director on environment-related concerns arising during project construction, and recommend corrective measures;
- Disseminate to stakeholders the results of environmental monitoring and implementation of safeguards, especially among HHs or small businesses near the construction sites;
- Include monthly contractor reports in quarterly status reports to CLWACO on status of EMP & environment safeguards, and public stakeholder issues during construction phase of subproject; and
- Prepare ToRs for EMA (see below) for implementation of monitoring plan of EMP, and for assistance with follow-up interviews and consultations with public stakeholders on issues and concerns arising during project construction

293. A Detailed Design and Supervision Consultant[2] (DDSC) who will assist with detailed designs of subproject, and update EMP to ensure EMP meets the final subproject designs. The ADB is responsible for monitoring to ensure subproject meets the environmental safeguards of the SPS (2009).

294. An Environmental Monitoring Agency (EMA) will be requisitioned to provide environmental monitoring support during project construction (using as baseline the environment survey that was conducted as part of this IEE), and to conduct follow-up consultations and interviews with local residents to identify concerns or grievances arising during construction.

295. A sub-group under the PMU would be designated to handle environment and public safety concerns. Its main duties are to:

a. Oversee the implementation of the safeguards related to handling of spoils, water quality protection, public nuisance impacts, unexploded ordnance survey, and public safety;

b. Coordinate with the Bac Giang town's PC on regulatory compliance issues (for water quality in streams affected by construction drainage or erosion from storage areas for excavated soil, noise and vibration from construction sites, sanitation in workers campsite, etc.);

c. Check that the safeguards are adequately addressed in the bidding documents (instruction to bidders), and in the evaluation criteria for awarding contracts;

d. Prepare terms of reference (ToR) for the survey of the pipeline route to detect unexploded ordnance(if present in the pipeline work areas);

e. Prepare ToR for the conduct of water and air quality sampling, including follow-up interviews with local residents on issues and concerns arising during project construction;

f. Advise the PMU director on environment-related concerns arising during project construction, and recommend corrective measures;

[2] DDSC contract expected to include construction supervision.

g. Disseminate to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among HHs or small businesses near the construction sites;

h. Prepare a quarterly status reports on environment and public safety protection to be submitted (through the PMU director) to the PC.

296. Monitoring compliance with the safeguards in the construction phase - especially with the implementation of the safeguards provided for in the construction contract, as recommended in this report - will be put to task the construction supervisor which can be assigned to WASECO (and supervised by the PMU). The compliance monitoring and auditing will be fully documented, and the findings and recommendations will be sent immediately to WASECO. During the operation phase, WASECO will be responsible for the protection and monitoring of effluent, and the results will be reported to the Bac Giang town PC.

297. Town PC will conduct monitoring and random testing environment before, during and after construction, as well as in urgent cases. If any unusual case found, Town's PC can ask for payment of fines and the suspension notice with a specific time limit for responsible unit. If a claim is formally received from the public through the PC, Town's PC will conduct verification, as described in claim solving procedures.

298. Within three months after completion of construction or no later than a year, an environmental monitoring and audit report of the completion of the project's components will be prepared by an eligible environmental research institute, for example Environment and Natural Resource Engineering One member Co., Ltd. This report will be reviewed and approved by the Town's PC and submitted to ADB.

299. The environmental monitoring, including environmental benefits monitoring, will be included in project preparation management system (PPMS) for the project. Backed by an local environmental specialist, the PMU will be responsible for analysing and unified data through its information management system. The PPMS will be designed to permit adequate flexibility to adopt the remedial action regarding project design, schedules, activities and development impacts. Initially, the PMU and consultants will complete a comprehensive PPMS procedures to systematically generate data inputs and outputs of the project components and environmental agreements. Socioeconomic indicators concerned will be used to assess the impact of the project. PMU will refine PPMS framework, confirm objectives achieved, set up detailed monitoring and recording arrangements, and establish systems and procedures no more than 6 months after loan's effect.

## B. Summary of Potential Impacts

300. The key potential impacts are primarily associated with the construction phase of the project. As previously seen, the potential impacts are summarized in Table 29.

**Table 30. Summary of Key Potential Impacts from IEE**

| Construction Phase |
|---|
| 1) Excavation work for the intake, the pipeline trenches and the basin will produce spoil; heaps of excavated soil beside the trench could obstruct community access, and erosion from spoil storage areas could silt up nearby streams and drains. Dry heaps could cause dust nuisance. Soils from specific areas could be contaminated. |

| |
|---|
| **Construction Phase** |
| 2) Obstruction to traffic flow, partial and complete, during raw water pipeline construction, exacerbated by the narrow road and work spaces:<br>• Local residents could be cut off from the road due to the trench-building;<br>• Increased traffic of dump trucks carrying spoils to and from storage areas;<br>• Air pollution from excavation and transport equipment;<br>• Traffic hazard to pedestrians, especially school children and elderly;<br>• Emergency units could face rerouting delays that could be life threatening for specific cases |
| 3) Nuisance and public safety hazards caused by pipeline excavation and pipe-laying activities in urban areas; |
| 4) Accidental detonation of unexploded ordnance (UXO) during pipeline excavations |
| **Operation Phase** |
| 5) Hazard created by water treatment process chemicals with chlorine being the most hazardous. |
| 6) Disposal of water treatment sludge and wastes from WTP operation. |
| 7) Increase in the volume of municipal wastewater generated. |

### C. Mitigation Plan

301. The mitigation plan in Table 30 addresses the environmental issues and concerns that were raised at the stakeholder meetings during the IEE.

302. The mitigation plan identifies responsible parties, location, and indicative costs, and timing. The mitigation plan combines the construction phase activities common to all components while highlighting activities and mitigations specific to a single component. The mitigation plan needs to be updated to meet the detailed designs of the subproject. Monitoring specifications described in Table 31 focuses on the potentially adverse environment-related impacts, based on the assessment presented in Chapter D. Benefits associated with providing adequate and safe water supply will be monitored within the project's overall design framework (i.e., the project logical framework).

## Table 31. Environmental Impact Mitigation Plan

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| ***Pre-construction Detailed Design Phase*** | | | | | | | | |
| Confirmation of required resettlement and temporary relocations | No community impacts | 1. Affected persons well informed well ahead of project implementation. | At intake and sedimentation basin at Thuong river, along raw water pipeline, at WTP & along distribution network. | Before subproject implemented | See resettlement plan | See resettlement plan | WASECO / PMU[3] | Resettlement committees |
| Disclosure, & engagement of community | No community impacts | 2. Implement information disclosure and activate grievance redress mechanism (see IEE) | At all construction sites. | Beginning of subproject | Quarterly | No marginal cost[4] | WASECO | PMU |
| GoV approvals | No negative impact | 3. Notify DoNRE of project initiation to ensure GoV EIA requirements approved , and obtain required project permits and certificates. | Entire subproject | Before construction | As required | No marginal cost | PPC & DDSC[5] | PMU |
| Detailed designs | Minimize negative environmental | 4. Complete detailed designs of: **1)** raw water intake, sedimentation basin, PS and pipeline from Thuong river to Phuc Ha WTP; **2)** new Phuc Ha WTP; and **3**) treated distribution network that incorporate the following:<br>a) updated review of raw water sources at Thuong river to ensure that sufficient and sustainable supplies of treatable raw water will be available to water supply systems long after commissioning stage;<br>b) re- confirm assertion of IEE that no critical habitat, rare or endangered flora or fauna, or cultural property or values will be affected by any component of the water supply systems;<br>c) minimal acquisition of agricultural land<br>d) no or minimal disruption to water supply, | (a-e), Entire subproject area: 1) raw water intake, basin, PS & pipeline corridor; 2) Phuc Ha WTP; and Treated water distribution network | Before construction initiated | Once with detailed designs documents | No marginal cost | WASECO / DDSC | PMU |

[3] Project Management Unit under WASECO; identified as Project Management Board (PMB) in IEE
[4] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors
[5] Detailed Design & Supervision Consultant

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | impacts | utilities, and electricity with contingency plans for unavoidable disruptions; and<br>e) Final review of ability for wastewater infrastructure to accommodate the increased wastewater that will be produced. | | | | | | |
| EMP | Minimize negative environmental impacts | 5. Update all mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs.<br>6. Identify any new potential impacts of project and include in EMP.<br>7. Submit updated EMP with new potential impacts to ADB to review.<br>8. For the three components of subproject develop individual environmental management sub-plans for: **a)** Securing GoV approvals; **b)** UXO survey & removal; **c)** Forest clearing, tree/ vegetation removal, & site restoration; **d)** Civil works; **e)** Cultural chance finds; **f)** Contaminated spoil identification & disposal; **g)** Construction materials acquisition, transport, & storage including borrow pit management; **h)** Erosion & river sedimentation control; **i)** Construction site drainage; **j)** Noise, dust & NOx, SOx, CO, $CO_2$ emissions; **k)** Worker camp operation; **l)** Solid and liquid waste disposal; **m)** Hazardous chemical & waste management; **n)** Construction & urban traffic (especially along raw water pipeline); **o)** Utility and Power Disruption; **p)** Worker and public Safety (especially along raw water pipeline); **q)** Raw water quantity & quality sustainability; **r)** Training & capacity development plan; **s)** WTP chemicals & sludge management; and **t)** Treated water quality management. | Entire subproject | In parallel with completion of detailed designs | Once, as part of detailed design phase | No marginal cost | WASECO / DDSC | PMU |
| Develop bid | No negative | 9. Ensure the EMP is included in contractor tender documents to enable contractors to develop their CEMP[6], and that tender documents specify that implementation of CEMP must be | All project areas | Before | Once for all | No marginal | WASECO / DDSC | PMU / DDSC |

[6] Contractors Environmental Management Plan

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| documents | environmental impact | included in cost estimates.<br>10. The environmental management sub-plans identified in 11) above should be identified in the appropriate contractor tender documents, for the contractor to detail into CEMPs for their bidding documents.<br>11. Specify in bid documents that contractor must have experience with implementing EMPs, and/or provide staff with EMP experience. | | construction begins | tenders | cost | | |
| UXO survey | Injured worker or public | 12. Ensure military is consulted and clears areas where necessary. | All construction sites. | Before any clearing or excavation | Once | See Monitoring Plan below | PPC & military | military |
| Training & capacity development | No negative environmental impact | 13. Develop and schedule training plan for WASECO / PMU staff to be able to fully implement EMP, and manage implementation of mitigation measures by contractors.<br>14. Create awareness and training plan for later delivery to contractors whom will implement mitigation measures. | For all project areas | Before construction begins | After each training session | No marginal cost | DDSC | DDSC / WASECO |
| Procurement of Contractor(s) | No negative environmental impact | 15. Ensure winning contractor bid(s) include a CEMP that addresses items 8 – 11 of the EMP" section above. | All project areas | Before contracts signed | Once | No marginal cost | WASECO / DDSC | WASECO / DDSC |
| Recruitment of workers | Community mischief, & sexually transmitted disease | 16. Use local workers as much as possible, reducing #s of migrant worker | For all work locations | Throughout construction phase | After worker hiring stages | No marginal cost | WASECO / DDSC | Contractor's bid documents |
| ***Construction Phase –***<br>***General Mitigations for all Components of Subproject*** | | | | | | | | |
| Initiate EMP & sub-plans, | Prevent or minimize impacts | 17. Initiate the EMP including individual management sub-plans for the different types of potential impacts identified in pre-construction phase. See sub-plan implementation guidance below. | For all construction sites | Beginning of construction | Once | No marginal cost | WASECO / DDSC | PMU & contractors |
| Obtain & | Prevent or | 18. Contractors to comply with all statutory | For all | Beginning of | Once | No marginal | WASECO / DDSC | PMU & contractors |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| activate construction permits and licenses | minimize impacts | requirements set out by DoNRE for use of construction equipment, hazardous waste & chemicals management, and operation of construction plants, e.g., concrete batching. | construction sites | construction | | cost | | |
| Worker camp operation | Pollution and social problems | 19. Locate worker camps away from human settlements.<br>20. Ensure adequate housing and waste disposal facilities including pit latrines, garbage cans and reclycling bins if services are available.<br>21. Exceeding prepared food should be offered to local charity (shelters/orphanage/food bank, temple).<br>22. A solid waste collection program must be established and implemented that maintains a clean worker camps<br>23. Locate separate pit latrines for male and female workers away from worker living and eating areas.<br>24. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times.<br>25. Worker camps must have adequate drainage.<br>26. Local food should be provided to worker camps. Guns and weapons not allowed in camps.<br>27. Transient workers should not be allowed to interact with the local community. HIV Aids education should be given to workers.<br>28. Preservatives should be provided if such practice does not interfere with local belief or customs.<br>29. Camp areas must be restored to original condition after construction completed. | All worker camps | Throughout construction phase | Monthly | No marginal cost | DDSC & PMU | contractor |
| Training & capacity | Prevention of impacts through education | 30. Implement training and awareness plan for WASECO / PMU (Environmental staff) and contractors. | PMU offices, construction sites | Beginning of construction | After each event | No marginal cost | DDSC | DDSC & PMU |
| Tree and vegetation removal, and | Damage or loss of trees, vegetation, and | 31. Restrict tree and vegetation removal to within designated RoWs.<br>32. Within RoWs minimize removals, and install | All construction sites. | Beginning and end of project | Monthly | No marginal cost | DDSC / PMU | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| site restoration sub-plan | erosion of landscape | protective physical barriers around trees that do not need to be removed.<br>33. All RoWs to be re-vegetated and landscaped after construction completed. Consult forestry department to determine the most successful restoration strategy and techniques.<br>34. Recuperate tree logs and make them available for local use. | | | | | | |
| Civil works | Degradation of terrestrial resources | 35. All construction sites should be located away forested, plantation, & agricultural areas as much as possible.<br>36. No unnecessary cutting of trees.<br>37. All construction fluids such as oils, and fuels should be stored and handled well away from forested and plantation areas.<br>38. No waste of any kind is to be discarded on land or in forests/plantations. | All construction sites | Throughout construction phase | Monthly | No marginal cost | DDSC & PMU | contractor |
| Civil works | Degradation of water quality & aquatic resources | 39. Minimize earthworks & final area of foundation for intake in Thuong river.<br>40. Thuong river pipeline placement should be done during dry season.<br>41. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion.<br>42. Plastic tarps should be used to cover piles to avoid drying and erosion of the piles.<br>43. Earthworks should be conducted during dry periods.<br>44. All construction fluids such as oils, and fuels should be stored and handled well away from surface waters.<br>45. No waste of any kind is to be thrown in surface waters.<br>46. No washing or repair of machinery near surface waters.<br>47. Pit latrines to be located well away from all surface waters.<br>48. No unnecessary earthworks in or adjacent to all water courses. | All construction sites | Throughout construction phase | Monthly | No marginal cost | DDSC & PMU | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | | 49. No aggregate mining from Thuong river, or from nearby lakes.<br>50. All existing irrigation ditches, canals and channels to be protected the same way as rivers and lakes. | | | | | | |
| Cultural chance finds | Damage to cultural property or values & chance finds | 51. As per detailed designs all civil works should be located away from all cultural property and values including cemeteries and pagodas.<br>52. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds.<br>53. Upon a chance find all work stops immediately, find left untouched, and PMU and CPC notified. If find deemed valuable, provincial cultural authorities must be notified.<br>54. Work at find site will remain stopped until authorities allow work to continue. | All construction sites | At the start , and throughout construction phase | Monthly | No marginal cost | DDSC & PMU | contractor |
| Construction materials acquisition, transport, and storage sub-plan | Pollution, injury, increased traffic, disrupted access | 55. All borrow pits and quarries should be approved by DoNRE.<br>56. Select pits and quarries in areas with low gradient and as close as possible to construction sites.<br>57. Required aggregate volumes must be carefully calculated prior to extraction to prevent wastage.<br>58. Pits and quarries should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural property or values.<br>59. Although it should be avoided at all costs, if aggregate mining from fluvial environments is required small streams and rivers should be used, and dry alluvial plains preferred.<br>60. All topsoil and overburden removed should be stockpiled for later restoration.<br>61. All borrow pits and quarries should have a fence perimeter with signage to keep public away.<br>62. After use pits and quarries should be | For all construction areas. | Throughout construction phase | Monthly | No marginal cost | DDSC / PMU | Contractor(s) |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | | dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original non-organic overburden excavation spoils.<br>63. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting.<br>64. Define & schedule how materials are extracted from borrow pits and rock quarries, transported, and handled & stored at sites.<br>65. Define and schedule how fabricated materials such as steel, wood structures, and scaffolding will be transported and handled.<br>66. All aggregate loads on trucks must be covered.<br>67. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non traffic areas. | | | | | | |
| Excavation spoil management sub-plan | Contamination of land and surface waters from excavated spoil | 68. Uncontaminated spoil to be disposed of in DoNRE-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified.<br>69. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, or on/near any other culturally or ecologically sensitive features including wetlands such as swamps.<br>70. Where possible spoil should be used at other construction sites, or disposed in spent quarries or borrow pits.<br>71. A record of type, estimated volume, and source of disposed spoil must be recorded.<br>72. Contaminated spoil disposal must follow GoV regulations including handling, transport, treatment (if necessary), and disposal.<br>73. Suspected contaminated soil must be tested, and disposed of in designated sites identified by DoNRE as per GoV regulations.<br>74. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity. | All excavation areas | Throughout construction phase | Monthly | No marginal cost<br><br>Testing of contaminated soil (See Monitoring Plan below) | DDSC, PMU & DoNRE | Contractor<br><br>DoNRE |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| Construction Drainage sub-plan | Flooding from loss of drainage & flood storage | 75. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding.<br>76. Manage to not allow borrow pits and quarries to fill with water. Pump periodically to land infiltration or nearby water courses.<br>77. Install temporary storm drains or ditches for construction sites.<br>78. Ensure existing road & street drains do not become plugged with construction waste .<br>79. Protect surface waters from silt and eroded soil. | All areas with surface waters | Design & construction phases | Monthly | No marginal cost | DDSC & PMU | contractor |
| Solid and liquid construction waste sub-plan | Contamination of land and surface waters from construction waste | 80. Management of general solid and liquid waste of construction will follow GoV regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force.<br>81. Areas of disposal of solid and liquid residual matter to be determined by DoNRE.<br>82. Disposed of residual matter should be catalogued for type, estimated weigh, and source.<br>83. Construction sites should have large garbage bins.<br>84. A schedule of solid and liquid residual matter pickup and disposal must be established and followed that ensures construction sites are as clean as possible.<br>85. Solid residual matters should be separated and recyclables sold to buyers in community.<br><u>Hazardous Waste</u><br>86. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow GoV regulations.<br>87. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents)<br>88. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good | All construction sites and worker camps | Throughout construction phase | Monthly | No marginal cost | DDSC, PMU, & DoNRE | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | | condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors.<br>89. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.<br>90. During construction, a prevention kit consisting of heavy weight oil only absorbent and / or cat litter should be available to prevent infiltrations much as possible. | | | | | | |
| Noise and dust sub-plan | Dust<br>Noise | 91. Regularly apply wetting agents to exposed soil and construction roads especially in high density areas.<br>92. Cover or keep moist all stockpiles of construction aggregates, and all truckloads of aggregates.<br>93. Minimize time that excavations and exposed soil are left open/exposed. Backfill asap.<br>94. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving.<br>95. Maintain equipment in proper working order<br>96. Replace unnecessarily noisy vehicles and machinery.<br>97. Vehicles and machinery to be turned off when not in use.<br>98. Construct temporary noise barriers around excessively noisy activity areas where possible and if the impacts of constructing such a barrier is lesser then the noise impact itself. | All construction sites. | Fulltime | Monthly | No marginal cost | DDSC & PMU | contractor |
| Utility and power disruption sub-plan | Loss or disruption of utilities and services such as water supply and electricity | 99. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected.<br>100. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages.<br>101. Contact affected community to inform them of planned outages.<br>102. Try to schedule all outages during low use time | All construction sites. | Fulltime | Monthly | No marginal cost | DDSC, PMU & Utility company | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | | such between 24:00 and 06:00. | | | | | | |
| Erosion sub-plan | Land erosion | 103. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas.<br>104. Earthworks should be conducted during dry periods.<br>105. Maintain a stockpile of topsoil for immediate site restoration following backfilling.<br>106. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready.<br>107. Re-vegetate all soil exposure areas asap. | All construction sites | Throughout construction phase | Monthly | No marginal cost | DDSC & PMU | contractor |
| Worker and public safety sub-plan | Public and worker injury, and health | 108. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites.<br>109. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites.<br>110. Worker and public safety guidelines published by MoLISA should be followed.<br>111. Population near blast areas should be notified 24 hrs ahead, and evacuated well before operation. Accepted GoV blast procedures and safety measures implemented.<br>112. Speed limits should be imposed on all roads used by construction vehicles.<br>113. Standing water suitable for disease vector breeding should be filled in.<br>114. Worker education and awareness seminars for construction hazards should be given. A construction site safety program should be developed and distributed to workers.<br>115. Appropriate safety clothing and footwear should be mandatory for all construction workers.<br>116. Adequate medical services must be on site or nearby all construction sites.<br>117. Drinking water must be provided at all construction sites. | All construction sites. | Fulltime | Monthly | No marginal cost | DDSC & PMU | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| | | 118. Sufficient lighting be used during necessary night work.<br>119. All construction sites should be examined daily to ensure unsafe conditions are removed. | | | | | | |
| Construction and local vehicle traffic sub-plan | Traffic disruption, traffic block, accidents, public injury | 120. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights at all construction locations.<br>121. Post speed limits, and create dedicated construction vehicle roads or lanes.<br>122. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads.<br>123. Increase the number of pedestrian crossings away from construction areas.<br>124. In the case that alternate routes for pedestrian is not possible, provide escort through the work site.<br>125. Increase road and walkway lighting.<br>126. Organize the dump trucks travelling to avoid as much as possible the circulation of empty loads on the roads.<br>127. Provide alternate routes and / or work planned locations to help emergency response units to plan their alternate routes | All construction sites | Fulltime | Monthly<br>Weekly | No marginal cost | DDSC & PMU | contractor |
| ***Specific Mitigations for Construction of Intake, PS and Raw Water Supply Pipeline*** | | | | | | | | |
| Construction of pipeline | Minimal negative environmental impacts | 128. Special attention to be given to sub-plans identified item #8 and 107 to 109 above as they apply to the intake, SP and raw water pipeline on the banks of Thuong river. Specific attention to be given to the protection of the following values:<br>• a) erosion through Thuong river new intake installation & water quality of Thuong river; b) public & worker safety; and c) traffic and community/commercial disruption along to WTP. | Pipeline corridor | During construction | Monthly | No marginal cost | DDSC / PMU | contractor |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| ***Specific Mitigations for Construction of Phuc Ha WTP & Treated Water Distribution Network*** | | | | | | | | |
| Construction of WTP | Minimal negative environmental impacts | 129. Mitigation measures to address potential impacts of Phuc Ha WTP are all addressed by the general subproject mitigations listed above. | Land around WTP site | During construction | Monthly | No marginal cost | DDSC / PMU | contractor |
| Construction of treated water distribution network | Minimal negative environmental impacts | 130. Mitigation measures to address potential impacts of distribution network are addressed by the mitigations identified for the raw water pipeline above. | End user property, roads, and public area | During construction | Monthly | No marginal cost | DDSC / PMU | contractor |
| | | | | | | | | |
| ***Post-construction Operation of Water Supply System*** | | | | | | | | |
| Treated water supply | Unsustainable quantity or quality of treated water | 131. Develop and implement O&M manual for all equipment and operations of WS system which includes regular maintenance of treatment system components, and materials supply to ensure treated water production ($m^3$/day) always meets WTP design specifications. Incorporate contingency and back-up plans for planned and unplanned system shutdowns.<br>132. Establish a regular treated water quality monitoring program to ensure the quality of treated water meets original WTP design specifications. Incorporate contingency and response plans to address episodes of decreased treated water quality, including public notification. (See Environmental Monitoring Plan below).<br>133. As part of #131 coordinate with Dept of Health for them to periodically monitor treated water quality to ensure it meets potable quality standards | Entire WS system<br>At WTP outlet and at select locations along distribution network | Quarterly, and as needed | As needed | No marginal cost | WASECO / DDSC | WASECO<br>EMA / DoH |
| Operation of raw & treated water pipelines | Local flooding from ruptures | 134. As part of implementation of O&M manual for entire WS system instate a regular inspection program of all pipeline networks starting at intake and basin at Thuong river to the PS to the raw pipeline, and then to WTP and then entire distribution network with focus on junctions and end-user connections. | At all pipeline locations | Quarterly, and as needed | As needed | No marginal cost | WASECO / DDSC | WASECO |

| Project Activity | Potential Impact | Proposed Mitigation Measure | Location | Timing | Reporting | Estimated Cost (USD) | Responsibility | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Supervision | Implementation |
| Operation of WTP | Chemical spills, and pollution from solid and domestic waste | 135. As part of O&M manual provide clear methods and procedures for safe handling and storage of planned treatment chemicals defined by Alum, soda, and chlorine in designated chemical house and chlorine house on WTP property, including spills action plan.<br>136. With O&M manual define and implement a formal solid and domestic waste collection and disposal protocol for all WTP activities. | At WTP | Continuously | As needed | No marginal cost | WASECO | WASECO |
| Production of WTP sludge | Contamination of environment | 137. Review and clarify with DN DoNRE the appropriate landfill location to dispose of the planned sludge produced at the WTP.<br>138. Ensure sludge is covered when transported to designated landfill.<br>139. Never dump or temporarily store sludge on lands outside landfill site, WTP property, or near water courses.<br>140. Develop and implement regular sludge quality monitoring to document sludge quality (See Environmental Monitoring Plan) | At WTP | Continuously | As needed | No marginal cost | WASECO / DoNRE | WASECO |
| Production of treated water | Wastewater production too much for city wastewater management | 141. Review and clarify wastewater loads generated from treated water from Bac Giang and Phuc Ha WTP can be handled by current and planned future capacity wastewater collection and treatment systems for Bac Giang. | At WTP | Periodically | As needed | No marginal cost | WASECO / DoNRE | WASECO |
| Operation of entire WS system, | Worker and public injury | 142. Educate workers in workplace safety of WS system operation according to MoLISA regulations. Prevent public access to the intake and its SP and WTP property, Thuong river intake area, and all pipeline areas with fencing and appropriate signage if possible.<br>143. Enforce WTP truck drivers to follow speed limits on roads and highways. Provide adequate signage informing public of WTP truck traffic routes, and pipelines service routes.<br>144. Ensure all WS system vehicles in good working order. | WTP and all pipeline property<br>WTP area & road to landfill site<br>All facilities | Continuously | As needed | No marginal cost | WASECO | WASECO |

## IX. ENVIRONMENTAL MONITORING PLAN

303. Monitoring environmental quality is one of the most important tasks in the management of the environment. Environmental monitoring is an effective tool for managers, professionals to strictly manage the waste sources polluting the environment, adjust the production plans and reduce the costs of recovery, pollution treatment and environmental protection in the most effective way.

304. The goal of the environmental quality management and monitoring program is a continuous collection of information about the change in environmental quality, in order to detect the adverse environmental impacts of the project and suggest recommendations of measures to prevent and minimize pollutions. In addition, the goal of the environmental quality management and monitoring program is to ensure compliance with the mitigation measures outlined in the report of environmental impact assessment, to ensure the proper program of management and the functions of waste management. The environmental management program of the project Construction Investment WTP No. 2 in the city of Bac Giang, Bac Giang province includes the following content:

- Regularly check implementation of occupational safety, prevention of incidents at the site during construction works;
- Monitor and force all construction vehicles to comply with the plan to minimize dust, noise, labor safety, and so on which has set out;
- Implement monitoring programs and force individuals and organizations living and working on the construction site to comply with the general rules of sanitation, fire safety, and so on.
- Implement the measures to reduce and control the environment pollution, prevention of incidents to improve the regional environment in the better.trend.

### A. Compliance Monitoring & Reporting

305. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the project is required as indicated in Table 32.

306. Construction contractors are required to submit brief monthly reports on environmental issues and mitigation activities to the PMU. The PMU must prepare quarterly reports on the EMP to the EA which include input from regular meetings with public stakeholders. The EA must prepare biannual reports on activity and effectiveness of EMP to ADB.

307. Environmental monitoring reports will be prepared in parallel quarterly for the PMU/EA by the monitoring agency. The reports will table all indicators measured from the monitoring plan of EMP, and will include relevant GoV environmental quality standards (i.e., QCVN & TCVN).

308. A template for monitoring process is presented in Annex 3.

## Table 32. Environmental Monitoring Plan

| Environmental Indicators | Location | Means of Monitoring | Frequency | Reporting | Responsibility | | Estimated[7] Cost (USD) |
|---|---|---|---|---|---|---|---|
| | | | | | Supervision | Responsibility | |
| ***Pre-construction Phase – Update Baseline Conditions*** | | | | | | | |
| Update baseline on presence of rare & endangered fauna & flora, and critical habitat that will be affected by raw water pipeline construction and operation. Include aquatic resources of affected reaches of Thuong river | Thuong river intake, PS and pipeline corridor in non-developed areas. | Review of existing data and information supplemented by original surveys as required. | Once | Once | DDSC & WASECO & MB of BN-NR | EMA | Part of the $573 840 compensation regulation by the government |
| Air quality (dust, CO, NOx, SOx, noise, wind, and vibration levels) to supplement baseline air quality data collected during PPTA and reported in IEE<br>Water quality parameters sampled at Thuong river station during PPTA & reported in IEE.<br>Water quality data collected in Thuong river during PPTA & reported in IEE are sufficient. | Representative sites of heavy civil & earthwork including along truck routes<br>At raw water intake at completed Thuong river | Using field and analytical methods described in QCVN and TCVN standards for ambient air and surface water quality sampling & analysis. | One day and one night measurement | One baseline supplement report before construction phase starts | DDSC & PMU | EMA | |
| Inventory of present and past land uses that could cause contaminated soil. | At all excavation sites, including borrow pits | Survey methods described in QCVN and TCVN standards for land use. | Once | Once | DDSC & PMU | EMA | |
| Analysis of soil quality if required from above (heavy metals (As, Cd, Pb, oil & grease, hydrocarbons). | Possible contaminated lands all sites | Use field and analytical methods described in QCVN and TCVN standards for soil quality sampling & analysis. | D): Once if needed | Once | DDSC & PMU | EMA | |
| Presence of UXO | Potentially located throughout project area | Military to survey and sweep affected areas of UXO | Once | Once | WASECO | military | |
| Updated community stakeholder comments & concerns of subproject | Public consultation sites with same stakeholders consulted during IEE | Same format used in IEE for obtaining stakeholder input to subproject | At least once & in conjunction with Grievance Redress Mechanism | For each event | PPC / WASECO | PMU | |

[7] Estimated costs to be updated at detailed design stage

| Environmental Indicators | Location | Means of Monitoring | Frequency | Reporting | Responsibility | | Estimated[7] Cost (USD) |
|---|---|---|---|---|---|---|---|
| | | | | | Supervision | Responsibility | |
| **Construction of intake, Sedimentation Basin, Pumping Station, Raw Water Pipeline, and Phuc Ha WTP, and Treated Water Distribution Network** | | | | | | | |
| **A)** Air quality: dust, CO, NOx, SOx, noise, wind, and vibration levels<br>**B)** Surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, $BOD_5$, temperature, $NH_3$, and other nutrient forms of N & P.<br>**C)** Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons.<br>**D)** Domestic and construction solid waste inside & outside construction sites including worker camps.<br>**E)** Public comments and complaints<br>**F)** Incidence of worker or public accident or injury | A – B): At water quality sites #1 - #4 sampled during PPTA and reported in IEE (Thuong river)<br>C): At sites where contaminated soil is suspected at excavation areas at all project areas<br>D): All construction sites and worker camps<br>E): Using hotline number placed at construction areas<br>F): At all construction areas | A – C : Using field and analytical methods described in QCVN and TCVN standards for ambient air and surface water quality monitoring.<br>Include visual observations of dust and noise from contractor & public reports .<br>D) Visual observation<br>E) Information transferred by telephone hotline number<br>F) regular reporting by contractors/PMU | (A – B): Quarterly during construction periods<br>C) Once before start of excavation<br>D) Monthly<br>E) Continuous public input<br>F) Continuous | Quarterly | (A - D): | | A) $1,500.<br>B) $950<br>C) not determined<br>D) With A-C $470<br>E) Not determined<br>F) No marginal cost |
| | | | | | DDSC / PMU | EMA | |
| | | | | | E & F) & daily observations: | | |
| | | | | | PPC / THOAWASCO | PMU / contractor | |
| **Operation of WTP & Pipeline Network** | | | | | | | |
| Air quality: dust, noise and vibration levels | At WTP | Using field and analytical methods described in QCVN & TCVN standards for ambient air quality monitoring. | Quarterly for 5 years | Biannual | WASECO | | $1,200.00 / yr |
| Worker & public injury associated with WTP & pipeline network<br>A Proteciton equipment for labor;<br>B)Installation of noise prevention | On property of WTP, pipelines, and pump stations | Regular record keeping | Continuously | For each event | WASECO | | No marginal cost<br>A) $560<br>B)2335$ |
| Treated water quality: total & faecal coliform, pH, DO, $NH_3$, $NO_3$, NO, chlorine, PAC, NaCl, and heavy metals (As, Cd, Pb,). | At WTP & random user locations along distribution network | Using field and analytical methods described in QCVN & TCVN standards for water quality monitoring, and parameters of QCVN 14:2008/BTNMT | Biannually, or when public complaint arises | For each event | WASECO / DoNRE / MoH | | Not determined |

| Environmental Indicators | Location | Means of Monitoring | Frequency | Reporting | Responsibility | | Estimated[7] Cost (USD) |
|---|---|---|---|---|---|---|---|
| | | | | | Supervision | Responsibility | |
| WTP solid waste and sludge volumes | Sedimentation Basin at Thuong river and treatment sludge at Phuc Ha WTP | A) Dredging of sludge storage tanks periodically and hiring Bac Giang Urenco for shipping and handling<br>B) construction of a 3 part septic tank for treatment | Continously | Biannually | WASECO | | A)$470/y<br>B) 935$ |
| WTP sludge quality: ToC, heavy metals (As, Cd, Pb,), coliforms, pH, BOD, nutrients (N&P), PAC, chlorine, | After removal from sludge drying building and before disposal at designated landfill. | Using field and analytical methods described in QCVN & TCVN standards for water quality monitoring | Quarterly for 5 years | Biannually | WASECO | | Not determined |
| Public complaints of operation of WTP, drinking water availability & quality, and malfunctions with pipelines (e.g., leaks). | At all sites | Regular record keeping | Continuously | Biannually | WASECO | | Not determined |
| Erosion follow up along the project | At all sites | Photographical record of sloped sites | 1 year after completion, 1 year after correction if needed | Annually, once if no problems are detected | WASECO | | Not determined |
| | Specifically at Thuong river intake | Photographical record of connecting pipe with ground | Biannually and after storm surges | Biannually | | | Not determined |

## B. Environment monitoring program

309. Environmental monitoring program is implemented during construction and operation of the project. The temporary changes include increase of noise, dust, air and water in the region.

310. Measurement, or environmental monitoring is one of the leading and very important functions of the environmental quality management, as well as a very critical part in assessing the environmental impacts of the project. However, in the operational phase of the project, the impacts on the environment are almost negligible, so the monitoring program will be implemented during construction.

### a. Waste monitoring

311. During the period of construction, the waste generated including domestic solid waste and construction waste. Therefore, the project will conduct the monitoring plan of solid waste generated during construction of the project, namely:

• Position of monitoring: Monitoring at 3 locations as follows:

- The construction area;
- The area of the gate;
- The camp area of the construction workers;

• Monitoring Indicators

- The volume of solid waste;
- The basic component of solid waste;
- The process of collection and treatment of solid waste;

• Collection Equipment: At the position of monitoring, the company will put 2 boxes / 1 location for sorting out domestic and construction solid waste, in order to serve the monitoring activity.

• Frequency of monitoring:

Frequency of monitoring for the management of solid waste is done 3 months / time.

### b. Monitoring the air environment

- *Monitoring position*

**Table 33. Positions of sampling air environment monitoring**

| Sign | Location | Coordinate | |
|---|---|---|---|
| | | Latitude | Longitude |
| GSKK1 | Monitoring the air at the raw pumping area | $106^0$17'15" | $21^0$15'07" |
| GSKK2 | Monitoring the air at the clean water treatment station | $106^0$17'11" | $21^0$15'09" |
| GSKK3 | Monitoring the air at the pressure pumping station | $106^0$17'23" | $21^0$15'05" |

- *Monitoring indicators*

**Table 34. Measurement, analysis indicators for air environment**

| No. | Indicators | Applicable codes |
|---|---|---|
| 1 | Temperature, humidity, wind speed, noise, pressure | **QCVN 05:2009/BTNMT** National technical standards for ambient air quality |
| 2 | CO, $SO_2$, $NO_2$, | |
| 3 | Suspended dust (TSP) | |

- *Monitoring frequency:* 6 months/time.

**c. Monitoring the water environment**

- *Monitoring positions*

**Table 35. Monitoring positions for water environment quality**

| Sign | Description of sampling, measurement position | Coordinate | |
|---|---|---|---|
| | | Latitude | Longitude |
| GSNM1 | Surface water in Thuong river far from the raw water pumping station about 50 meters southeast off | $106^0$17'22'' | $21^0$15'04'' |
| GSNM2 | Surface water in the middle of the Lim Xuyen bridge, Song Khe Commune | $106^0$17'16'' | $21^0$15'05'' |
| GSNM3 | Surface water is taken from Thuong river, approximately 20m far from the Sat bridge to the west | $106^0$17'12'' | $21^0$15'10'' |

- *Indicators of measurement, analysis*

**Table 36. Indicators for measurement, analysis of the water environment**

| No. | Indicators | Applicable codes |
|---|---|---|
| 1 | pH; Hardness, DO; TSS; Total solid components; COD; $BOD_5$; $NH_4^+$; $NO_3^-$; $PO_4^{3-}$; $SO_4^{2-}$ | **QCVN 08:2008/BTNMT** National technical regulation on surface water quality |
| 2 | Cu; Fe; Zn; Mn | |
| 3 | Total oil; Coliform | |

- *Monitoring frequency:* 6 months/time.

**d. Monitoring the sliding factors on the river bank of Thuong river**

• *Position monitoring:* Monitoring the elements of sliding, falling, land subsidence, river bank erosion, changes in water level at three positions of the river Thuong

- The area of the Thuong river bank near the pre-sedimentation lake;

- The area of the river bank near the raw water pumping station;

- The area of the river bank near the irrigation water pump station.

• Frequency of monitoring: 6 months / time.

## C. Commitment of project owner

312. Commitment to undertake the measures for waste treatment and minimizing other impacts is outlined in the agreement: During project implementation, the Project Owner is committed to fully implementing the measures for handling waste, mitigating the negative impact on the natural and eco-social environment in the town, specifically as follows: (i) commitment to building wastewater treatment facilities such as BASTAF tanks and portable toilets, ensuring that water quality after going through the treatment system meets the discharge limits for domestic wastewater, preventing surface water and groundwater from being polluted by wastewater; (ii) Commitment not causing air pollution due to transport activities and excavation, not allowing rock and soil spillage into the street, not allowing dust carried by movement of dump trucks on the street causing dust contamination for the HHs residing along the transport routes; (iii) commitment to collecting and handling solid waste in accordance with the provisions of the Decree No. 59/2007/ND-CP dated 09/04 2007 04 on solid waste management; collecting, storing, transporting and handling hazardous wastes in accordance with the Circular No. 9/2012/TT-BTNMT dated 14/4/2011 of the MoNRE on hazardous waste management; (iv) commitment to good management of plant's staff, not allowing conflicts with the local people; (v) commitment to working closely with the local authorities in using water, ensuring security and order, and environmental sanitation.

313. Commitment to achieving the current treatment standard requirements and technical regulation on environment: during construction, the Project Owner is committed to ensuring compliance with the Vietnamese and International standards and regulations on environment, ensuring air quality, surface water, groundwater, sediment and soil, including: (i) QCVN 08:2008/BTNMT National Technical Regulation on Surface Water Quality; (ii) QCVN 09:2008/BTNMT National Technical Regulation on Groundwater Quality; (iii) QCVN 14:2008/BTNMT National Technical Regulation on domestic wastewater; (iv) QCVN 05:2009/BTNMT National Technical Regulation on Ambient Air Quality; (v) QCVN 40:2011/BTNMT National Technical Regulation on Industrial Wastewater; (vi) QCVN 26:2010/BTNMT National Technical Regulation on Noise ; (vii) QCVN 27:2010/BTNMT National Technical Regulation on Vibration.

314. Commitment to undertaking the other measures for environmental protection under the provisions of the current law of Vietnam: The Project Owner strictly committed to the Environmental Protection Law adopted by the National Assembly on 29/11/2005 and Decree No. 80/ND-CP dated 09/08/2006 of the Prime Minister guiding the implementation of environmental protection law; Decree No. 21/ND-CP dated 28/02/2008 of the Prime Minister on revision and supplement of some articles of Decree 80/ND-CP dated 09/08/2006 and Decree No. 29/2011/ND-CP dated 18/04/2011 of the Government on strategic environmental impact assessment, environmental impact assessment and commitment to environmental protection; Circular No. 26/2010/TT-BTNMT dated 18/7/2010 of the Ministry of Natural Resources and Environment guiding the implementation of articles of Decree No. 29/2011/ND-CP dated 18/4/2011 of the Government on environmental impact assessment, environmental impact assessment and commitment to environmental protection.

315. In a more described way, the project owner agrees :

- To implement strictly the environmental protection laws, national strategies and action plans, state standards on environmental protection during construction activities,

construction of pipelines for clean water transmission and operation of water treatment plants, the current regulations on environmental management, prevention, control, treatment, remedy of environmental pollution, degradation and problems.

- That the construction of the water transmission pipelines based on the master plan for Bac Giang city under the general plan of Bac Giang province, ensure not to influence the environment around renovated and newly constructed clean water transmission pipelines.
- In the process of construction and operation of clean water transmission pipe system, the measures to minimize environmental pollution will be applied, especially the methods of construction and modern technology will be employed to reduce at the lowest level the impacts on the natural environment and the lives of neighborhood residents.
- To perform fully the measures to minimize adverse impacts, prevent and response environmental incidents described in Chapter IV.
- Absolutely to comply with the standards and regulations of Vietnam on the current design and construction of urban water supply systems.
- To comply with the regulations, standards on the environment, in particular:
  - Raw water after handling and transmission is distributed into the distribution network to ensure the water quality standards for domestic use according to the decision by the Ministry of Health No. 01/2009/QD-BYT;
  - Emissions in the area of construction will be controlled so as not to affect the ambient air quality standards QCVN 05, 06: 2009/BTNMT;
  - Noise and transport vehicles from the construction site and when the project will go into operation must be complied with the standards no. TCVN 5948-1998 and no. TCVN 5949-1998 Noise in the residential area, the maximum noise permitted;
  - To the implementation in accordance with the provisions of the laws on collection, classification, storage and handling of solid waste. In particular, hill leveling to create the construction ground of the water plant, road digging, and landfilling for the clean water transmission pipe network will generate a large volume of rock and soil. The disposal is made in the direction of the Municiple People's Committee of Bac Giang city and Bac Giang Province;
  - Decree 201/2013/ND-CP on stricter regulations for effective water resource management including associated consultation of communities.
  - Commitment to restore the status of sidewalks, trees, roadways after construction;
  - To have a close collaboration between investors, the communal people’s committees in informing the project progress during the phases of site clearance and construction of the project items so that people in the project area to actively coordinate in implementation;
  - To perform fully the program of environmental monitoring including monitoring the quality of air and water environments, be responsible for reporting to environmental

management agency, which is the Department of Natural Resources and Environment of Bac Giang province;

- To train, raising awareness and responsibility of the Environmental Protection for officials and workers involved operating the water supply system;

– To recommend local authorities, institutions, agencies, departments in association with the project owner to carry out and monitor the implementation of compensation for ground clearance to the affected HHs.

– In order to facilitate the implementation of the project as the plan and schedule, to propose Bac Giang province's DoNRE to review, evaluate and submit the PPC for approval of the environmental impact assessment report.

## X. CONCLUSIONS

316. Through the above results of survey, analysis and assessment of environmental impacts, it is shown that the construction investment project of the water plant no.2 in Bac Giang city, Bac Giang province is a necessary and urgent demand, and brings in a lot of economic - social and environmental benefits for the region, therefore, it has received high consensus of the local authorities and local people. The positive impacts of the implementation, and construction of the water plant with capacity of 25,000 m3/day are to bring out the clean water to most of the communes in Bac Giang city with 100% support and consensus from the residents and local authorities in the project area.

317. However, during preparation, and construction, it may also cause negative impacts to the natural environment and the economic- social conditions of the region. These impacts include the impacts to air quality due to dust, noise and harmful emissions, the impacts on the environment due to waste water by construction workers, stormwater runoff and construction wastewater, the impacts on land the environment due to solid waste and waste water, and so on. These impacts are assessed to be at moderate or negligible level, with temporary nature (during construction). However, the project owner will take reasonable measures to control, reduce the impacts as proposed in the report.

318. For purposes of compliance with ADB environmental assessment guidelines, no additional study or full environmental impact assessment is needed to further assess the potential environmental impacts of the project.

## Annex 1: Overall Project Implementation Schedule

1. Project schedule includes: project preparation and project implementation phases.

- Project preparation phase:
  - Preparation of FS report, basic design and support reporting for ADB's appraisal, PPC approval. Loan negotiation and signing is planned by the end of 2014.

- Project implementation phase:
  - Geological Survey, topographic surveys, connection status;
  - Detailed designs, cost estimate, prepare construction and equipment supply bidding documents.
  - Update of EMP, consultation with downstream communities by the PMU and compliance with GoV regulations;
  - Organization of contractor selection and sign contract;

- : Overall Project Implementation Schedule is presented in the table below:

Table 2: Chart the progress of project implementation

| No | Content | Year / Month | Starting time | 2014 | | | | | | 2015 | | | | 2016 | | | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1st Qarter | 2nd Qarter | 3rd Quarter | 4th Quarter | 1st Qarter | 2nd Qarter | 3rd Quarter | 4th Quarter | 1st Qarter | 2nd Qarter | 3rd Quarter | 4th Quarter | 1st Qarter | 2nd Qarter | 3rd Quarter | 4th Quarter | 1st Qarter | 2nd Qarter | 3rd Quarter | 4th Quarter | 1st Qarter | 2nd Qarter |
| I | Prepare FS (include approval time) | 06 months | 06/2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Updating FS following ADB requierment | 3 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Appraisal the FS by ADB and PPC | 2 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| II | Prepare the Detailed design, Bidding document | 26 months | 11/2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Bidding for Detailed design consultant and prepare the bidding document | 11 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Implementation | 9 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| III | site clearance | 06 months | 07/2015 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IV | construction supervision | 48 months | 07/2015 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Bidding for supervision consultants | 6 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Implementation | 42 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V | Bidding for Construction and Equipment supply | 12 months | 07/2015 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Package 1: Intake work, raw water pumping station and raw water pipeline | 6 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Parkage 2: Water treatment plant No.2 Bac Giang city | 6 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Package 3: Transmission pipeline and distribution pipeline | 6 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V | Construction and Equipment supply | 39 months | 01/2016 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Package 1: Intake work, raw water pumping station and raw water pipeline | 24 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Parkage 2: Water treatment plant No.2 Bac Giang city | 36 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Package 3: Transmission pipeline and distribution pipeline | 36 months | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| vi | commissioning, commissioning and handover | 03 months | 4/2019 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## Annex 2: Minutes of Public Meetings & Pictures

| Date and month | Place | Concerns of the participants |
|---|---|---|
| 14h on January 10, 2011 | Song Khe commune's people committee | ***Content:***<br>- Representative from Project Management Unit introduced targets and social significance of public consultation meetings on the environmental impacts caused by the project;<br>- Representatives of Consulting Unit presented the contents of investment project to build water plant no. 2 in Bac Giang City-Bac Giang Province;<br>- Representative of the consultation Unit presented the environmental impacts caused by the construction and installation of water treatment plant, transmission pipeline networks and water distribution as well as measures to reduce environmental pollution to be applied;<br>- Discussed the issues of the project, the environmental impacts and pollution mitigation measures ;<br>**Concerns of the participants:**<br>- Representation of the People's Committee, Song Khe Commune agreed with the construction of water supply system;<br>- Representative of Song Khe Commune's Fatherland Front Committee agreed with the project;<br>- Representative from the community supported the implementation of the project, suggested project management unit, construction and operation contractors to comply with the mitigation measures of environmental pollution as outlined in the consultation meeting, and agreed with solutions to minimize environmental pollution in the project area; |
| 8h on January 10, 2011 | Tan My commune's people committee | ***Content:***<br>- Representative from Project Management Unit introduced targets and social significance of public consultation meetings on the environmental impacts caused by the project;<br>- Representatives of Consulting Unit presented the contents of investment project to build water plant no. 2 in Bac Giang City-Bac Giang Province;<br>- Representative of the consultation Unit presented the environmental impacts caused by the construction and installation of water treatment plant, transmission pipeline networks and water distribution as well as measures to reduce environmental pollution to be applied;<br>- Discussed the issues of the project, the environmental impacts and pollution mitigation measures ;<br>**Concerns of the participants:**<br>- Representation of the Communal People's Committee agreed with the construction of water supply system; |

| | | |
|---|---|---|
| | | - Representative from the community supported the implementation of the project, suggested the project should be implemented as soon as possible; requested PMU to facilitate local labor recruitment for creating jobs in the local area. |
| 8h on January 11, 2011 | Dinh Tri commune's people committee | ***Content:***<br>- Representative from Project Management Unit introduced targets and social significance of public consultation meetings on the environmental impacts caused by the project;<br>- Representatives of Consulting Unit presented the contents of investment project to build water plant no. 2 in Bac Giang City-Bac Giang Province;<br>- Representative of the consultation Unit presented the environmental impacts caused by the construction and installation of water treatment plant, transmission pipeline networks and water distribution as well as measures to reduce environmental pollution to be applied;<br>- Discussed the issues of the project, the environmental impacts and pollution mitigation measures ;<br>**Concerns of the participants:**<br>- Representation of the communal People's Committee agreed with the construction of water supply system;<br>- Representative of Dinh Tri Commune's Fatherland Front Committee agreed with the project;<br>- Representative from the community supported the implementation of the project; suggested project management unit, construction and operation contractors to comply with the mitigation measures of environmental pollution as outlined in the consultation meeting; and agreed with solutions to minimize environmental pollution in the project area; |
| 14h on January 11, 2011 | Tan Tien commune's people committee | ***Content:***<br>- Representative from Project Management Unit introduced targets and social significance of public consultation meetings on the environmental impacts caused by the project;<br>- Representatives of Consulting Unit presented the contents of investment project to build water plant no. 2 in Bac Giang City-Bac Giang Province;<br>- Representative of the consultation Unit presented the environmental impacts caused by the construction and installation of water treatment plant, transmission pipeline networks and water distribution as well as measures to reduce environmental pollution to be applied;<br>- Discussed the issues of the project, the environmental impacts and pollution mitigation measures ;<br>**Concerns of the participants:**<br>- Representation of the Communal People's Committee agreed |

| | | |
|---|---|---|
| | | with the construction of water supply system;<br>- Representative of Tan Tien Commune's Fatherland Front Committee agreed with the project;<br>- Representative from the community supported the implementation of the project; suggested project management unit, construction and operation contractors to comply with the mitigation measures of environmental pollution as outlined in the consultation meeting; and agreed with solutions to minimize environmental pollution in the project area; |
| 8h on January 12, 2011 | Dong Son commune's people committee | ***Content:***<br>- Representative from Project Management Unit introduced targets and social significance of public consultation meetings on the environmental impacts caused by the project;<br>- Representatives of Consulting Unit presented the contents of investment project to build water plant no. 2 in Bac Giang City-Bac Giang Province;<br>- Representative of the consultation Unit presented the environmental impacts caused by the construction and installation of water treatment plant, transmission pipeline networks and water distribution as well as measures to reduce environmental pollution to be applied;<br>- Discussed the issues of the project, the environmental impacts and pollution mitigation measures ;<br>**Concerns of the participants:**<br>- Representation of the Communal People's Committee agreed with the construction of water supply system;<br>- Representative of Dong Son Commune's Fatherland Front Committee agreed with the project;<br>- Representative from the community supported the implementation of the project; suggested project management unit, construction and operation contractors to comply with the mitigation measures of environmental pollution as outlined in the consultation meeting; and agreed with solutions to minimize environmental pollution in the project area; |

**SOME PICTURES IN COMMUNITY CONSULTATION MEETINGS**


***Community consultation meeting in Dinh Tri commune – Bac Giang city***


***Community consultation meeting in Dong Son commune – Bac Giang city***


***Community consultation meeting in Song Khe commune – Bac Giang city***

***Community consultation meeting in Tan Tien commune – Bac Giang city***

## Phụ lục 1. CÁC VĂN BẢN THAM VẤN CỘNG ĐỒNG

**BIÊN BẢN THAM VẤN CỘNG ĐỒNG**
**VỀ CÁC TÁC ĐỘNG MÔI TRƯỜNG**
**Dự án: Đầu tư xây dựng nhà máy nước số 2 thành phố Bắc Giang tỉnh Bắc Giang**

**1. Thời gian:** 14..h.00., ngày..11...tháng..01..năm 2011

**2. Địa điểm:** Hội trường, Ủy ban nhân dân xã Tân Tiến

**3. Đại biểu tham dự:**

***Đại diện chủ dự án:***

- Ông Hường Xuân Công - PGĐ Cty TNHH MTV CTN Bắc Giang
- .....

***Đại diện đơn vị tư vấn:***

- Ông Nguyễn Trường Huynh - Chuyên gia Môi trường
- Bà Hoàng Kiều Hoa - Chuyên gia Môi trường
- Ông Ngụy Thế Thanh - Cán bộ Kỹ thuật

***Đại diện UBND & UBMTTQ xã:***

- Ông Trần Văn Thắng - CT UBND xã Tân Tiến
- .....
- .....

***Đại diện một số hộ dân sống trong khu vực dự án chịu ảnh hưởng của dự án:***

*(Xem danh sách kèm theo)*

**4. Nội dung cuộc họp:**

- Đại diện Ban quản lý dự án giới thiệu về mục tiêu và ý nghĩa xã hội của cuộc họp tham vấn cộng đồng về các tác động đến môi trường gây ra bởi các dự án;

- Đại diện đơn vị Tư vấn trình bày về nội dung của dự án Đầu tư xây dựng nhà máy nước số 2 Thành phố Bắc Giang - tỉnh Bắc Giang;

- Đại diện đơn vị Tư vấn trình bày tác động môi trường gây ra bởi việc xây dựng và lắp đặt nhà máy xử lý nước sạch, mạng lưới đường ống chuyển tải và phân phối nước cũng như các biện pháp giảm thiểu ô nhiễm môi trường sẽ được áp dụng;

- Thảo luận về các vấn đề của dự án, những tác động môi trường & các biện pháp giảm thiểu sự ô nhiễm.

**5. Những ý kiến của chính quyền địa phương và đại diện của cộng đồng dân cư:**

* Đại diện Uỷ ban nhân dân xã Tân Tiến:

- Đồng ý với việc đầu tư xây dựng hệ thống cấp nước vì sẽ mang lại khả năng cấp nước sạch tốt hơn cho các tổ chức, cá nhân, hộ gia đình sinh sống tại xã Tân Tiến;

- Khuyến khích áp dụng các phương pháp giảm thiểu tác động môi trường trong thời

gian ngắn hạn.

- Đề xuất thi công nhanh, không dàn trải gây ảnh hưởng đến mỹ quan và đời sống của người dân.

- Đưa ra các chế tài mạnh đối với đơn vị thi công nếu không tuân thủ đúng các yêu cầu nêu trong hợp đồng trách nhiệm

- Chấp thuận các giải pháp giảm thiểu các ô nhiễm môi trường tại khu vực dự án mà đơn vị tư vấn môi trường đưa ra và ủng hộ triển khai tại địa phương.

* Đại diện Uỷ ban mặt trận tổ quốc xã Tân Tiến:

- Đồng ý với dự án.

- Đề nghị Ban quản lý dự án lựa chọn đơn vị thi công thi công có đủ năng lực (về tài chính, về con người, về thiết bị, máy móc phục vụ thi công) để thực hiện theo đúng tiến độ đề ra, tránh kéo dài gây ảnh hưởng đến người dân và đảm bảo chất lượng công trình.

- Tham vấn cộng đồng thường xuyên để tìm hiểu các sự cố, hiện trạng và tiến độ thi công và khi vận hành hệ thống.

***Những ý kiến của đại diện các cộng đồng dân cư:***

Bà.Nguyễn..Thị..Hà.....:

- Ủng hộ việc thực hiện dự án;

- Đề nghị Ban quản lý yêu cầu Nhà thầu xây dựng và vận hành hệ thống cấp nước thực hiện đúng các giải pháp giảm thiểu và phòng ngừa ô nhiễm như đã đề ra trong buổi tham vấn cộng đồng hôm nay.

Ông.Nguyễn..Văn..Lí.....:

- Rất mong dự án sớm được thực hiện để toàn bộ người dân trong thị xã được sống trong môi trường trong sạch.

- Đồng ý các giải pháp giảm thiểu các ô nhiễm môi trường tại khu vực dự án mà đơn vị tư vấn môi trường đưa ra.

**6. Ý kiến phản hồi và cam kết từ phía chủ dự án**

Giám đốc Ban quản lý dự án đại diện chủ dự án cảm ơn sự có mặt của chính quyền địa phương, Ủy ban Mặt trận tổ quốc và các hộ dân trong xã Tân Tiến đã tham dự buổi họp này. Đồng thời xin tiếp thu và đồng ý các ý kiến của chính quyền địa phương và cam kết sẽ thực hiện nghiêm túc công tác bảo vệ môi trường tại địa phương trong quá trình thi công và vận hành dự án.

**7. Kết luận cuộc họp:**

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản được lập thành 06 (sáu) bản, có giá trị pháp lý như nhau.

Cuộc họp kết thúc vào hồi 17h30' cùng ngày.

**UBND XÃ TÂN TIẾN**

TM. UBND XÃ TÂN TIẾN
CHỦ TỊCH
**TRẦN VĂN THĂNG**

**UBMTTQ XÃ TÂN TIẾN**

**ĐẠI DIỆN CHỦ ĐỰ ÁN**

CÔNG TY T.N.H.H MỘT THÀNH VIÊN CẤP THOÁT NƯỚC BẮC GIANG

KT GIÁM ĐỐC
PHÓ GIÁM ĐỐC
KS Hoàng Tuấn Công

*Danh sách thành phần tham gia cuộc họp gồm có:*

| STT | Họ và tên | Địa chỉ/ chức vụ | Ghi chú |
|---|---|---|---|
| 1 | Trần Văn Thăng | Chủ tịch UBND xã | |
| 2 | Đỗ Văn Nhiều | cán bộ UBND xã | |
| 3 | Nguyễn Quốc Thận | chủ tịch Hội Nông dân | |
| 4 | Lê Anh Tập | Trưởng Thôn Thanh Cảm | |
| 5 | Đỗ Văn Quế | Trưởng Thôn An Bình | |
| 6 | Nguyễn Văn Cô | Trưởng Thôn Ngã | |
| 7 | Lê Đăng Của | Trưởng Thôn Xuân | |
| 8 | Ngô Xuân Chuyện | Chủ tịch cựu chiến binh | |
| 9 | Đỗ Hà Bắc | Trưởng Thôn Đo | |
| 10 | Nguyễn Thế Nuôi | Trưởng Thôn Văn Giang | |
| 11 | Đỗ Văn Luyện | Trưởng Thôn Tuốc | |
| 12 | Trần Văn Huy | phó chủ tịch UBND. | |
| 13 | Ngô Xuân Phan | CB Giáo thông TL. | |
| 14 | Nguyễn Xuân Quang | CT Mặt trận Cao Thượng | |
| 15 | Hoàng Văn Thiều | Đài truyền | |
| 16 | Nguyễn Thị Hồ | CB UBND xã | |
| 17 | Đường Văn Thuý | CT CTF | |
| 18 | Đoàn Thị Chu | Trưởng CA xã | |
| 19 | Hoàng Văn Hoàng | VH xã. | |
| 20 | Trần Văn Long | CB - PVV xã | |
| 21 | Nguyễn Thanh Hưng | Bí thư Đoàn xã | |

**UBND xã Tân Tiến**

TRẦN VĂN THĂNG

**BIÊN BẢN THAM VẤN CỘNG ĐỒNG**
**VỀ CÁC TÁC ĐỘNG MÔI TRƯỜNG**

**Dự án: Đầu tư xây dựng nhà máy nước số 2 thành phố Bắc Giang tỉnh Bắc Giang**

**1. Thời gian:** 14 h 00, ngày 10 tháng 1 năm 2014
**2. Địa điểm:** Hội trường, Ủy ban nhân dân xã Song Khê
**3. Đại biểu tham dự:**
***Đại diện chủ dự án:***
- Ông Hướng Xuân Công - PGĐ Cty TNHH MTV CIN Bắc Giang
.....
***Đại diện đơn vị tư vấn:***
- Ông Nguyễn Trường Huynh - Chuyên gia môi trường
- Bà Hoàng Kiều Hoa - Chuyên gia môi trường
.....
***Đại diện UBND & UBMTTQ xã:***
- Ông Đào Hữu Phương - PCT UBND xã Song Khê
- Ông Ninh Văn Bình - CT UB MTTQ xã Song Khê
.....
***Đại diện một số hộ dân sống trong khu vực dự án chịu ảnh hưởng của dự án:***
*(Xem danh sách kèm theo)*

**4. Nội dung cuộc họp:**

- Đại diện Ban quản lý dự án giới thiệu về mục tiêu và ý nghĩa xã hội của cuộc họp tham vấn cộng đồng về các tác động đến môi trường gây ra bởi các dự án;

- Đại diện đơn vị Tư vấn trình bày về nội dung của dự án Đầu tư xây dựng nhà máy nước số 2 Thành phố Bắc Giang - tỉnh Bắc Giang;

- Đại diện đơn vị Tư vấn trình bày tác động môi trường gây ra bởi việc xây dựng và lắp đặt nhà máy xử lý nước sạch, mạng lưới đường ống chuyển tải và phân phối nước cũng như các biện pháp giảm thiểu ô nhiễm môi trường sẽ được áp dụng;

- Thảo luận về các vấn đề của dự án, những tác động môi trường & các biện pháp giảm thiểu sự ô nhiễm.

**5. Những ý kiến của chính quyền địa phương và đại diện của cộng đồng dân cư:**

* Đại diện Uỷ ban nhân dân xã Song Khê:

- Đồng ý với việc đầu tư xây dựng hệ thống cấp nước vì sẽ mang lại khả năng cấp nước sạch tốt hơn cho các tổ chức, cá nhân, hộ gia đình sinh sống tại xã Song Khê;

- Khuyến khích áp dụng các phương pháp giảm thiểu tác động môi trường

trong thời gian ngắn hạn.

- Đề xuất thi công nhanh, không dàn trải gây ảnh hưởng đến mỹ quan và đời sống của người dân.

- Đưa ra các chế tài mạnh đối với đơn vị thi công nếu không tuân thủ đúng các yêu cầu nêu trong hợp đồng trách nhiệm

- Chấp thuận các giải pháp giảm thiểu các ô nhiễm môi trường tại khu vực dự án mà đơn vị tư vấn môi trường đưa ra và ủng hộ triển khai tại địa phương.

* Đại diện Uỷ ban mặt trận tổ quốc xã Song Khê:

- Đồng ý với dự án.

- Đề nghị Ban quản lý dự án lựa chọn đơn vị thi công thi công có đủ năng lực (về tài chính, về con người, về thiết bị, máy móc phục vụ thi công) để thực hiện theo đúng tiến độ đề ra, tránh kéo dài gây ảnh hưởng đến người dân và đảm bảo chất lượng công trình.

- Tham vấn cộng đồng thường xuyên để tìm hiểu các sự cố, hiện trạng và tiến độ thi công và khi vận hành hệ thống.

***Những ý kiến của đại diện các cộng đồng dân cư:***

Bà..Đặn...Thị...Thúy.....:

- Ủng hộ việc thực hiện dự án;

- Đề nghị Ban quản lý yêu cầu Nhà thầu xây dựng và vận hành hệ thống cấp nước thực hiện đúng các giải pháp giảm thiểu và phòng ngừa ô nhiễm như đã đề ra trong buổi tham vấn cộng đồng hôm nay.

Ông..Giáp..Văn..Nam.....:

- Dự án được thực hiện càng sớm càng tốt;

- Đề nghị Ban quản lý dự án tạo điều kiện tuyển dụng lao động tại địa phương, tạo công ăn việc l àm;

- Đồng ý với dự án;

- Cần phải xây dựng kế hoạch chi tiết thực hiện dự án, tránh kéo dài.

- Đề nghị nên để đại diện dân cư địa phương tham gia vào giám sát kỹ thuật trong quá trình xây dựng;

**6. Ý kiến phản hồi và cam kết từ phía chủ dự án**

Giám đốc Ban quản lý dự án đại diện chủ dự án cảm ơn sự có mặt của chính quyền địa phương, Ủy ban Mặt trận tổ quốc và các hộ dân trong xã Song Khê đã tham dự buổi họp này. Đồng thời xin tiếp thu và đồng ý các ý kiến của chính quyền địa phương và cam kết sẽ thực hiện nghiêm túc công tác bảo vệ môi trường tại địa

phương trong quá trình thi công và vận hành dự án.

**7. Kết luận cuộc họp:**

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản được lập thành 06 (sáu) bản, có giá trị pháp lý như nhau.

Cuộc họp kết thúc vào hồi 17 h30 cùng ngày.

**UBND XÃ SONG KHÊ**

KT. CHỦ TỊCH XÃ SONG KHÊ
PHÓ CHỦ TỊCH

**ĐÀO HỮU PHƯƠNG**

**UBMTTQ XÃ SONG KHÊ**

Ninh Văn Bình

**ĐẠI DIỆN CHỦ DỰ ÁN**

CÔNG TY T.N.H.H MỘT THÀNH VIÊN CẤP THOÁT NƯỚC BẮC GIANG

K.T GIÁM ĐỐC
PHÓ GIÁM ĐỐC

KS Hoàng Tuấn Công

***Danh sách thành phần tham gia cuộc họp gồm có:***

| STT | Họ và tên | Địa chỉ/ chức vụ | Ghi chú |
|---|---|---|---|
| 1 | Đào Hữu Phương | Phó CT xã Song Khê | |
| 2 | Hoàng Văn Việt | Thôn Yên Khê | |
| 3 | Đào Văn Hợp | Thôn Song Khê | |
| 4 | Đào Hữu Tiến | Thôn Song Khê | |
| 5 | Lý Thị Mậu | Thôn Song Khê | |
| 6 | Đào Thị Thuý | Thôn Song Khê | |
| 7 | Thân Văn Thiệp | Thôn Cầu Xuyên | |
| 8 | Nguyễn Khắc Giang | Thôn Song Khê | |
| 9 | Đinh Văn Thiết | Văn phòng UBND xã | |
| 10. | Giáp Văn Nam | Trưởng Thôn yên Khê | |

***UBND xã Song Khê***

T.CHỦ TỊCH XÃ SONG KHÊ
PHÓ CHỦ TỊCH
ĐÀO HỮU PHƯƠNG

**BIÊN BẢN THAM VẤN CỘNG ĐỒNG**
**VỀ CÁC TÁC ĐỘNG MÔI TRƯỜNG**

**Dự án: Đầu tư xây dựng nhà máy nước số 2 thành phố Bắc Giang tỉnh Bắc Giang**

**1. Thời gian:** 08 h00, ngày 10 tháng 01 năm 2011
**2. Địa điểm:** Hội trường, Uỷ ban nhân dân xã Tân Mỹ
**3. Đại biểu tham dự:**
***Đại diện chủ dự án:***
Ông Hường Xuân Công - PGĐ
.....
***Đại diện đơn vị tư vấn:***
- Ông Nguyễn Trường Huynh - Chuyên gia Môi trường
- Bà Hoàng Kiều Hoa - Chuyên gia Môi trường
Ông Ngụy Thế Thanh - Cán bộ kỹ thuật
***Đại diện UBND & UBMTTQ xã:***
- Ông Hoàng Văn Phùng - CT UBND xã Tân Mỹ
- Bà Phạm Thị Thu - CT UBMTTQ xã Tân Mỹ
.....
***Đại diện một số hộ dân sống trong khu vực dự án chịu ảnh hưởng của dự án:***
*(Xem danh sách kèm theo)*

**4. Nội dung cuộc họp:**

- Đại diện Ban quản lý dự án giới thiệu về mục tiêu và ý nghĩa xã hội của cuộc họp tham vấn cộng đồng về các tác động đến môi trường gây ra bởi các dự án;
- Đại diện đơn vị Tư vấn trình bày về nội dung của dự án Đầu tư xây dựng nhà máy nước số 2 Thành phố Bắc Giang - tỉnh Bắc Giang;
- Đại diện đơn vị Tư vấn trình bày tác động môi trường gây ra bởi việc xây dựng và lắp đặt nhà máy xử lý nước sạch, mạng lưới đường ống chuyển tải và phân phối nước cũng như các biện pháp giảm thiểu ô nhiễm môi trường sẽ được áp dụng;
- Thảo luận về các vấn đề của dự án, những tác động môi trường & các biện pháp giảm thiểu sự ô nhiễm.

**5. Những ý kiến của chính quyền địa phương và đại diện của cộng đồng dân cư:**

* Đại diện Uỷ ban nhân dân xã Tân Mỹ:

- Đồng ý với việc đầu tư xây dựng hệ thống cấp nước vì sẽ mang lại khả năng cấp nước sạch tốt hơn cho các tổ chức, cá nhân, hộ gia đình sinh sống tại xã Tân Mỹ;
- Có giám sát cộng đồng trong giai đoạn thi công và vận hành.
- Khuyến khích áp dụng đầy đủ các biện pháp giảm thiểu thi công.

- Bồi thường, hỗ trợ thoả đáng cho người dân bị thu hồi đất, công trình, hoa màu, đất.

* Đại diện Uỷ ban mặt trận tổ quốc xã Tân Mỹ:

- Đồng ý với dự án.

- Đề nghị Ban quản lý dự án lựa chọn đơn vị thi công thi công có đủ năng lực (về tài chính, về con người, về thiết bị, máy móc phục vụ thi công) để thực hiện theo đúng tiến độ đề ra, tránh kéo dài gây anh hương đến người dân và đam bao chất lượng công trình.

- Đồng ý về các biện pháp giảm thiểu các tác động môi trường như: Giáo dục, tuyên truyền vho kỹ sư, Cán bộ công nhân viên; An ninh tại trạm xử lý nước sạch; Lắng nghe ý kiến phản ánh của cộng đồng,…

***Những ý kiến của đại diện các cộng đồng dân cư:***

Bà..Hoàng...Thị..Lý.....:

- Đồng ý với dự án;

- Thời gian tiến độ của dự án phải được thông báo công khai để nhân dân biết và góp phần giúp đỡ đối với dự án.

Ông.Nguyễn..Quốc..Chiến:

- Dự án được thực hiện càng sớm càng tốt;

- Đề nghị Ban quản lý dự án tạo điều kiện tuyển dụng lao động tại địa phương, tạo công việc làm.

**6. Ý kiến phản hồi và cam kết từ phía chủ dự án**

Giám đốc Ban quản lý dự án đại diện chủ dự án cảm ơn sự có mặt của chính quyền địa phương, Ủy ban Mặt trận tổ quốc và các hộ dân trong xã Tân Mỹ đã tham dự buổi họp này. Đồng thời xin tiếp thu và đồng ý các ý kiến của chính quyền địa phương và cam kết sẽ thực hiện nghiêm túc công tác bảo vệ môi trường tại địa phương trong quá trình thi công và vận hành dự án.

**7. Kết luận cuộc họp:**

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản được lập thành 06 (sáu) bản, có giá trị pháp lý như nhau.

Cuộc họp kết thúc vào hồi 11h30 cùng ngày.

UBND XÃ TÂN MỸ

T.M UBND XÃ TÂN MỸ
CHỦ TỊCH
HOÀNG VĂN DŨNG

UBMTTQ XÃ TÂN MỸ

T.M UBMTTQ XÃ TÂN MỸ
CHỦ TỊCH
PHẠM THỊ THU

ĐẠI DIỆN CHỦ DỰ ÁN

CÔNG TY T.N.H.H MỘT THÀNH VIÊN CẤP THOÁT NƯỚC BẮC GIANG

K.T GIÁM ĐỐC
PHÓ GIÁM ĐỐC
KS Hoàng Xuân Công

***Danh sách thành phần tham gia cuộc họp gồm có:***

| STT | Họ và tên | Địa chỉ/ chức vụ | Ghi chú |
|---|---|---|---|
| 1 | Hoàng Văn Dũng | CT. UBND Xã | |
| 2 | Lê Văn Cảnh | VP. UBND Xã | |
| 3 | Trần Văn Hòa | T2 Lò | |
| 4 | Lương Hồng Cảnh | T2 Đồng Lý | |
| 5 | Hoàng Văn Cường | T2 Lục | |
| 6 | Hoàng Thị Lý | T2 Tỉ | |
| 7 | Nguyễn Văn Thanh | T2 Đồng | |
| 8 | Nguyễn Văn Lớp | T2 Phố | |
| 9 | Lê Văn Đức | T2 Cường | |
| 10 | Nguyễn Quyết Chiến | T2 Mỹ Cầu | |
| 11 | Hoàng Văn Phúc | T2 Bến | |
| 12 | Hoàng Văn Hiệp | T2 Tân Phương | |
| 13 | Hoàng Văn Phương | T2 Nhân | |

UBND xã Tân Mỹ

CHỦ TỊCH UBND XÃ TÂN MỸ

HOÀNG VĂN DŨNG

**BIÊN BẢN THAM VẤN CỘNG ĐỒNG**
**VỀ CÁC TÁC ĐỘNG MÔI TRƯỜNG**

**Dự án: Đầu tư xây dựng nhà máy nước số 2 thành phố Bắc Giang tỉnh Bắc Giang**

**1. Thời gian:** 08h , ngày 11 tháng 01 năm 2014
**2. Địa điểm:** Hội trường, Ủy ban nhân dân xã Dĩnh Trì
**3. Đại biểu tham dự:**
***Đại diện chủ dự án:***
- Ông Hoàng Xuân Công - PGĐ Cty TNHH MTV CTN Bắc Giang
.....
***Đại diện đơn vị tư vấn:***
- Ông Nguyễn Trường Thuỳnh - Chuyên gia Môi trường
- Bà Hoàng Kiều Hoa - Chuyên gia Môi trường
- Ông Ngụy Thế Thanh - Cán bộ Kỹ thuật
***Đại diện UBND & UBMTTQ phường:***
- Ông Tạ Quang Như - PCT UBND xã Dĩnh Trì
- Ông Hà Huy Thường - CT UBMTTQ xã Dĩnh Trì
.....
***Đại diện một số hộ dân sống trong khu vực dự án chịu ảnh hưởng của dự án:***
*(Xem danh sách kèm theo)*

**4. Nội dung cuộc họp:**

- Đại diện Ban quản lý dự án giới thiệu về mục tiêu và ý nghĩa xã hội của cuộc họp tham vấn cộng đồng về các tác động đến môi trường gây ra bởi các dự án;
- Đại diện đơn vị Tư vấn trình bày về nội dung của dự án Đầu tư xây dựng nhà máy nước số 2 Thành phố Bắc Giang - tỉnh Bắc Giang;
- Đại diện đơn vị Tư vấn trình bày tác động môi trường gây ra bởi việc xây dựng và lắp đặt trạm bơm nước, mạng lưới đường ống chuyển tải và phân phối nước cũng như các biện pháp giảm thiểu ô nhiễm môi trường sẽ được áp dụng;
- Thảo luận về các vấn đề của dự án, những tác động môi trường & các biện pháp giảm thiểu sự ô nhiễm.

**5. Những ý kiến của chính quyền địa phương và đại diện của cộng đồng dân cư:**

* Đại diện Uỷ ban nhân dân xã Dĩnh Trì:

- Đồng ý với việc đầu tư xây dựng hệ thống cấp nước vì sẽ mang lại khả năng cấp nước sạch tốt hơn cho các tổ chức, cá nhân, hộ gia đình sinh sống tại xã Dĩnh Trì;
- Chấp thuận các giải pháp giảm thiểu các ô nhiễm môi trường tại khu vực dự án mà đơn vị tư vấn môi trường đưa ra và ủng hộ triển khai tại địa phương.

* Đại diện Uỷ ban mặt trận tổ quốc xã Dĩnh Trì:

- Đồng ý với dự án.
- Đề nghị Ban quản lý dự án lựa chọn đơn vị thi công thi công có đủ năng lực (về tài chính, về con người, về thiết bị, máy móc phục vụ thi công) để thực hiện theo

đúng tiến độ đề ra, tránh kéo dài gây ảnh hưởng đến người dân và đảm bảo chất lượng công trình.

***Những ý kiến của đại diện các cộng đồng dân cư:***

Bà: Nguyễn Thị Oanh - Chủ tịch HPN

- Ủng hộ việc thực hiện dự án;
- Đề nghị Ban quản lý yêu cầu Nhà thầu xây dựng và vận hành hệ thống cấp nước thực hiện đúng các giải pháp giảm thiểu và phòng ngừa ô nhiễm như đã đề ra trong buổi tham vấn cộng đồng hôm nay.

Ông: Nguyễn Văn Sinh

- Đồng ý với dự án;
- Thời gian tiến độ của dự án phải được thông báo công khai để nhân dân biết và góp phần giúp đỡ đối với dự án.

**6. Ý kiến phản hồi và cam kết từ phía chủ dự án**

Giám đốc Ban quản lý dự án đại diện chủ dự án cảm ơn sự có mặt của chính quyền địa phương, Ủy ban Mặt trận tổ quốc và các hộ dân trong xã Dĩnh Trì đã tham dự buổi họp này. Đồng thời xin tiếp thu và đồng ý các ý kiến của chính quyền địa phương và cam kết sẽ thực hiện nghiêm túc công tác bảo vệ môi trường tại địa phương trong quá trình thi công và vận hành dự án.

**7. Kết luận cuộc họp:**

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản được lập thành 06 (sáu) bản, có giá trị pháp lý như nhau.

Cuộc họp kết thúc vào hồi 11h30' cùng ngày.

| | |
|---|---|
| **UBND XÃ DĨNH TRÌ** | **UBMTTQ XÃ DĨNH TRÌ** |
| PHÓ CHỦ TỊCH THƯỜNG TRỰC | |
| TẠ QUANG NHU | Hà Huy Thường |

**ĐẠI DIỆN CHỦ DỰ ÁN**

CÔNG TY T.N.H.H MỘT THÀNH VIÊN CẤP THOÁT NƯỚC BẮC GIANG

KT GIÁM ĐỐC
PHÓ GIÁM ĐỐC

KS Hoàng Xuân Công

*Danh sách thành phần tham gia cuộc họp gồm có:*

| STT | Họ và tên | Địa chỉ/ chức vụ | Ghi chú |
|---|---|---|---|
| 1 | Tạ Quang Nhu | PCT UBND xã Dĩnh Trì | |
| 2 | Nguyễn Đình Tu | CBC, VP TT. | |
| 3 | Ng Duế Tu | phó ch. HĐND. | |
| 4 | Ng văn Hiến | phó ch. UBND. | |
| 5 | Ng Đình Cảnh | T[illegible] Thái Mỹ | |
| 6 | Ng văn phương | T[illegible] Kum | |
| 7 | Ng văn Long | T[illegible] Rieu | |
| 8 | Ng Đình phán | phó [illegible] Đồng Mo | |
| 9 | Ng ngọc tường | T[illegible] Cóc | |
| 10 | Ng văn Quý | T[illegible] Nguồn | |
| 11 | Lê Quốc Tình | T[illegible] Cầu | |
| 12 | Ng Khắc Nhiễm | T[illegible] Chuyền | |
| 13 | Ng Duế giang | ch. hội nông dân | |
| 14 | Ng Thị Oanh | ch. hội phụ nữ | |
| 15 | Hoàng văn Khang | T[illegible] Đồng Nghè | |
| 16 | Giáp văn Đoàn | T[illegible] Mười Trong | |
| 17 | Ng Duế Mạ | T[illegible] Bãi ổi | |
| 18 | Hoàng văn Hiền | T[illegible] Rừng (c) | |
| 19 | Ng văn Sinh | T[illegible] Kum | |
| 20 | Nguyễn Văn Minh | Chủ tịch CCB | |
| 21 | Nguyễn Đức Quang | Chủ tịch Hội LHTN | |
| 22 | Nguyễn Thị Oanh | chủ tịch Hội PN | |

UBND xã Dĩnh Trì

TẠ QUANG NHU

**BIÊN BẢN THAM VẤN CỘNG ĐỒNG**
**VỀ CÁC TÁC ĐỘNG MÔI TRƯỜNG**

**Dự án: Đầu tư xây dựng nhà máy nước số 2 thành phố Bắc Giang tỉnh Bắc Giang**

**1. Thời gian:** ..08..h ..00.. ngày..12.....tháng..01.....năm 2011
**2. Địa điểm:** Hội trường, Ủy ban nhân dân xã Đồng Sơn
**3. Đại biểu tham dự:**
***Đại diện chủ dự án:***
- Ông Hường Xuân Công - PGĐ Cty TNHH MTV CIN Bắc Giang
.....
***Đại diện đơn vị tư vấn:***
- Ông Nguyễn Tường Thuynh - Chuyên gia Môi trường
- Bà Hoàng Kiều Hoa - Chuyên gia Môi trường
- Ông Ngụy Thế Thanh - Cán bộ kỹ thuật
***Đại diện UBND & UBMTTQ xã:***
- Ông Nguyễn Đăng Ninh - Chủ tịch UBND xã Đồng Sơn
- Ông Trịnh Văn Bảng - Chủ tịch UB MTTQ xã Đồng Sơn
.....
***Đại diện một số hộ dân sống trong khu vực dự án chịu ảnh hưởng của dự án:***
*(Xem danh sách kèm theo)*

**4. Nội dung cuộc họp:**

- Đại diện Ban quản lý dự án giới thiệu về mục tiêu và ý nghĩa xã hội của cuộc họp tham vấn cộng đồng về các tác động đến môi trường gây ra bởi các dự án;
- Đại diện đơn vị Tư vấn trình bày về nội dung của dự án Đầu tư xây dựng nhà máy nước số 2 Thành phố Bắc Giang - tỉnh Bắc Giang;
- Đại diện đơn vị Tư vấn trình bày tác động môi trường gây ra bởi việc xây dựng và lắp đặt nhà máy xử lý nước sạch, mạng lưới đường ống chuyển tải và phân phối nước cũng như các biện pháp giảm thiểu ô nhiễm môi trường sẽ được áp dụng;
- Thảo luận về các vấn đề của dự án, những tác động môi trường & các biện pháp giảm thiểu sự ô nhiễm.

**5. Những ý kiến của chính quyền địa phương và đại diện của cộng đồng dân cư:**

* Đại diện Uỷ ban nhân dân xã Đồng Sơn:

- Đồng ý với việc đầu tư xây dựng hệ thống cấp nước vì sẽ mang lại khả năng cấp nước sạch tốt hơn cho các tổ chức, cá nhân, hộ gia đình sinh sống tại xã Đồng Sơn;
- Khuyến khích áp dụng các phương pháp giảm thiểu tác động môi trường trong thời gian ngắn hạn.
- Đề xuất thi công nhanh, không dàn trải gây ảnh hưởng đến mỹ quan và đời sống của người dân.
- Đồng ý với các các tác động môi trường: Các rủi ro và sự cố môi trường; An toàn lao động; Ách tắc và tai nạn giao thông,…

toàn lao động; Ách tắc và tai nạn giao thông,…

- Chấp thuận các giải pháp giảm thiểu các ô nhiễm môi trường tại khu vực dự án mà đơn vị tư vấn môi trường đưa ra và ủng hộ triển khai tại địa phương.

* Đại diện Uỷ ban mặt trận tổ quốc xã Đồng Sơn:

- Đồng ý với dự án.

- Đồng ý với các các tác động môi trường: Các rủi ro và sự cố môi trường; An toàn lao động; Ách tắc và tai nạn giao thông,…

- Đề nghị Ban quản lý dự án lựa chọn đơn vị thi công thi công có đủ năng lực (về tài chính, về con người, về thiết bị, máy móc phục vụ thi công) để thực hiện theo đúng tiến độ đề ra, tránh kéo dài gây ảnh hưởng đến người dân và đảm bảo chất lượng công trình.

***Những ý kiến của đại diện các cộng đồng dân cư:***

Bà; Ông : Ta Văn Chung

- Ủng hộ việc thực hiện dự án;

- Đề nghị Ban quản lý yêu cầu Nhà thầu xây dựng và vận hành hệ thống cấp nước thực hiện đúng các giải pháp giảm thiểu và phòng ngừa ô nhiễm như đã đề ra trong buổi tham vấn cộng đồng hôm nay.

Ông: Nguyễn Văn Hải

- Đồng ý với dự án;

- Thời gian tiến độ của dự án phải được thông báo công khai để nhân dân biết và góp phần giúp đỡ đối với dự án.

**6. Ý kiến phản hồi và cam kết từ phía chủ dự án**

Giám đốc Ban quản lý dự án đại diện chủ dự án cảm ơn sự có mặt của chính quyền địa phương, Ủy ban Mặt trận tổ quốc và các hộ dân trong xã Đồng Sơn đã tham dự buổi họp này. Đồng thời xin tiếp thu và đồng ý các ý kiến của chính quyền địa phương và cam kết sẽ thực hiện nghiêm túc công tác bảo vệ môi trường tại địa phương trong quá trình thi công và vận hành dự án.

**7. Kết luận cuộc họp:**

Biên bản lập xong, đọc tại cuộc họp cho mọi người tham dự cùng nghe và nhất trí ký tên dưới đây.

Biên bản được lập thành 06 (sáu) bản, có giá trị pháp lý như nhau.

Cuộc họp kết thúc vào hồi 11h30' cùng ngày.

| | |
|---|---|
| **UBND XÃ ĐỒNG SƠN** | **ỦY BAN MTTQ XÃ ĐỒNG SƠN** |
| CHỦ TỊCH UBND | |
| NGUYỄN ĐĂNG NINH | TRỊNH VĂN BỐNG |

**ĐẠI DIỆN CHỦ DỰ ÁN**

*Danh sách thành phần tham gia cuộc họp gồm có:*

| STT | Họ và tên | Địa chỉ/ chức vụ | Ghi chú |
|---|---|---|---|
| 1, | Nguyễn Đăng Ninh | Chủ tịch UBND xã | |
| 2, | Tạ Văn Chung | Trưởng thôn Chùa | Chung |
| 3, | Nguyễn Thị Tuyết | Trưởng thôn Tân Mỹ | |
| 4, | Nguyễn Văn Phong | Trưởng thôn phố Bắc | |
| 5, | Đinh Xuân Bản | CT CCB | Bản |
| 6, | Trần Thị Thường | CBD xã | Thường |
| 7, | Không Đức Sy | phó thôn | |
| 8, | Nguyễn văn Hồi | TT N D | Hồi |
| 9. | Trần văn Nhật | CBĐ xã | Nhật |
| 10. | Trịnh văn Bằng | CT UBMTTQ xã | |

UBND xã Đồng Sơn

## Annex 3: Template for Safeguards Monitoring Report

### I. Summary:

**(to be included as part of the *main* Report)**

- **Summary of EMP/RP Implementation**
- **Description of monitoring activities** carried out (e.g. field visits, survey questionnaire, public consultation meetings, focus group discussions, etc.)
- **Key issues**, any **corrective actions** already taken, and any **grievances**
- Recommendations

### II. Safeguards Monitoring Report

**(to be included in the annex/appendix of the *main* Report)**

#### 1. Introduction and Project Overview

| | | |
|---|---|---|
| **Project Number and Title:** | | |
| **Safeguards Category** | Environment | |
| | Indigenous Peoples | |
| | Involuntary Resettlement | |
| **Reporting period:** | | |
| **Last report date:** | | |
| **Key sub-project activities since last report:** | This section can include, among others, the following:<br>• Activities of Proponent<br>• Progress of Work (% physical completion)<br>• Changes of Surrounding Environment<br>• Status of Permits / Consents | |
| **Report prepared by:** | | |

#### 2. Environmental Performance Monitoring

a. Summary of Compliance with EMAP Requirements (Environmental Performance)

| EMAP Requirements | Compliance Status (Yes, No, Partial) | Comment or Reasons for Non-Compliance | Issues for Further Action |
|---|---|---|---|
| Use environmental impact as main heading and EMAP as listing (see example below) | Use EMoP list as basis for rating/evaluating compliance (see example below) | | |
| Rise of employment opportunities:<br>• Job openings of the project should give priority to local communities.<br>• Recruitment of local laborers should be stipulated in the contract for construction | • Field inspections and interviews with communities - DONE<br>• Note each complaint case in the field – 3 COMPLAINTS RECEIVED<br>• Set up grievance centre and report as part of monitoring action plan – NOT DONE | | |
| | | | |
| | | | |

b. Issues for Further Action

| Issue | Required Action | Responsibility and Timing | Resolution |
|---|---|---|---|
| **Old Issues from Previous Reports** | | | |
| List of EMoP measures or activities not completed (last column of previous table) | | | |
| | | | |
| | | | |
| **New Issues from This Report** | | | |
| | | | |
| | | | |
| | | | |

c. Other activities

- Other issues not covered by EMAP/EMoP
- Environmental monitoring as required by GOI (e.g., air quality, water sampling)

**3. Involuntary Resettlement Performance Monitoring**

a. Summary of Compliance with RP Requirements

| RP Requirements | Compliance status Yes/No/Partial | Comment or Reasons for Compliance, Partial Compliance/Non-Compliance | Issues for Further Action[8] |
|---|---|---|---|
| Establishment of personnel in PMU/PIU | | | |
| Public consultation and socialization process | | Provide information on:<br>• Public consultation, participation activities carried out<br>• Inclusive dates of these activities<br><br>To be elaborated on in Item 5 | |
| Land area to be acquired is identified and finalised | | | |
| Land acquisition completed | | | |
| Establishment of Resettlement Site(s) | | Please state:<br>• Number of AHs to be relocated as per agreed RP<br>• Number of AHs already relocated<br>• Number of houses built<br>• Status of installation of community facilities to be provided as per agreed RP | |
| Compensation payments for affected assets is completed | | Please state:<br>• Total Number of Eligible AHs and APs (as per agreed RP)<br>• Number of AHs and APs compensated as of this monitoring period<br>• Total Budget allocation as per agreed RP<br>• Total budget disbursed to AHs as of this monitoring period | |
| Transport assistance for relocating affected HH | | As above | |
| Additional assistance to vulnerable affected household | | Please state:<br>• Total Number of vulnerable AHs and APs (as per agreed RP) | |

[8] To be elaborated further in table 3.b (Issues for Further Action)

| | | | |
|---|---|---|---|
| | | • Agreed forms of assistance as per RP<br>• Number of AHs and APs assisted as of this monitoring period | |
| Income Restoration Program | | Please state progress per income restoration feature/activity and actual period of implementation | |
| Temporary impacts have been addressed (affected properties restored to at least pre-project conditions) | | Please state:<br>• Total Number of AHs affected by temporary impacts as per agreed RP<br>• Actual Number of AHs and total area affected by temporary impacts (if this differs from the projected number, such as in cases of unforeseen project impacts)<br>• Status of restoring affected property | |
| Capacity building activities | | | |
| | | | |

b. Issues for Further Action

| Issue | Required Action | Responsibility and Timing | Resolution |
|---|---|---|---|
| **Old Issues from Previous Reports** | | | |
| List of RP activities not completed (last column of previous table) | | | |
| | | | |
| **New Issues from This Report** | | | |
| | | | |
| | | | |

## 4. Occupational, Health and Safety (OHS) Performance Monitoring

a. OHS for worker

| Issue | Required Action | Responsibility and Timing | Resolution |
|---|---|---|---|
| **Old Issues from Previous Reports** | | | |
| | | | |
| | | | |
| | | | |
| **New Issues from This Report** | | | |
| | | | |
| | | | |
| | | | |

b. Public Safety

| Issue | Required Action | Responsibility and Timing | Resolution |
|---|---|---|---|
| **Old Issues from Previous Reports** | | | |
| | | | |
| | | | |
| | | | |
| **New Issues from This Report** | | | |
| | | | |

| | | | |
|---|---|---|---|
| | | | |

**5. Information Disclosure and Socialization including Capability Building**

- Field Visits (sites visited, dates, persons met)
- Public Consultations and meetings (Date; time; location; agenda; number of participants disaggregated by sex and ethnic group, not including project staff; Issues raised by participants and how these were addressed by the project team)
- Training (Nature of training, number of participants disaggregated by gender and ethnicity, date, location, etc.)
- Press/Media Releases
- Material development/production (e.g., brochure, leaflet, posters)

**6. Grievance Redress Mechanism**

**Summary:**

- Number of new grievances, if any, since last monitoring period: ____
- Number of grievances resolved: _____
- Number of outstanding grievances: _____

| Type of Grievance | Details (Date, person, address, contact details, etc.) | Required Action, Responsibility and Timing | Resolution |
|---|---|---|---|
| **Old Issues from Previous Reports** | | | |
| | | | |
| | | | |
| | | | |
| **New Issues from This Report** | | | |
| | | | |
| | | | |
| | | | |

**7. Conclusion**

- Important results from the implementation of EMAP/EMoP and RP monitoring
- Recommendations to improve EMAP/EMoP and RP management, implementation, and monitoring

**8. Attachments**

- Consents / permits
- Monitoring data (water quality, air quality, etc.)
- Photographs
- Maps