VIETNAM NATIONAL UNIVERSITIES DEVELOPMENT PROJECT

VIETNAM NATIONAL UNIVERSITY HANOI SUBPROJECT

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

(Final Draft)

Project location: Thach Hoa commune, Thach That district, Ha Noi city

HA NOI – FEBRUARY 2020

ABBREVIATIONS AND ACRONYMS

C-ESMP	Contractor's Environmental and Social Management Plan
CSC	Construction supervision consultant
DONRE	Department of Natural resources and environment
ECOP	Environmental Code of Practices
ES	Environmental specialist
ESHS	Environment, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GoV	Government of Vietnam
IEMC	Independent environmental monitoring consultant
MONRE	Ministry of Natural resources and environment
Pre-FS	Pre-Feasibility study report
PMU	Project management unit
PS	Pumping station
VNU-HN	Vietnam National University, Hanoi
WWTP	Wastewater treatment plant
WB	World Bank

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EXECUTIVE SUMMARY

Project Background

Vietnam National University Hanoi (VNU-HN) was established on December 10, 1993. After 25 years of construction and development, VNU-HN has gained important achievements, affirming the leading university position in Vietnam, ranking high in the world higher education system. The rapid change of technology requires education to provide learners with new skills, creativity, challenges and new requirements that traditional education methods cannot. response. Therefore, schools must improve and innovate training programs, technologies and methods of training high-quality human resources to meet the development needs of society and integrate into the world. Training institutions must have good preparation of teaching resources, especially teaching staff, training programs, building learning spaces and equipment for training and research. ... In this context, the Vietnam National University Development Project - Vietnam National University Hanoi Subproject is proposed to use loans from the World Bank. The project implements a part of VNU construction master plan in Hoa Lac.

The proposed project consists of 3 components:

Component 1 - Quality of Teaching and Learning

Component 1 aims to prepare high-quality graduates by supporting the three universities (i) build and/or upgrade infrastructure (buildings, lecture halls, classrooms, labs, and associated facilities); (ii) provide equipment and build/upgrade foundational digital technology infrastructure (data centers, networks); (iii) innovate teaching-learning methods (e.g. e-learning - MOOCs/adaptive learning); and (iv) internationalize selected training programs.

Component 2 - Research Excellence and Knowledge Transfer,

Component 2 seeks to achieve research excellence and enhance knowledge transfer by supporting the three universities (i) construct modern research infrastructure (research center/institute buildings, labs, etc.); (ii) provide modern equipment & technology (including High Performance Computing, VinaRen); (iii) establish strong research groups in priority sectors; (iv) collaborate with national & international institutions, industry and government agencies on science, technology and innovation.

Component 3: Governance and Project Management

The Proposed Project covers three Universities, namely the Vietnam National University – Hanoi (VNU-HN), the University of Da Nang (UD) and the Vietnam National University – Ho Chi Minh city (VNU-HCMC). The proposed project will meet the requirements of the World Bank Safeguard Policies, apply WBG Environmental, Health and Safety Guidelines (EHSG) and comply with national environmental legislations.

The Project was classified as Environmental Category A at concept stage under the Bank's Safeguard Policy OP 4.01 – Environmental Assessment. Accordingly, three Environmental and Social Impact Assessment and an Environmental and Social Management Plan (ESIA/ESMP))have been prepared. The main contents of the ESIA/ESMP includes:

Chapter 1: Project Description
Chapter 2: Natural, Social and Economic Condition
Chapter 3: Environmental and social Impacts Assessment
Chapter 4: Comparison and Analysis of Proposed Option
Chapter 5: Environmental and Social Management Plan
Chapter 6: Public Consultations and Information Disclosure
Conclusions and Recommendations.

This ESIA/ESMP cover the VNU-HN subproject. The key findings and recommendations of the ESIA/ESMP are briefed below.

1. Proposed Investments

The proposed physical investments of the Hanoi subproject will be implemented in three zones with total land area of 37.5 ha among the total 1,100 ha of the campus.

- Construction of 18 buildings from one to eight storey with classrooms, offices, library, laboratories, experiemental and a sport center areas etc. for teaching, learning and research.

- Construction of two wastewater treatment plants (WWTP), internal yards and access, drainage and sewers pipelines. One WWTP has capacity of 1,475 m^3/d treating domestic wastewater only. The other WWTP has capacity of 600 m^3/d comprising of two clusters, one to treat wastewater from all laboratories to meet Vietnamese standard on industrial wastewater QCVN40:2011/BTNMT and then led to cluster 2 where it is further treated together with domestic wastewer to meet QVN14:2008.

2. Baseline Conditions.

VNU-HN's Village (campus) located in Thach That district, about 30 km from Ha noi Capital and be accessible easily from the Lang- Hoa Lac and No. 21 National Highways. The area is situated in a semi-arid area characterized with low hills interfacing with low-lying plain. The campus is 1,100 ha, formed more than 20 years ago but due to long delays in investments, currently only basic techncial infrastructure such as internal roads, some bridges, a guest house and a multiple-purpose training centre (supposed to be domitory) have been built within the campus. The construction of some five-storey buildings have been nearly completed for the University of Natural Science, a member of VNU-HN. The site used to be Farm No1 which was transferred to the VNU-HN in 1995, and land acquisition for the VNU-HN campus have been completed in 2007.

The Bank financed subproject will construct facilities for learning, teaching and researches in three zones with total cleared land area of 37.5 ha, currently mainly vacant land with shurbs, crop land, tea plantation and without any residential houses. There are several water bodies within the University's boundaries, noticeably the Cot Cu, Vai nghieng, Vai Ca-Na Muong streams, the Da Lat, Cong Binh and Cot Cu lakes, all of these runs into the Tich River. Nearby the construction asrea there are Than Lan and Muc mountains, and some lakes. The quality of air, surface and groundwater, and soil in the project area meets applicable standards. Ground water is abundant with good quality but the campus has not yet been connected to piped water system of Hanoi city. Birds, reptiles, fishes, birds, and other aquatic species are found in the project areas but there is no known species listed in the Red Books. There are also some existing green space with beautiful landscape within the University site but some invasive flora species such as mimosa were found in the shrubs. There is a residential cluster living outside but near the boundary of VNU-HN, and some housesholds who have received compensation but still been temporarily living and cultivating in some parts of the VNU-HN village while investments are pending. They will be informed and move out prior to construction commencement.

3. Potential Social and Environmental Impacts and Risks, and mitigation measures.

The environmental and social potential impacts and risks have been identified and assessed in Chapter 3 of the ESIA. Overall, the project would bring about significant social and environmental impacts during operation phase to help improving the quality of teaching, learning and research. During construction phase, the project will also bring about job opportunities and additional income for local people who are hired by the contractors for shorterm jobs during construction phase or by the University for cleaning and maintenance during operation phase;

Beside the significant positive impacts, there would be also some negative environmental and social impacts and risks during the pre-construction, construction and operations of the infrastructure provided under the subproject.

Pre-construction Phase .

Land acquisition and Unexploded Ordnances (UXO) were considered for Pre-construction phase. Regarding land acquisition, the total land area of the subproject is 37.5 ha, land acquisition was already completed in 2007. Due diligence review on Resettlement has been done and details are presented in the Due Dilligence Report. Currently, some households are still cultivating and animal raising to get additional income while construction has not been implemented. The Project will inform these households at least 6 months priror to construction commencement for them to harvest on time. With UXO, as The site used to be affected by the war and boming in the past, thus some UXO may have been left in the ground after the war. Clearnce of unexploded ordnances has been implemented in the project area in accordance with Decision 2270/QD-BQP dated September 22, 2001 of the Minister of Defense on approving the plan for detection and clearance of unexploded ordnances in the construction area inHoa Lac - Thach That - Ha Tay.

Construction Phase

The potential negative environmental and social impacts andduring construction phase identied and assessed including: increased level of dust, noise and vibrations due to earth works; generation waste and waste water; localized flooding and sedimentation, biological impacts with losses of vegetation cover, trees and some green space, occupational health and safety risks for the workers, particularly when working at high above the ground, community health and safety risks; traffic disturbance and increased traffic safety risks , damage to existing infrastructure and public services, and social issues relating to labor influx especially community disturbance and social risks related to gender-based violence, sexual harassment and abuse, and child labor. Most of the negative construction impacts are considered temporary, localized, at moderate level and manageable.

Air quality impacts: Dust, gas emission, noise, vibration will be generated from earthworks such as excavation, operations of construction plants and equipment, transporation, and construction activities such as piling. Air quality at both construction areas and along transportation routes would remain within applicable standards QCVN 05:2013/BTNMT. The workers at the site and the households along the transportation routes would be the main receptors affected by dusts and exhaust emission; noise pollution; vibration. The potential impacts on air quality will be managed by known measures such as the use construction plants of which emission levels meet applicable standards, watering the sites, covering under constructed buildings, trucks and materials dumps, provide PPEs including face masks for the workers to use etc. Such measures together with the others for addressing common construction impacts are presented in the ESIAs in the form of Environmental Codes of Practices (ECOP) and Workers Codes of Conducts**.**

Waste and wastewater generation: Approximately 102,785 m^3 of wastes including biomass, top soil from site clearance and excavated materials. will be generated and require space for loading/disposal. As the heavy metal contents in the soils in project area are within allowable limits of QCVN 03-MT:2015/BTNMT, the excavated materials (10,000 m^3) will be reused at the existing nursery ground or for ground levelling. It is anticipated that up to 1,000 workers could be mobilized at the site at peak duration, of which 30% (300 workers) will live at the camps. Accordingly, it was estimated that 150 kg of solid domestic wastes and approximately 16.72 m^3 of wastewater will be generated each day from workers' camps. If not properly managed, such volume of wastes and wastewater would generate bad odor, cause nuisance and environmental

pollution, and affect public health. The ESIA proposed that top soild can be gathered at It can be gathered at the nursery garden of the VNU-HN next to road No. 3, 1.5 - 2 km from the entrance of VNU in Hoa Lac. Waste collection service provider will be hired to collect and transport all construction, domestic wastes, hazardous waste to the Nam Son landfill where all the wastes from Hanoi city are disposed of and/or treated. The contractors will also be required to build sanitation facilities with septic tanks on-site for collecting and treating domestic wastewater before leaving the and camps. In addition, rainwater overflowing at the constrcutin site will also be controlled through the drains and sedimentation traps to be installed at the site for localized flooding risks and sedimentation control. For dug wells, it is necessary to maintain and protect the well area during construction and fill it safely before handing over the project.

Biological impacts and landscape change: The existing grasslands, shrubs, and trees scatteredly distributed in the 37.5 ha of the project area would be disturbed or loss during construction. Some perennial trees with shade and landscape values may also be lost due to construction. Although not directly disturbed by construction activities, the presence of the workers in the project areas may also cause some risks to the trees, vegetation , the birds, fish and repltiles that may be found at the project area due the workers'behaviours if they are not trained properly. For example, trees may be cut down or damaged, fish and reptiles may be caught, birds and other wildlifes may be hunted for food, consumption or keeping in cage by the workers. Bushfire may happen if the workers set fire without authorization. The biological impacts an risks is anticipated at moderate level and can be managedby measures such as conserving the areas with biological/landscape values, minimising land area to be disturbed through careful layout design, diserminate and train the workers on Codes of Conducts etc..

Occupational Health and Safety risks to the Workers

Occupational Health and Safety (OHS) for the workers were also identified as one of the key concerns during construction phase of VNU-HN project, particularly in relation to the construction of multiple-storey buildings and working in summer season with hot weather. Rsks during construction phase may be accident due to falling, electric shock, fire, explosion and leakage of fuel, hitting point-out steel bars or broken glasses, inhaling paint smells in long hours without adequate protection etc.. Accident risks often involve floors high above the ground, deep excavation areas, stockpiles of materials and waste, machinery and truck operations, bulky materials such as scaffolding, temporary open ditch areas, etc. Explosion hazards include transportation and storage of fuel, power lines or electricity consumption.Workers' health may alsobe affected by noise, dust and emissions from materials, waste and machinery. OHS risk is substantial but can be manageable thorough introduction and implementation of strict safety rules, the provision and use of adequate suitable PPEs depending on working position, warrning, fencing and portection of dangerous locations, and strictly monitor compliance.

Labor influx and social impacts

The mobilization of about 1,000 workers, 300 of those may come from other localities to live and work in the project area during the construction period of 2 years, most of them are males. Their stay and the project area may lead to social disturbance or even conflict to arise due to pollution and disturbance from construction and transportation, competition for jobs and incomes, accessibility to public infrastructure, disturbance and/or damages to cultivation activities surounding the construction site, increased burden on local health services, gender-based violence, inflation of prices, increased in traffic and safety risks. Social conflicts may also happen due to worker's language and/or behavior not suitable to local customs particularly if they involve in drinking, gambling, sexual harassment or prostitution. Construction impacts, waste and wastewater generation from camps causing nuisance, disturbance or even disruption of daily activities of local communities may also lead to social conflicts. Besides, child labor force may be abused in case contractors recruit workers with ages lower than 15 or between 15

and 18 without agreement of their families/patronizers according to Law on Labor, 2012. By analyzing the background of the workers and local authorities communities and past experience from similar projects in the area, the ESIA concluded that the potential impacts and risks related to labour influx will be predictable, mitigable and manageble. The measures proposed for mitigating social conflicts presented in the Workers Codes of Conducts, in which the importance of appropriate behavior, alcohol abuse, and compliance with relevant laws and regulations will be outlined for application. Each employee shall be informed of the Code of Conduct and bound by it while in the employment of the Client or Contractors. The Code of Conduct shall be available to local communities at the subproject information centers or other places easily accessible to the communities. To mitigate social impacts, the Contractor is responsible for registering workers with the local authorities for temporary residence and providing appropriate training to all staffs/workers according to their level of responsibility for environmental, health and safety matters.

The ESIA also have assessed specific impacts measures and proposed corresponding mitigation meausres in Chapters 3 and 5.

Operation Phase .

The potential impacts during operation include the management of waste and wastewater generated from laboratories and domestic activities. OHS risks related to the operation of the WWTP and laboratories were considered the key operational issues. These potential impacts and risks are expected to be at moderate level, site-specific and could be mitigated to the acceptable levels by appropriate design, and good construction and management practice.

Some of the mitigation measures to be applied at the new facilties have already been incorporated into project design, such as inclusion of wastewater treatment plants. Wastewater from laboratories will be collected and treated separately to meet applicable national standards (QCVN 40:2011/TNMT, then QCVN 14:2008/TNMT). Solid wastes will be separated at source and licensed service providers will be contracted for collection and safe disposal.

For the relocation of laboratories, the service provide will work closely with university staff to prepare Laboratory Relocation and Reinstallation Plan before implementation. LRRP will cover at least the followings:

- Schedule for Inventory of the existing laboratory equipment, machines and materials to be relocated;
- List of the items that requires specific requirements on dismantling, handling, transportation and reinstallation, and descriptions of the specific requirements. Appoint staff in charge of doing and supervising each step in the entire relocation process;
- Sequence of lab equipment dismantling, wrap up, transportation and reinstallation/set up;
- Specific Measures to ensure EHS to be applied and Emergency Response procedure;
- Inspection of new labs readiness before moving;
- Testing operations at new campus;
- Schedule for cleaning up the existing labs, separate hazardous and non-hazardous wastes and dispose of all the wastes in safe manner.
- Review and update laboratory and OHS rules and regulations.

With the laboratory operations, Occupational Health and Safety risks, generation of wastewater, solid wastes including some hazardous wastes were considered to be the key issues. It is expected that only legtimate and reliable suppliers will be contracted by the project to provide

equipment and setting up the new laboratories or do all the works needed for relocation of existing laboratories. In addition, VNU-HN also already had extensive experience in running and managing the existing laboratories including the hi-tech ones in the other operating campus for many years. Therefore the ESIAs recommended that safety risks relating to the operations of laboratories is expected to be manageable and under control through the compliance with available strict laboratory management requirements including those provided by the manufactures/suppliers of specialized equipment and tools. Meanwhile, through literature review, the ESIAs also have provided number of other measures such as training for the operators, procedures for preventing/addressing hazards in chemical laboratories, safety regulations etc. for managing the risks related to laboratory operations. These could be used for reviewing and updating relevant existing laboratory regulations as applicable. For new specialized laboratory equipment and machines, safe transportation, installation, commissioning/test runs, operational trainings including risk management will be included as part of the Technical Specifications in the Shopping contracts.

Regarding the operation of the wastewater treatment plants, odours, generation of sludge, occupational health and safety of the operations were identified as the key issues. Most of these potenital impacts and risks are relative short-term, temporary, at low to moderate levels, and manageable through detail engineering design, construction or operational practices. For example, the WWTP design would include covering of the odour-generating areas, collect and treat the gases, collect for disposal of sludge to landfills and provisions of PPEs for the workers. While the treated wastewater will meet applicable standards, the envionmental quality monitoring programs proposed periodical surfacewater sampling at the outlet and downstream of the WWTP's receptors.

In addition, safety and comfort for the users of the new facilities, energy consumption and effient use of resources have also been considered in the ESIA, and the ESMP has proposed number of specific measures for incoroporation of the building design toward "green and climate resilient infrastructure"

Traffic Safety: Operation of motorbikes and cars of students and lecturers at rush hours (i.e. 6-8 a.m. and 4 - 6 p.m.) will add pressure on traffic especially in the areas around the university entrances. Thus, there is a risk of traffic congestionand increased traffic safety in this area. . The university will need to work with local government specifically road management authority and particually traffic police to install additional signboards near the entrances of the Univerisity and/or coordinate and manage traffic if necessary.

4. Environmental and Social Management Plan (ESMP)

ESMP has been prepared as an integral part of the ESIA. The measures for addressing common construction impacts are presented in the form of ECOP (Environmental Codes of Practices). Specific mitigation measures are also included in the ESMP.

The ESMP also described the responsibilities for ESMP implementation, as below:

The ESMP proposed an institutional arrangement and identified responsibilities for the implementation of the stakeholders, as below.

PMU will be responsible for monitoring the overall subproject implementation, including environmental compliance of the subproject. PMU will have the final responsibility for ESMP implementation and environmental performance of the subproject during the construction and operational phases. - Specifically the PMU will: (i) closely coordinate with local authorities in the participation of the community during subproject preparation and implementation; (ii) Ensure that the detailed design include all environment provisions as indicated in the ESMP; (iii) monitor and supervise ESMP implementation including incorporation of ESMP into the

detailed technical designs and bidding and contractual documents; (iv) ensure that an environmental management system is set up and functions properly; (v) be in charge of reporting on ESMP implementation to the DONRE and the World Bank.

*The contracto*r will assign Enviromental, Social Health and Safety (EHS) staff to carry out Enviromental and Social mitigation measures proposed in ESIA/ESMP: responsible for establishing a Contractor ESMP (CESMP) for each construction site area, submit the plan to PMU and CSC for review and approval before commencement of construction; get all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations; implement the mitigatation measures specifid in the ESMP,, CESMP, bidding documents etc.

The CSC will assgin qualified Environmental and Social Staff(s) to supervise the implementation of ESMP and ensure compliance; responsible for routine environmental supervision and reporting during construction phase; also assist the PMU in reporting and maintaining close coordination with the local community; arrange for training on HIV/AIDs awareness raising for all workers, CSC team and PMU staff. The cost for this training included in the consulting service contract; carry out the periodical environmental quality monitoring during construction period and first-year-operation, prepare periodical environmental monitoring and supervision reports for submission to Vietnamese authorities.

IEMC will provide support to PMU to establish and operate an environmental management system, coordinate with the CSC team to provide trainings to the Contractors on project environmental management requirements; offers suggestions for adjusting and building capacity for relevant agencies during subproject implementation and monitor the site-speific ESMP implementation; prepare monitoring reports after each visits.

Other stakeholders (Provincial DONRE, District Natural Resources and Environment Division, Environmental police division, Public utility companies, Local community) are shown in Table 5.11.

In addition, the ESMP also have proposed an environmental monitoring and supervision program as well as reporting requirements, capacity building training plan, compliance framework and penalty system as detail in Chapter 5. The total estimated costs for ESMP implementation are summarized below.

Public consultation and Information Disclosure

Consultation on environmental issues is conducted after completion of the first draft of the ESIA..

The final draft ESIA/ESMP will be disclosed locally in Project area and at the World Bank's website before Project Appraisal, expected to be at the end February 2020.

Conclusions and Recommendations

Overall, the project would bring about significant positive socio-environmental impacts. Most of these positive impacts are expected to be achieved during the operation phase of the subproject..
The potential negative environmental and social impacts and risks identified, assessed in the ESIA include common construction impacts such as increased dust, noise and gas emission, vibrations, generation of solid wastes and wastewater, surface water quality reduction, traffic disturbance and increased traffic safety risks, damages to existing infrastructure (power/water supply, drainage etc.) and disruption of related services increased health and safety issues for the public and the workers etc. During operation phase, the main issues relates to waste and wastewater generation, OHS issues related to the operation of the laboratories and WWTPs. These impacts and risks are predicted to be at moderate level, and manageable through the

environmental and social management plan. The project is proposed to be Environmental Category B and should be implemented.

INTRODUCTION

I. OVERVIEW

I.1. Project Origin/Context

Vietnam National University Hanoi (VNU-HN) was established in 1993 on the basis of combining the Hanoi University, University of Pedagogy and Foreign Language Teachers' Training College. After 25 years of construction and development, VNU-HN has gained important achievements which affirms its leading position in Vietnam's higher education, and get increasingly higher rank in the world's higher education system. Being a high-quality multi-sector and multi-field scientific and technological training and research center which is prioritized for development by the Government, at present, VNU-HN is implementing 126 undergraduate training programs and 131 master training programs and 107 doctoral training programs in the fields of natural sciences, technology, humanity and social science, economics, education, foreign languages, etc. The training scale of VNU-HN is 30,777 students/graduate students, of which undergraduate training accounts for 70% of the total training scale. VNU-HN currently has 36 undergraduate majors (4 talented majors; 22 high-quality; majors, 3 advanced majors; 7 majors that meet international standards) and 8 graduate majors that meet international standards. The number of students attending specialized training programs is 3,196 which accounts for 13.8% of the total number of full-time students in VNU-HN. Such training and research activites have been implemented in a number of existing campuses with limited space located in the urban area of Hanoi city.

As it is a key regional university of a large development scale and investment demand, most of the existing training facilities are centralized in the inner city of Hanoi, the land fund is no longer available for new development and expansion. In addition, the system of laboratories and practice for training is weak and inconsistent, the quantity and quality of equipment have not met the requirements, especially in the technical and technological sectors, which is difficult to attract scientists, oversea experts and Vietnamese expatriates for teaching, research and technology transfer at VNU-HN; the training scale among disciplines and training level is imbalanced, in which the scale of postgraduate training is low and has not been closely linked to researches because postgraduate students and graduate students have less chance to carry out researches in intensive laboratories. Facilities like classrooms, equipment for teaching, learning, dormitories, sports facilities, etc. have not met the learning and living needs of students.

The 4th revolution has been creating a particularly significant change in all areas of life including education. The rapid change in technology, education requires the education to bring for learners new skills, creativity, adaption to challenges and new requirements that were not seen in traditional educational methods. This forces universities to continuously improve, innovate appropriate training programs, technologies and methods to train high-quality human resources to meet the social development needs and international integration. The training institutions must have a good preparfation of teaching resources, especially teaching staff, training programs, build learning and equipment spaces for training and research, etc.

The development of a new campus for VNU-HN in Hoa Lac will bring profound changes for the socio-economic development of Hanoi in particular and of the country in general, especially in the context that Vietnam begins to step into middle-income countries and is on the way of striving to become an advanced industrialized country. Vietnam National University Development Project - Vietnam National University Hanoi subproject which is proposed to be funded by the World Bank will create an important premise for successful implementation of the Master Plan on construction of Vietnam National University Hanoi in Hoa Lac. The project will be a strategic step in sharing urban function with Hanoi Capital, an important subproject in the masterplan of Hanoi.

I.2. Agencies Approving Feasibility Study and Environmental Impact Assessment Report

FS approval agency: Vietnam National University Hanoi

Address: No.144, Xuan Thuy street, Cau Giay district, Hanoi.

Environmental Impact Assessment Report will be approved by Ministry of Natural Resources and Environment and subject to clearance by the World Bank.

I.3. Related Projects and Plans

The project will comply with the following relevant plans:

- Scientific and Technology Development Strategy for the period 2011-2020, approved in the Decision No.418/QD-TTg on April 11, 2012 of the Prime Minister;
- Adjusted Master Plan of Hanoi City until 2030 and vision 2050;
- Vietnam National University Development Scheme until 2020 with vision 2030 approved under Decision 4488/QD-DHQGHN on November 28, 2014 of Vietnam National University Hanoi.
- The Masterplan for Building Vietnam National University Hanoi in Hoa Lac approved by the Prime Minister under Decision No.1907/QD-TTg dated March 18, 2013.

Some details of this master plan are presented below :

Figure 0.1: The planning map of Vietnam National University Hanoi (VNU)

According to the University's Development Master Plan, VNU-HN in Hoa Lac (total land area of 1100 ha) will be invested through 23 sub-projects (or 'component' project) according to the list below. By early 2020, 4 out of 23 component projects have been completed. The World Bank – financed project partcly cover three of these 23 component projects.

Table 0.1. VNU-HN's Component Projects

No.	Name of Project	Items	Schedule
1	Resettlement site project (QG-HN01)	Construction of technical and social infrastructure in the northern area of the project. Prepare construction investment project (FS) and implement the investment in the technical and social infrastructure in the West area.	
2	Technical infrastructure project (QG-HN02)	Construction of roads No. 1, 4, 5, 6, 9, 12, canals phase I and 110 kV transformer station, transmission line 110KV and phase I outgoing cables. Construction of roads No.2, 7, No.8, No.10, No.14, No.18 and the ring road; complete the connection of nodes No.1, 2 and 5; Complete the construction of phase 1 wastewater treatment plant; Prepare Detailed design drawings – cost estimation of works of phase II wastewater treatment plant.	Basically completed (2015 – present) Not yet implemented
3	Project on construction of the VNU Center (QG-HN03)	construction VNU Center with a total floor area of 63,500 m2 in the period 2021 - 2025.	Detailed planning 1/500 being prepared. Covered under WB-financed Project
4	Multiple Purpose Education Center Project (QG-HN04)	Total floor area of 35,000 m^2.	FS approval awaited
5	Dormitory Construction Project (QG-HN05)	Complete the entire internal technical infrastructure of 5 dormitories; invest in completing the dormitory No.4 with a total floor area of 103,974 m^2 (including the North and the South); complete the dormitory No.5 with a total floor area of 100.500 m^2; Invest in the dormitory No.3 with a total floor area of 119,362 m^2. Zone No.1 and No.2 will be invested in later stage. The project uses socialized capital of 30% of investment capital.	Completed Buiding No. D2, D3, D4, D5 and the infrastructure in the South of the dormitory No.4 (2014)
6	Public Housing Project (QG-HN06)	Complete the entire internal technical infrastructure of the project area to attract socialized investment.	Completed the public housing area No.1 and put into operation in 2014
7	Natural Science University Project (QG-HN07)	Total floor area of 242,400 m^2. Order of priority as follows: Zone 4 (Floor area of 40,360 m^2, capital of VND 386,540 billion); the remaining works of zone 3 - Zone 2; Zone 1 and the rest Zones with a total floor area of about 202,040 m^2 (about 1,981,138 billion - if allocated with enough capital).	Zone 4 is under construction of the project including 04 items: Research Building NC1, Department of Mechanical Information Mathematics (HT1), Department of Physics (HT2) and internal infrastructure
8	University of Technology Project (QG-HN08)	Proposed to be covered under this WB-financed project, total floor area of about 99,000 m^2	Detailed planning scale 1/500 is in progress. Covered under WB-financed Project
9	University of Social Sciences and Humanity Project (QG-HN09)	Approval of detailed planning: 1/500 Total floor area of about 207,000 m^2.	Detailed construction planning adjustment 1/500 scale is in progress.
10	Foreign		Not yet implemented.

No.	Name of Project	Items	Schedule
	Languages University Project (QG-HN10)		
11	Economics University Project (QG-HN11)	Preparation detailed planning 1/500 and construction investment project. with a total floor area of about 50,220 m^2. The project using socialized capital of 30% of investment capital.	Not yet implemented.
12	Institutes and Scientific Research Centers (QG-HN12)	Preparing revised detailed planning 1/500. complete the technical infrastructure for 22.9 hectares; invest in constructing internal technical infrastructure and some institutes when fund is allocated, with a total area of about 38.412 m^2.	Detailed planning of 1/500 scale is in progress. Covered under WB-financed Project
13	International University Project (QG-HN13)	Preparation of detailed planning 1/500 and construction investment project; Total area of about 61,950 m^2. The project uses 100% capitalized social capital.	Detailed construction planning adjustment of 1/500 scale is in progress.
14	Education University Project (QG-HN14)	Preparationapproval of detailed planning 1/500 and construction investment project (FS). Ttotal area of about 46.800 m^2.	Detailed planning 1/500 being prepared. Implement investment in the period 2021-2025
15	Law University Project (QG-HN15)	Not yet implemented	Not yet implemented.
16	Interdisciplinary Post-Graduate Department (QG-HN16)	Not yet implemented	Not yet implemented.
17	Sports Center Project (QG-HN17)	Not yet implemented	Not yet implemented.
18	Faculty of Medicine - Pharmacy and National University Hospital	Not yet implemented	Not yet implemented.
19	Faculty of Culture and Arts Project (QG-HN19)	Not yet implemented	Not yet implemented.
20	Faculty of Urban Studies Project (QG-HN20)	Not yet implemented	Not yet implemented.
21	Public Policy Department Project (QG-HN21)	Not yet implemented	Not yet implemented.
22	Viet-Nhat University Project	Not yet implemented	Not yet implemented.
23	Tran Nhan Tong Institute Project	Not yet implemented	Not yet implemented.

The proposed Vietnam National University Development Project – Vietnam National University Hanoi subproject covers small parts of the approved plan. The propseod subproject consists of 3 component projects:

- VNU Center Project (QG-HN03),

- University of Technology Project (QG-HN08),
- Project on construction of Institues and Scientific Research Centers (QG-HN12)

II. LEGAL AND TECHNICAL BASES

II.1. Legal and Technical Documents of Vietnamese Government

a. Legal Documents:

**** Law:***

- Law on Environmental Protection No.55/2014/QH13 passed on June 23, 2014 by the XIIIth National Assembly of Socialist Republic of Vietnam at its 7th session;
- Land Law No.45/2013/QH13 passed on November 29, 2013 by the XIIIth National Assembly of the Socialist Republic of Vietnam at its 6th session and took effect from July 1, 2014;
- Construction Law No.50/2014/QH13 passed on June 18, 2014 by the XIIIth National Assembly of Socialist Republic of Vietnam at its 18th session and took effect from January 01, 2015;
- Education Law No. 43/2019/QH14 dated June 14, 2019.
- Law on occupational safety and sanitation No. 84/2015/QH13 dated June 25, 2015;
- The Law amending and supplementing a number of Articles of the Law on Fire Prevention and Fighting No.40/2013/QH13 passed on November 22, 2013 by the XIIIth National Assembly of the Socialist Republic of Vietnam, Session 6, and took effect from July 1, 2014;
- Law on Water Resources No.17/2012/QH13 passed on June 21, 2012 by the XIII th National Assembly of the Socialist Republic of Vietnam, at its 3rd session and took effect from 1 January 2013;
- Investment Law No.67/2014/QH13 passed on November 26, 2014 by the XIII th National Assembly of the Socialist Republic of Vietnam at its 8th Session and took effect from July 1, 2015;
- Law on persons with disabilities 51/2010/QH12 dated June 17, 2010;
- Chemical Law No.06/2007/QH12 passed by the XIIth National Assembly of the Socialist Republic of Vietnam, 2nd Session on November 21, 2007 and takes effect from July 1, 2008;

**** Decree***

- Decree No.18/2015/ND-CP prescribing environmental protection master plan, strategic environmental assessment, environmental impact assessment and environmental protection plan;
- Decree No.19/2015/ND-CP dated 14 February 2015, detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No. 40/2019/ND-CP amending and supplementing a number of articles of decrees detailing and guiding the implementation of the Law on Environmental Protection (Decree No. 40/2019/ND-CP);
- Decree No. 108/2008/ND-CP of October 7, 2008, detailing and guiding the implementation of a number of articles of the Chemical Law.
- Decree No.104/2009/ND-CP of November 9,2009 prescribing the list of dangerous goods and their transportation by road motor vehicles.
- Decree No.26/2011/ND-CP dated April 8, 2011 of the Government amending and supplementing a number of articles of Decree No.108/2008/ND-CP dated October 7, 2008.
- Decree No.46/2012/ND-CP, dated May 22, 2012 of the Government amending and supplementing a number of articles of Decree No.35/2003/ND-CP, dated April 4, 2013 detailing the implementation of a number of articles of the Law on Fire Prevention and

Fighting and Decree No.130/2006/ND-CP dated November 8, 2006, providing for the compulsory fire and explosion insurance regime;
- Decree No.15/2013/ND-CP, dated 06/02/2013 of the Government on quality management of construction works;
- Decree No.155/2016/ND-CP dated November 18, 2016 of the Government stipulating the handling of administrative violation in the field of environmental protection;
- Decree No.201/2013/ND-CP, dated November 27, 2013 of the Government detailing a number of articles of the Law on Water Resources;
- Decree No.164/2013/ND-CP dated December 19, 2013 of the Government supplementing a number of articles of Decree No.29/2008/ND-CP.
- Decree No.43/2014/ND-CP, dated May 15, 2014 of the Government detailing the implementation of a number of articles of the Land Law;
- Decree No.79/2014/ND-CP, dated 31 July 2014 of the Government detailing the implementation of a number of articles of the Law on Fire Prevention and Fighting and the Law amending and supplementing a number of articles of Law on Fire Prevention and Fighting;
- Decree No.80/2014/ND-CP, dated August 6, 2014 of the Government on drainage and wastewater treatment;
- Decree No.38/2015/ND-CP dated April 24, 2015 of the Government stipulating the management of waste and discarded materials;
- Decree No.59/2015/ND-CP, June 18, 2015 of the Government on management of construction investment projects;

**** Circular***

- Circular No.27/2015/TT-BTNMT dated May 29, 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan;
- Circular No.36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on hazardous waste management.
- Circular No.19/2016/TT-BYT dated June 30, 2016 of the Ministry of Health on guidelines for management of occupational hygiene and employee health;

b. Vietnamese Standards and Regulations on Environment

- QCVN 05:2013/BTNMT - National technical regulation on ambient air quality.
- QCVN 06:2009/BTNMT - National technical regulation on some hazardous substances in the surrounding air.
- QCVN 26: 2010/BTNMT - National technical regulation on noise.
- QCVN 27: 2010/BTNMT - National technical regulation on vibration.
- QCVN 08-MT: 2015/BTNMT - National regulation on surface water quality.
- QCVN 09-MT: 2015/BTNMT - National technical regulation on underground water quality.
- QCVN 14: 2008/BTNMT - National technical regulation on domestic wastewater quality.
- QCVN 03-MT: 2015/BTNMT - National technical regulation on permissible limits of some heavy metals in the soil;
- QCVN 40:2011/BTNMT - National technical regulation on industrial wastewater.
- QCVN 43: 2012/BTNMT - National technical regulation on sediment volume.
- QCVN 07: 2009/BTNMT - National technical regulation on hazardous waste thresholds.
- Vietnamese regulation QCVN 02:2009/BXD - National technical regulation on data of natural conditions used in construction.
- Vietnamese Standard TCVN 2622-1995 - Fire protection for houses and buildings - Design standards.
- Vietnamese Standard TCVN 3890:2009 - Fire prevention and fighting means for houses and structures - equipment, layout, inspection and maintenance.

- Vietnamese Standard TCVN 33-2006-System of design documents for water supply and drainage-External network – Detailed design drawings; Industry standard 20TCN 33-85: Water supply and drainage, external networks and facilities.
- Vietnamese standard issued together with Decision No.256 BXD/KHKT dated December 31, 1990 of the Minister of Construction; TCVN 5308-1991: Technical regulations on construction safety.
- QCXDVN 01:2008/BXD: Vietnam construction standards on construction planning;
- QCVN 07:2010/BXD: National technical regulation on urban technical infrastructure works;

❖ Comparison of values in applied QCVN and standards in World Bank ESHG:

No.	Normative name	Parameters	Value according to QCVN (µg/m^3)	Value according to ESHG (µg/m^3)
1	QCVN 05:2013/BTNMT - National technical regulation on ambient air quality	SO_2	350	50 - 125
		NO_2	200	200
		PM_{10}	150	100 – 150
		$PM_{2,5}$	50	50 - 75
		Ozon	200	160
2	QCVN 14: 2008/BTNMT - National technical regulation on domestic wastewater quality (column A)	pH	5-9	6-9
		BOD	30	30
		COD	150	125
		Total nitrogen	30	10
		Total photphorus	6	2
		Total grease and mineral oil	10	50
		TSS	50	400
		Coliform	3,000	400
3	QCVN 26: 2010/BTNMT - National technical regulation on noise	Special area	6:00 – 21:00: 55dB 21:00 – 6:00: 45dB	7:00 – 22:00: 55dB 22:00 – 7:00: 45dB
		Normal area	6:00 – 21:00: 70dB 21:00 – 6:00: 55dB	7:00 – 22:00: 70dB 22:00 – 7:00: 70dB

Comments: In general, the values of QCVN and ESHG are relatively similar. The requirements on domestic wastewater quality in ESHG is more stringent than in QCVN 14: 2008/BTNMT with regards to COD, coliform, total nitrogen, total phosphorus and coliform parameters, the difference in allowable limites vary from around 0.4 to 5 times.

II.2. Safeguard Policy of the World Bank

The following World Bank's safeguard policies will be triggered in the subProject:

Environmental Assessment OP/BP 4.01

The policy is triggered due to the potential adverse environmental and social impacts and risks associated with the activities propposed under components 1 and 2. The proposed physical investments cover construction buildings such as classrooms, offices, laboratories, lecture halls, libraries, sport complex, experiment area, wastewater treatment plants etc. for improving the quality of teaching and learning.

An Environmental and Social Assessment/ Environmental Management Plans (ESIA/ESMP) have been preprared during project preparation. The main potential impacts and risks during construction phase include dust, noise, vibration, loss of trees and vegetation cover, generation of solid waste and wastewater, traffic and community disturbances, health and safety risks for the workers and local community etc. have been have been assessed. During operation phase, the main environmental concerns would be related to emissions from the wastewater treatment plants, occupational health safety risks relate to the operation of the laboratories and WWTP, and traffic disturbance. These potential impacts and risks were

assessed to beat moderate level and manageable. Therefore, the Project is proposed to be classified as Environmental Category B.

To meet the requirements of OP 4.01, the ESMP prepared as integral parts of the ESIA has proposed adequate measures to mitigate the identified impacts and risks together with a monitoring plan. Implementation responsibilities, institutional arrangements, reporting requirements and budgeting were also be proposed as part of the ESMP. Public consultation have been done as part of ESIA/ESMP preparation, and disclosure for public access will be carried out as soon as the Project Proposal is approved by the Ministry of Planning and Investments.

Physical Cultural Resources OP/BP 4.11

The policy is triggered as the project includes excavation activities under components 1 and 2, which may result in chance findings. Chance-finds procedures has been included in the ESMP.

International Waterway OP/BP 7.50

VNU-HN will build two wastewater treatment plants, the effluents were proposed to be discharged to a stream and a lake which then flow into the Tich river, a tributary of the Red River. The Red river is an international waterway and Vietnam is located in the lowest downstream of the Red river. The Tich river runs exclusively within Vietnam territory. Therefore, the exemption under sub-paragraph 7 (c) of OP/BP 7.50 is applied.

Access to information

Bank's policy requires that during the ESIA formulation process, the Borrower shall conduct meaningful consultations with stakeholders including project affected groups and those interested in the project. Relevant stakeholder's recommendations will be incorporated into the project design. Draft social and environmental safeguard documents must be made public in the localities and on the Bank's internet before the project appraisal.

General Environment, Health and Safety Guidelines (EHSG)

Projects funded by the World Bank will apply the Bank's Environmental, Health and Safety Guidelines ("EHS Guidelines"). The EHS Guidelines are technical references with general and industry-specific examples of Good International Industry Practice. This subproject will apply appropriate guidelines in the General Guidance on Environment, Health and Safety and specific guidance on the water and sanitation sector

II.3. Legal Documents

Official Letter No.6275/BKHDT-KTĐN dated September 7, 2018 of the Ministry of Planning and Investment on the proposal for the World Bank-funded project of VNU;

II.4. Documents Prepared by the Project Owner

The documents formulated by the Project Owner during subproject preparation include.

- Project Proposal No. XXX approved by the XXX on date
- Prefeasibility Study report of the technical infrastructure project and urgent works for VNU-HN approved by the Ministry of Construction in Decision No.1177/QD-BXD dated November 20, 2013.
- Draft Prefeasibiilty Study Report for the Hanoi subproject under the National Univesity Development Project to be financed by the World Bank (this Project) – January 2020 version. -.
- Preliminary design drawings of the Technical Infrastructure Project and urgent works for VNU-HN.
- Detailed construction planning scale 1/2000 Vietnam National University Hanoi in Hoa Lac;
- Detailed planning 1/500 of the University of Technology Project-VNU; Detailed

planning 1/500 of the complex of research, application cooperation and science and technology transfer at the land of VNC2 - Hoa Lac; detailed planning 1/500 of the International University Project;

- Socio-economic report of Hanoi city, Thach That district, communes of the subproject area.
- Report of the Resettlement Plan of the Technical Infrastructure Construction Project and urgent works for VNU-HN.

III. ESIA IMPLEMENTATION ORGANIZATION

III.1. Participants and Duties

ESIA report of Vietnam National University Development Project - Vietnam National University (VNU) Hanoi subproject will be responsible by VNU-HN as Project Owner for organizing the implementation. The participants preparing the report is listed in the table below.

Table 0.2. List of Participants Preparing the Project's ESIA Report

No.	Name	Professional degree	Contents assigned in ESIA	Signature
I. Project Owner's representatives				
1.	Pham Xuan Hoan	Assoc.Prof.Dr. of Economics		
2.	Tran Viet Dung	Master of Business Administration		
II. Consultant's members				
3.	Nguyen Thi Thuy	Master of Environmental Engineering	ESIA preparation manager - General management of reporting, survey of existing status, environmental impact assessment, and mitigation measures.	
4.	Phung Cong Thanh	Environmental Engineer	Co-management of ESIA preparation, surveying existing status, assessing environmental impacts, proposing mitigation measures and developing environmental management plans	
5.	Tran Thi Ngoc	Sociological Bachelor	Participate in surveying existing status , pubic consultation and socio-economic impact assessment and mitigation measures.	
6.	Nguyen Thi Mai Hoa	Master of Environmental Engineering	In charge of environmental monitoring and sampling; participate in environmental impact assessment and development of environmental protection plan.	

No.	Name	Professional degree	Contents assigned in ESIA	Signature
7.	Nguyen Thi Phuong Mai	Doctor of Ecology	Survey and assess the status of biological resources in the project area.	
8.	Tran Thi Thuy Trang	Sociological Master	Participate in public consultation, assess the impacts due to land acquisition, land clearance and propose mitigation measures.	
9.	Le Thi Phuong Khanh	Environmental Engineer	Participate in surveying existing status , public consultation and write chapters 2 and 6.	
10.	Dao Thi My Linh	Climate Change and Sustainable Development Engineer	Surveying existing status , public consultation and write chapters 2 and 6.	
11.	Vu Anh Phu	Civil Works and Industrial Engineer	General support of technical documents of the project; participate in proposing mitigation measures.	

III.2. ESIA Implementation Process

The ESIA report preparation process of the project follows the steps

- Study master plan of Vietnam National University
- Study detailed planning of each sub-project area within VNU.
- Study related reports such as pre-feasibility study (Pre-FS) and other relevant legal and technical documents and discuss with the technical team to promptly update information on technical proposal and background information to identify and evaluate impacts and mitigation measures to ensure consistency between Pre-FS and ESIA.
- Study the environmental impact assessment report prepared and approved for the sub-projects implemented at the National University (QG-HN-02, QG-HN07)
- Collect data on socio-economic, climate, hydrology, topography, geology ...in the project implementation area.
- Investigate and survey the existing status of environment, water drainage, houses, residents, production, infrastructure, biological and plant resource status of the project area, take samples to analyze components of soil, water, air, aquatic life, sediments in the project area;
- Identify sources of impact, subjects, scale affected, analyze, evaluate and forecast project impacts on the environment.
- Develop measures to minimize adverse impacts, prevent and respond to environmental incidents.
- Develop an environmental and social management plan for the project.
- Analyze data and write reports according to the specialized fields of experts. Gather the data, formulate the report
- Conduct consultations with the community, local authorities and related units such as the project supervisor in progress at the National University and interview households in the project area about the construction of facilities of the project.
- Incorporate ESIA report of the project.
- Submit the project's ESIA report to WB and the Ministry of Natural Resources and

Environment for appraisal and approval.

III.3. ESIA Preparation Method

a. Objectives of Environmental and Social Impact Assessment

The objective of the environmental and social impact assessment is to ensure that the projects are environmentally sustainable, potential impacts and risks are identified and assessed in order to propose mitigation measures which will minimize those impacts and risks.

b. Scope of Environmental and Social Impact Assessment

The environmental impact assessment will be conducted according to the affected areas of the proposed investments, including: (i) Construction areas: areas of University of Technology Project, the central area, the Institutes and Research Centers and 2 wastewater treatment plants .... (ii) Project's beneficial area or affected area.

Scope of assessment over time: The report will consider the environmental, social (direct, indirect, and cumulative) impacts of the project during its implementation from the pre-construction phase, construction and operation and management phase.

Figure 0.2: The Project Area

c. Objects Considered and Assessed

The affected environmental and social factors include: Natural environment (air, water, soil ... resources), ecosystems and biological resources, economics and cultural and social environment.

The impact assessment will consider: a) the physical environment (water, air, soil, existing infrastructure, taking into account the basic conditions such as climate, geography, topography and air quality); such as the impact of the project on existing water bodies, structures and infrastructure in the VNU.Hanoi area in Hoa Lac), b) historical, cultural and archeological issues; c) Biological systems such as flora and fauna, habitat types, fisheries, etc. and d) socio-economic environmental aspects such as health care and health, employment and income, gender issues, social security and stability of life, access to basic services such as water, energy, health and education, etc.).

d. Approach Methodology

ESIA assessment should incorporate the project's economic, institutional, social and technical analysis to ensure that environmental and social issues are taken into account in project selection, location and decisions related to technological solutions. – Predict and quantitatively assess the potential impacts of the subproject.

Distinguish between positive - negative, direct - indirect, cumulative effects, medium-long-

term effects. Identify potential impacts that may occur during construction and unavoidable and irreversible impacts.

e. Environmental Impact Assessment Methods

Field survey method: Conduct field survey and investigation of the existing status of environmental resources, take samples of water and soil, quickly assess some water quality indicators on the site in order to update and supplement the latest documents of the project area.

Sociological investigation method: investigate and interview, etc. households (directly, indirectly affected and benefited), and leaders of relevant departments at provincial, district and commune levels.

Statistical method: collect, process and analyze relevant meteorological, hydrological, environmental and socioeconomic data.

Expert method: through meetings, consultations with experts on the proposal of measures to minimize the negative impacts of the project.

Incorporating, analyzing and developing report: analyzing and incorporating the impacts of the project on the natural environment and socio-economic elements in the project area.

Rapid assessment method: using pollution factors of the World Health Organization (WHO) to estimate emissions and forecast pollution.

Comparative method: assess the impacts by comparing with regulations, standards on soil, water, noise, air quality and other relevant environmental standards.

Matrix method: assess the impacts of the project on each environmental or social parameter or element (including air, water, health, economy, etc.) to assess the cause-consequence relationship of the subproject implementation.

f. Consultation with Stakeholders

This method can assess the participation of stakeholders, the participation of the community in project implementation. In consultation with the community, the consultant group has organized the public consultation meetings and group discussions in all areas where the project items are built, ensuring sufficient participants such as:

- Representatives of local governments from project communes/towns;
- Branches/offices: health facilities, relevant departments ... of the project area communes.
- Representatives of households in the project area include households whose land has been acquired, beneficiary households, especially vulnerable households, households with disabled persons, etc.
- Construction, supervision units of the structures/facilities within VNU in Hoa Lac.

The contents that were consulted and exchanged by the Consultant include: (i) Introduction of the project's items and components; (ii) Outstanding environmental and social conditions of the project area; (iii) Proposed items; (iv) Potential environmental and social impacts during construction and operation of proposed items. The consulted delegates were invited to give their opinions. Details on the information dissemination and consultation are provided in the public consultation of this ESIA report.

CHAPTER 1. PROJECT DESCRIPTION

1.1. Name of Project

Vietnam National University Development Project - Vietnam National University Hanoi Sub-Project

Project Owner: Vietnam National University. Hanoi.

- Address: –No. 144 Xuan Thuy st., Dich Vong ward, Cau Giay district, Hanoi.
- Telephone: 024-37547670 (527) / Fax: 024-37547724
- Legal representative: Nguyen Kim Son, Director

1.2. Project Location

The project will be implemented in Thach Hoa commune, Thach That district, Hanoi City. The project area covers an area of 37.49 hectares, located within the campus of the Vietnam National University Hanoi (total area of 1100 hectares), which is 35 km southwest of Hanoi center . The proposed investments are located in 03 zones of the University, covering three component projects among the 23 component projects listed in Table 1, including:

- University of Technology Project (zone 1), covers an area of 8ha
- Institutes and Research Centers (zone 3), covers an area of 6.6ha
- The Central area of Vietnam National University Hanoi (zone 4), covers an area of 22.89 ha.

The project also constructs two wastewater treatment plants, one in Zone 3 and one in the Central area.

The project location is shown below:

Figure 1.1: Map of Project Location in The Master Plan of Vietnam National University Hanoi in Hoa Lac

1.3. Project Development Objectives

The Project's Development Objective is "to improve the quality of:Improve the quality of teaching andresearch at three targeted national universities through enhanced infrastructure, technology, and governance.

1.4. Project Components

The proposed Projectroject consists of 3 components:

Component 1 - Quality of Teaching and Learning

Component 1 aims to prepare high-quality graduates by supporting the three universities (i) build and/or upgrade infrastructure (buildings, lecture halls, classrooms, labs, and associated facilities); (ii) provide equipment and build/upgrade foundational digital technology infrastructure (data centers, networks); (iii) innovate teaching-learning methods (e.g. e-learning - MOOCs/adaptive learning); and (iv) internationalize selected training programs.

Component 2 - Research Excellence and Knowledge Transfer,

Component 2 seeks to achieve research excellence and enhance knowledge transfer by supporting the three universities (i) construct modern research infrastructure (research center/institute buildings, labs, etc.); (ii) provide modern equipment & technology (including High Performance Computing, VinaRen); (iii) establish strong research groups in priority sectors; (iv) collaborate with national & international institutions, industry and government agencies on science, technology and innovation.

Component 3: Governance and **Project Management**

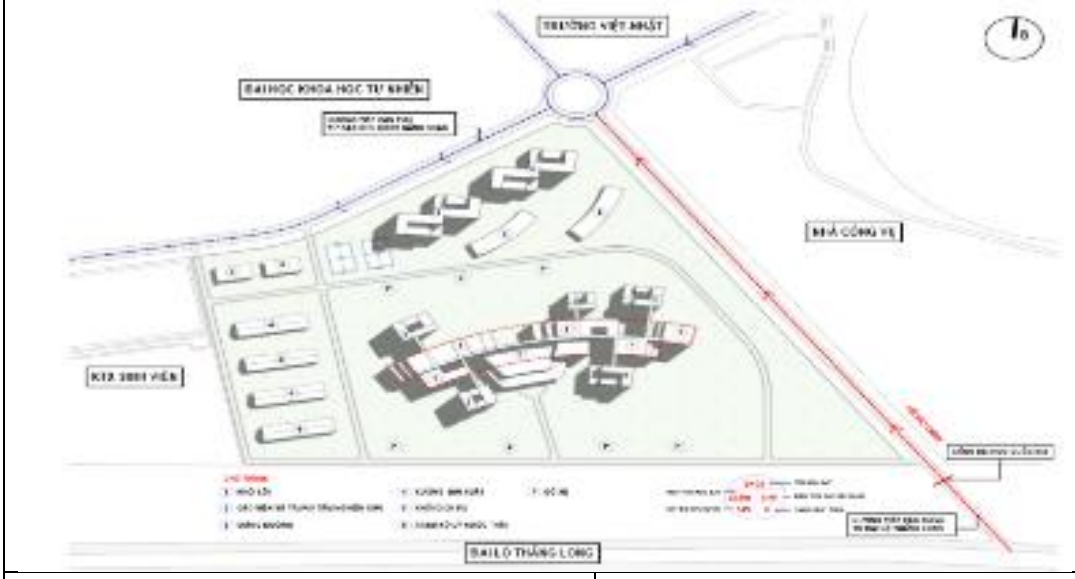
For the VNU HN subproject, Components 1 and 2 will cover civil works to be built in the area of 37.5 ha in three zones as shown in the map below.

Figure 1.2: University Campus Layout and the locations of the proposed

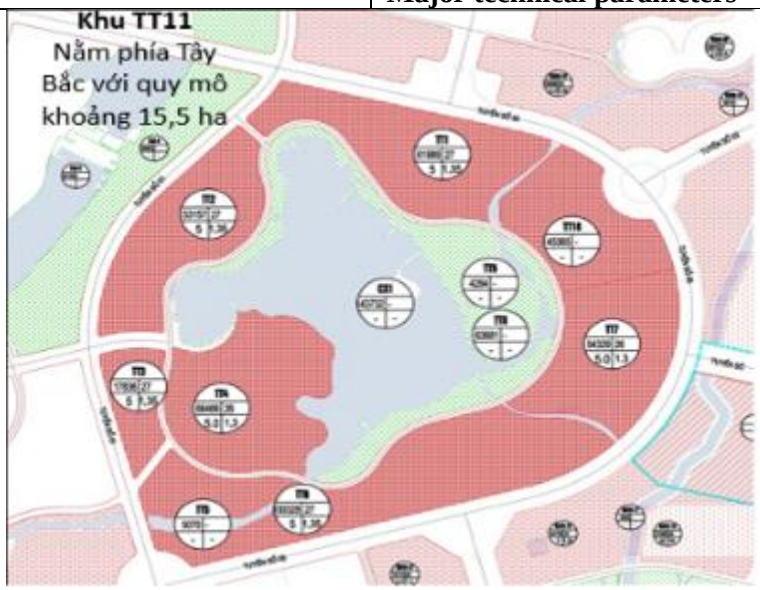
The proposed physical investment include: Construction of Administration Centre and building, lecture halls, experimental practice houses, Library, Institutes and Research Centers including key interdisciplinary and key laboratories, blocks of researchers and production workshops, and technical infrastructure (wastewater treatment plants, internal roads, electricity, water supply and drainage, etc. inside the area).The proposed items are listed in Table 1.1 below:

Table 1.1. Description of Investment Items

Building	**Major technical parameters**
1. Zone 1: University of Technology: 8 ha, Serving: 5,500 students, 300 staff. 	
Falculty and institute - Administration building	1 five-storey building Area: 2400 m^2, Floor area: 12,000 m^2
Academic block	one five-storey building Area: 1800 m^2, Floor area: 9,000 m^2
Practical and experimental block	one three-storey building Area: 2,000 m^2, Floor area: 6,000 m^2
Practical and experimental block	1 one-storey buildings Area: 3,000 m^2
International conference center and hall	1 two-storey building Area: 1,000 m^2, Floor area: 2,000 m^2
Service block	1 two-storey buildings Area: 2,250 m^2, Floor area: 4,500 m^2
Agricultural practice area (greenhouses, net houses)	1 Single-storey building Area: 1.0ha
Outdoor experimental area (unmanned aircraft, self-propelled vehicles, radio measurement, etc.)	1 Single-storey building Floor area: 1.0 ha
Internal infrastructure (yard, internal roads, landscapes, trees, garages, other auxiliary items ...)	Area 5.08 ha
Total – zone 1	The project will build 2 eight storey-buildings, 1 three-storey buildings, 2 two-storey buildings and 3 one storey buildings.
2. Zone 3: Institute and Research Center: 22.89ha, Serving: 1,580 students, 130 graduate students, 427 staff.	

Building	**Major technical parameters**
	
Building of interdisciplinary laboratory system (including 5 large laboratories: • advanced material & component lab; • AI and ICT technology laboratory; • technology manufacturing & decoding laboratory; • food and environmental quality testing • sustainable development laboratory)	1 five-storey building Area: 3,918 m^2 Floor area: 19,590 m^2
Key laboratory system building (high-performance computing center; • scientific laboratory of multi-ratio calculation for complex systems; • Nano and energy center; Accelerator laboratory; • bio-energy development lab; • UWD advanced materials in green development lab; • environmental and food safety testing lab; • center for research, development and application of analytical science; • environmental technology and sustainable development center; • Laboratory of Enzymes and Protein; • Research Center for life science, • environmental geology and climate change adaption; • marine and island research center; • geological and geotechnical and hazard mitigation laboratory; • environmental hydrodynamics center; • environmental monitoring and modeling center; • environmental analysis laboratory.	1 five-storey building Area: 4,102.4 m^2 Floor area: 20,512 m^2
Institutes and research center block : Research building 1 Research building 2	 1 five-storey building, Area: 796 m^2 Floor area: 3,980 m^2 1 five-storey building, Area: 950m^2 Floor area: 4,750 m^2

Building	**Major technical parameters**
Research building 3 Research building 4 Research building 5 Research building 6	1 five-storey building, Area: 985m^2 Floor area: 4,925 m^2 1 five-storey building, Area: 634m^2 Floor area: 3,170 m^2 1 five-storey building, Area: 626m^2 Floor area: 3,130 m^2 1 five-storey building, Area: 458m^2 Floor area: 2,290 m^2
Post-graduate lecture-hall	1 five-storey building, Area: 4633m^2 Floor area: 23,166 m^2
Production workshop	1 two-storey building. Area: 5,000m^2 Floor area: 10,000 m^2
Service block Technology transfer centre Exhibition conference block	 1 five-storey building, Area: 1000m^2 Floor area: 5,000 m^2 1 two-storey building, Area: 2,500m^2 Floor area: 5,000 m^2
Sport area and auxiliary items	1 building, Area: 3,964m^2
Internal infrastructure (yard, internal roads, landscapes, trees, garages, auxiliary items ...)	Construction area: 20 ha
Wastewater treatment plant	Capacity: 600 m^3/day, including two clusters: Cluster 1 to treat wastewater from laboratories. The effluent from cluster 1 (meet QCVN 40: 2011/BTNMT column B standard) is led to cluster 2 for further treatment together with domestic wastewater. Cluster 2: treat the effluent from cluster 1 and domestic wastewater from zone 3. Treated wastewater quality meet Vietnamese Standard QCVN 14: 2008/BTNMT (Column A)The effluents was proposed to be discharged into a drainage, then to the Muc lake before entering the Tich river, a tributary of the Red river that runs exclusively within Vietnam territory.
Total – zone 3	The Project will: - build 10 five-storey buildings, 2 two-storey buildings, and 2 one-storey buidlings; one sport centre - Build a wastewater treatment plant capacity 600 m3/d - procure equipments and machnies for the interdisciplinary laboratories - support the relocation of the existing laboratories to the new campus.Moree details are provided in Annex 2.
3. Zone 4: Central area: 6.6 ha Serving: 650 students, 220 staff.	

Building	**Major technical parameters**
	
Administration building of VNU center	Area: 782 m^2, 1 twelve-storey building Floor area: 9,380 m^2
Library building	1 five-storey building Area: 2,624 m^2, Floor area: 13,117 m^2
Garage	2 one – storey Area: 2,716 m^2, floor area: 5,432 m^2
Internal infrastructure (yard, internal road, landscape, trees, garage, auxiliary items ...)	Construction area 6.16 ha,
Wastewater treatment plant The south of VNU (zone 4 - the center of VNU-HN)	Capacity: 1,475m^3/day. Technology: CSBR. Area: 5,000 m^3 Treated wastewater meets Vietnamese Standard QCVN 14: 2008/BTNMT (Column A)
Total – zone 3	1 twelve storey building, 1 five storey building, 2 one-storey buidlings and one wastewater treatment plant capacity 1,475 m^3/d

In the VNU-HN WB-financed sub-project new infrastructure will be built for the University of Technology and the research center institutes to move from existing campus in Hanoi to the new campus in Hoa Lac. Units to be moved will be: University of Technology; Institute of Natural Resources and Environment; Institute of Microbiology and Biotechnology; Information Technology Institute; International Francophone Institute; Knowledge transfer center and start-up support.

The system of laboratories of the University of Technology and the institutes moved to the new headquarters, including:

- The key laboratory of the unit: Key laboratory for bioenergy development; Key Laboratory Advanced materials for green development; Key Laboratory for Environmental Geography and Climate Change Response; Key Laboratory of Analytical Technology for Environmental Inspection and Food Safety; Key laboratory for science of multi-scale calculation for complex systems; Key laboratories Micro and nano technologies; Key laboratory Intelligent integrated system; Center for Economic and Policy Research; Key laboratory of National-level Enzyme and Protein Technology; Nano and Energy Center.
- Interdisciplinary laboratory system (core):
    + Field of advanced materials and components: Advanced material and component laboratories.

+ Environment and sustainable development: Module: Laboratory for the development of applied analytical science in food and environmental testing; Module: Testing laboratory and quality control of urban and industrial environment; Module: Control laboratory, assess the quality of natural environment.
+ Biotechnology and biomedical fields: Module: Biomedical technology laboratory, diagnostic and high-tech treatment; Module: Biotechnology laboratory for high agricultural development.
+ ICT, AI, Data Science fields for manufacturing, decoding technology & developing complete products: AI and ICT technology laboratory; Laboratory manufacturing and decoding technology.

Thus, the project will build a total of one 12-storey building, 13 5-storey buildings, one 3-storey building, four 2-storey buildings, sevensinglestorey buildings, a sport centre , two wastewater treatment plants and other internal infrastructure in a total area of 37.5 ha. Specification of each wastewater treatment plant is described below:

WWTP 1: located in zone 3 - the institute and research center area.

- Location: next to the road No. 11.
- The plant area: 260 m^2
- Capacity: 600m^3/day
- Treatment Technology:
  - Cluster 1: Influent: Wastewater from laboratories. The influent is treated in a separate module. The treated wastewater from cluster 1 is conveyed to Cluster 2 for further treatment together with domestic wastewater. Laboratory waste water reaches column B QCVN 40: 2011/BTNMT before moving to cluster 2.
  - Cluster 2: Influent: domestic wastewater from zone 3 and the treated waster from cluster 1. The influent will be treated by the Conventional Sequencing Batch Reactor technology (CSBR) same as the WWTP 2. Description of treament process are provided in **Figure 1.3** next page. The effluent quality: meets Vietnam Standard QCVN 14: 2008/BTNMT (Column A) – National Technical Regulation on Domestic Wastewater.
- Receivingbody: Muc lake, will be confimed later.

The effluent from the WWTP 600 m^3/day in zone 3 will be discharged to a road-crossing drain, then run into the Muc Lake in basin 6, then follow the drains of NH21A to the combined drainage system of high-tech zone, finally to the Tich river. The Muc Lake is a natural lake with a capacity of 96,000 m^3, being recharged by rainwater in the catchment including the flow passing existing cultivation land.

Laboratory wastewater characteristics and Proposed treatment technology for Cluster 1:

Characterisitics of laboratory wastewater

Type and basic information about the laboratory to be set-up in the new campus is provided in Annex 2B. Wasteater in laboratories mainly generated from the washing of the testing equipment, the quantity of wastewater is usually not large but may contain various contaminants, depending on the types of chemicals used for the experiments. The organic and inorganic waste materials found from laboratories include dicloetan, cyclohexan, aceton, toluene, benzene, chloroform, butanol, methanol, SO42-, NO3-, Cl-, photphorus componds,… Most of these are hazardous and may cause environmental pollution thus need to be treatment before being released into the environment. Below is the indicative untreated wastewater

quality from laboratory[1] and the effluent quality according to the applicable QCVN 40:2011/BTNMT:

	Parameter	Unit	Influent Quality	Column B QCVN 40-2011/BTNMT
1	Total P	Mg/l	6 – 10	4
2	Total N	Mg/l	15 – 50	20
3	SS	Mg/l	70 – 120	50
4	COD	Mg/l	500 – 900	75
5	BOD5	Mg/l	400 – 600	30
6	pH	-	6.0 – 8.0	6 – 9

Wastewater quality is not constant or stable overtime. Common chemicals used in medical laboratories may include[2]:

+ Solid chemicals (Amoni acetat, Amoni dihydrophosphate, Amoni molipdate, Amoniclorine, As, acids such as ascorbic, Barbituric, benzoic, boric, Chromo tropic, citric…

+ Liquid chemicals: organic solvents such as như Benzen, Etalnol, Formandehit, n-Hexan, 0-xylen,…

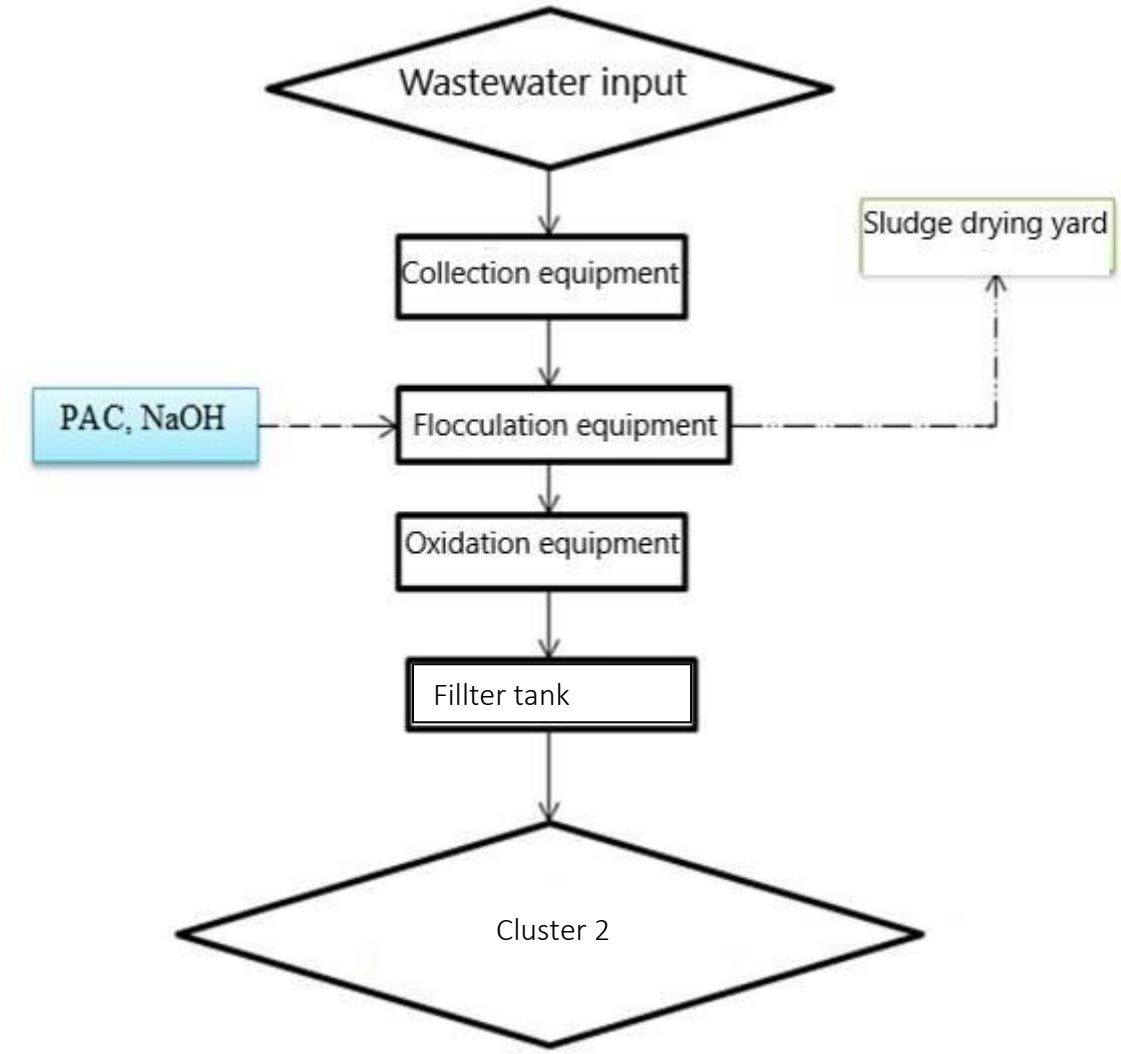
+ dyer, standard solutions etc …

+ Anti-biotic products such as Amoxicillin & Ampicillin, b -Lactam,..

Possible treatment processes applied to laboratory wastewater:

Wastewater from the laboratory, is piped to the tank. Due to the nature of the wastewater, the flow of wastewater and the concentration of pollutants in the wastewater at each time are different. Therefore, to ensure the performance as well as to avoid overloading of rear treatment facilities, the wastewater before entering the treatment system should be put into the collection tank, to regulate the flow and concentration. At the same time, remove a part of inorganic solids capable of settling. .Waste water from the collection tank is pumped to flocculant-settling equipment to remove suspended solids. The principle of operation in this device is that small colloidal particles are suspended in water by the effect of flocculation, they will stick together to form large scale flakes, easily separated from water. Due to the relatively low flow of wastewater discharged from the laboratory during the day, to save costs, this equipment will be adjusted to work in batches, 2 batches a day, each batch operates 4 phases: filling water, settling, discharging, waiting phase.

[1] http://nihophawa.com.vn/chi-tiet-tin/tham-khao-he-thong-xu-ly-nuoc-thai-phong-thi-nghiem.html
[2] http://www.moitruongvietbac.com/xu-ly-nuoc-thai-phong-thi-nghiem



Wastewater is pumped into the device, and PAC flocculant and pH regulator (NaOH) are added. The agitator will be started at the same time to mix chemicals in wastewater. When water fills the device, pumping water and adding chemicals will stop working. The agitator is adjusted at a slow speed so that the debris can form bigger, avoiding strong agitation to break the debris. After the reaction time, the agitator stopped working. In the process of sedimentation, the sediments due to gravity are deposited to the bottom of the tank. When the sedimentation process is finished, the sediments are now completely settled, the water discharge system operates. The clear water will be directed to the device's water collection system and directed to the oxidizer.

At the Oxidation Reactor, the chemical adding system will add H_2O_2 to facilitate the oxidation process, the wings will mix chemicals into wastewater. The purpose of this device is to remove toxic organic material that is left in the sewage. The toxic organic compounds which are oxidized will be completely turned into simple inorganic substances. At the same time, in this device, the pathogenic germs in the sewage will be removed. Wastewater from the oxidation device is pumped into the filtration device, to remove the remaining residue in the wastewater.

Waste water after exiting the pressure filter, will be transferred to cluster No. 2 for further treatment to reach QCVN 14:2008 / BTNMT (column A) and section 1.3. Waste water and surrounding water quality in ESHG.

WWTP 2:

- Scope of service: The plant will collect and treat wastewater for University of Technology, the center of VNU in Hoa Lac.
- Location: located on road No.6, next to VNU center
- The plant area: 5,000 m^2
- Capacity: 1,475 m^3/ day,
- Influent wastewater quality:

No	Parameter	*Unit*	*Influent Quality*	Effluent quality (to meet QCVN 14:2008/BTNMT)	ESHG
1	BOD_5	mg/l	250	**30**	**30**
2	COD	mg/l	315	**-**	**125**
3	TSS	mg/l	270	**50**	**10**
4	TDS	mg/l	750	**500**	**2**
5	NH_3	mg/l	32	**5**	**50**
6	PO_4^{3-}	mg/l	12.5	**6**	**400**
7	Coliform	MNP/100ml	13.10^6	**3,000**	**400**

- Technology: Conventional Sequencing Batch Reactor (CSBR).
- Effluent quality: meets Vietnamese Standard QCVN 14: 2008/BTNMT (Column A).
- Receiving source: No.1 Stream.

The effluent from the WWTP 1,475 m^3/day in zone 4 will flow into a road-crossing drain to the stream No. 1 then Na Muong stream, then flow to Tich river through the Dong Lac stream system. The length of the waterway from the WWTP discharge point in the project area to the Tich river is more than 6 km. Then, the Tich river (over 70 km) to Bui river, to Red river and finally the sea. No.1 stream is a natural flow with a fairly large flow of 3.1 m^3/s.

The proposed wastewater treratment technology and process for 2 WWTP is described below.

WWTP uses the Conventional Sequencing Batch Reactor (CSBR), also known as improved Sequencing Batch Reactor technology. The processes of aeration and sedimentation takes place continuously in the same CSBR tank based on the principle of repeating each batch. A CSBR cycle consists of three basic steps; 1) filling-aeration, 2) filling-settling and 3) draining. A batch treatment cycle usually takes 3-4 hours with a time dependence due to the actual wastewater flow entering the treatment plant. At the peak period, the treatment cycle of the CSBR system will occur more continuously and when the actual wastewater inflow the CSBR system is interrupted (stopped) during the process of draining settling water so as not to affect this process.

A CSBR tank is divided into two zones. Zone 1 is considered as a "selection stage" with the main purpose of eliminating readily biodegradable substrates in an environment conducive to the formation of sludge. This zone is usually self-adjusted for all load conditions and operates in aerobic condition during aeration period and in anaerobic condition during period without aeration. From Zone 1, wastewater flows in the form of bottleneck flow to a series of aeration compartments in Zone 2. This is the main area of the treatment tank which accounts for about 85% of the total volume of the CSBR tank. Zone 2 is equipped with fine foam air supply devices at the bottom of the tank and this area will be operated as a completely-mixed aerobic tank during aeration period. The aeration takes place nearly 50% of the time of a treatment cycle to supply air for the respiration of microorganisms in the activated sludge. The sedimentation and drainage process will take place for about 50% of the rest of the cycle.

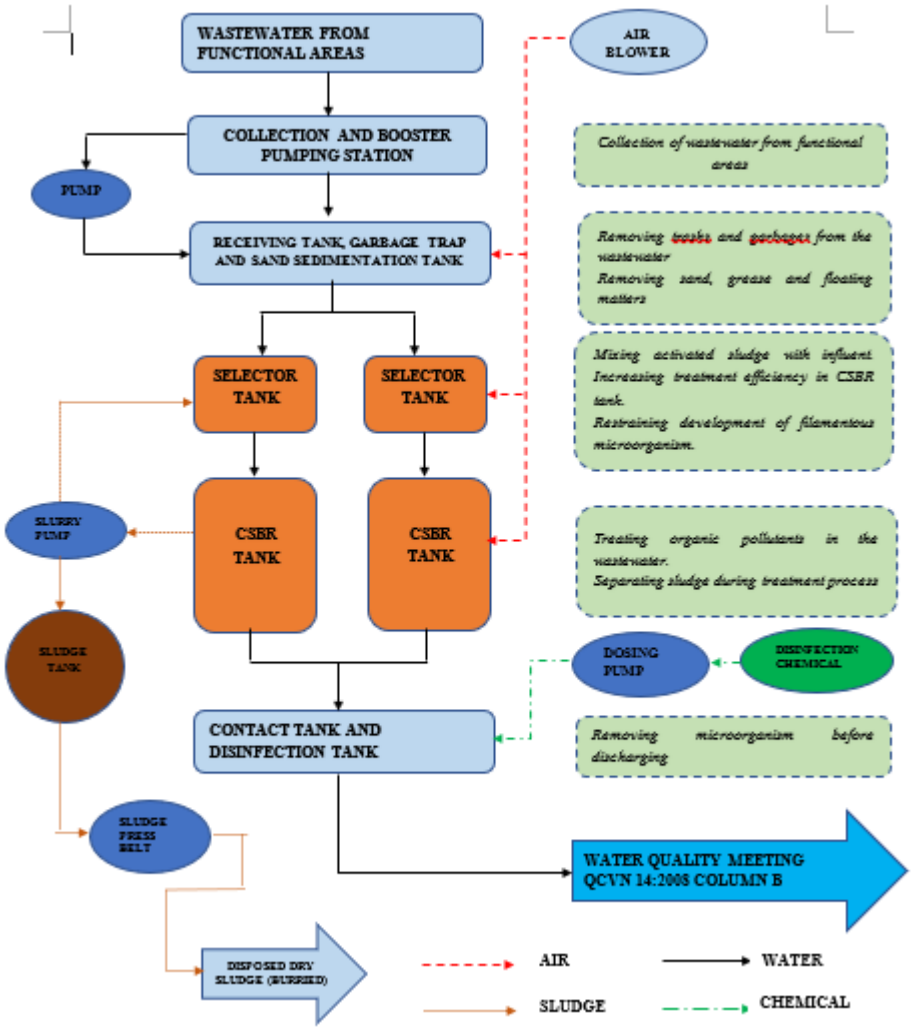


Figure 1.3: Wastewater treatment process

1.5. Construction Method

- Foundation construction:

Before commencement of the construction work, contractor will prepare construction method and equipment mobilization plan, prepare the construction site, check the testing devices, determine benchmarks and coordinate system of the works. The construction contractors must strictly follow the process for construction of bored piles to ensure the quality of the piles meets TCXDVN 326-2004 standard, take measures for earthwork with great depth and for mass concrete construction in accordance with TCVN 305-2004.

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- Construction method for 1-2 storey works: Construction of the single footing is as follows: pile driving; dig the foundation pit; flatten the surface of foundation pit; check the level of foundation lining; pour the concrete lining; pile caps; set the formwork for the foundation, concrete the foundation and remove the formwork. Build the buildings and ancillary works.
- Construction method for 3 – 7 storey works: The works with height from 3 to 7 storeys will have concrete pile foundation .Using precast concrete piles; drive the piles in pile groups; from the middle to the surrounding.

- Wering the pile: Using pile driving machine to press the pile into the soil, Excavate the soil to the depth of 2-3m. Let the piles set in over 30 days before carrying out static tests on the piles. Start the pressing on the piles accurately and reasonably. Build the buildings and ancillary works. The foundation is designed with natural soil

condition

- Technical solution for construction of foundation of the building with more than 10 storeys.
- The high-rise building will have a large load, so, for cost effective and safety for the project, bored pile construction method will be used. Retaining wall will be constructed, foundation is pile foundation with bored pile diameter D800, D1000 and D1200. Use bentonite solution for the boring work

➢ **Method for installation of formworks and scaffolding:**

Formwork and foundation will comply with the requirements of TCVN 5724-1992. Construction of formwork will be done by teams of skilled and experienced workers. Formwork is classified, gathered separately in each area and transported to the construction site mainly by tower cranes.

➢ **Construction method for formwork of girder, floor and roof**

Before installing formwork, we will check and position central axle of the beam. Install the formwork, check after installation to ensure safety during construction.

➢ **Construction method for high-rise works**

Formwork used for structures using shaped steel formwork. The components fabricated on the ground will be brought to installation position by cranes. Transport the concrete by specialized vehicles and brought to high platform by pump or cranes. Transport other materials to high platform by cranes or hoists. The formwork system to be used should be convenient, easy to assemble and should ensure stability under working load and wind effects. Follow construction order for each floor, the construction joints, the expansion joints between girders, beam and floors, ensure integrity. Fabrication, assembly and erection of steel structures of the heat exchanger will strictly follow the process of erection of steel structure. The erection will be implemented upwardly and at the same time with process of installation of equipment.

➢ **Method for water supply and drainage in the buildings under the project**

Determine locations, Install indoor water supply pipes. Standpipes will be connected to the water supply pipes to supply water to the base of each building. For the administrative building or central operation building with about 10 floors, the pipes will be manually brought to the floors through technical boxes. Determine location of the pump and concrete the support of the pump to ensure no vibration during operation process.

- Installation of indoor drainage pipes of the Project

Specialized hanging device will be use to position the drainage pipes on each floor. The hanging device will be manufactured in such a way that it can easily adjust the height to facilitate the slope. PVC pipes and fittings will be joined together by specialized pipe glue. Every position where the pipe penetrates through the concrete floor will be waterproofed.

➢ Installation of sanitary wares

The sanitary wares are mostly made of porcelain, so they will be carefully installed and have protective measures to ensure their safety; Sanitary wares will be installed when the process of masonry, plastering, tiling, tile and ceiling are completed; The couplings between the sanitary wares and the pipeline will be the types supplied or selected by the sanitary ware manufacturer; The lavabo and wall hanging urinal must be tighten to the wall by galvanized steel or stainless steel bolts; The sanitary wares will be checked and tested after being installed; Protective measures will be provided until the works are handed over and brought in to use.

➢ Installation of outdoor water supply pipeline

Processing and cutting galvanized steel pipes by manual cutting table combined with specialized thread cutting machine; Transporting the pipes to locations where installation is required; Excavating cable trenches and placing steel pipes into trenches and conducting steel pipe connection joints; The gasket, sealing gap of the threaded joints during construction are

all sealed to avoid foreign objects; After the installation is completed, conduct the testing and inpecting water supply capacity to each project area.

- Installation of outdoor drainage system

Dig drainage ditches, manholes and settling pits of the Project strictly complying with the design drawings; Construct drainage ditches, manholes, settling pits; Install water drainage sewers at the drainage position of the Project into the surrounding environment; Check the drainage system to solve problems and repair technical errors caused by the construction process.

- Installation of lighting system, sockets and switches

Prepare supplies including: lamps, sockets and switches and installation aids. Mark the location to be installed with luminescent and colorful ink in contrast with the ceiling and floor in accordance with the project's design. Install rack system of concealed box, signs. Connect wire to each material and equipment. Clean and seal supplies and equipment where persons may access.

- Construction and installation of grounding system – lightening protection

Survey the structures to identify the type of soil, the characteristics of humidity, pH, groundwater level to select the form of grounding and the number of piles needed for the system; Identify the location of piles at the required depth for pile driving based on the design drawings; Connect the piles into a bare copper wire network; Check the connection joints, welds, then connect to the main switchboard, write the marks on the grounded busbar to facilitate the operation of the system.

- Construction and installation of the external power system of the Project

Turn the trenches to bury the underground power line. Each underground power line is threaded in a conduit to ensure safety from short-circuiting.

- Construction, installation of transformer:

Excavate soil, erect reinforced concrete pillars, main drag resistance and install earthing road for the substation. Install uPVC pipes passing medium voltage cables, low voltage outgoing cables before construction of transformer station foundation, pipe connections must be glued of special type, the pipe ends must be cleaned before glued.

Concreting transformer foundation and foundation.

- Installation of medium voltage cable, low voltage outgoing cable, electrical cabinets:

Installing nacre, switchgear, metering equipment, transformers, and electrical cabinets ensure the approved design site. Medium voltage cable and low voltage outgoing cable when threaded in underground pipes are only taped at both ends when laying wires, absolutely do not wrap tape on the line for easy purpose to change wires during maintenance of the system. The ends of waiting wires to connect electric cabinets and transformers must be calculated on the basis of the elevation of the road foundation, sidewalks, the position of equipment connection, ... avoid additional connection of wires. The terminals connected to the electrical cabinent are numbered according to the general regulations to avoid confusion during connection and repair. When the wiring is completed, check and record the insulation resistance parameters (> 10MOHM), measure the continuity and compare with the "Cable Schedule" with the supervision of the Consultant.

After the transformer, electrical cabinets, generators are installed, connect wires to the cabinet.

1.6. Manpower, Construction Equipment and Machineries, Construction Materials

Manpower, Machineries, Equipment

Anticipated manpower demand and construction duration of each work item as shown in the following Table.

Table 1.2. Manpower Demand and Planned Construction Duration

Items	Duration (months)	Peak number of workers/month (person)
(1) Construction of University of Technology (appro. 8ha).	18	300
(2) Construction of the center of VNU-HN (approx. 6.6 ha)	22	250
(3) Construction of institute, research center (22.89 ha)	24	400
(4) Wastewater treatment plant, capacity 1,475 m^3/day.	06	50
Note: Based on field consultations of construction works in the area of VNU village, specifically building HT1 building under project QG-HN07, 70% of the workers employed at the site are local, only 30% are experienced and senior workers of the contractor are immigrant workers who come from other localities and live in camps to be set up on site.		

The list of main machines needed for basic construction activities is presented in the Table below.

Table 1.3. List of Main Construction Equipment

Machineries/equipment	1. University of Technology	2. Institute, Research Center	3. Centre of VNU
Single-bucket excavator	10	10	11
Bulldozer 108 CV	8	8	9
Vibratory roller 10T	4	5	5
Wheel-mounted compactor 16T	4	4	5
Vibratory roller 25T	4	4	5
Automobile crane 10T	5	6	4
Street sprinkler 5m^3	2	3	3
Asphalt truck 7T	2	2	3
Mortar mixer	10	8	11
Water pump	4	4	5
Asphalt concrete paver	2	2	3
Pile pressing machine	4	4	5
Self-dumping truck	5	5	6
Bar Cutting & bending Machine	4	4	
Electric welding machine	5	5	6
Tamping rammer	4	4	5

The volume of excavation and backfill soil for the project is listed in the following table:

Table 1.4. The Volume of Demolition, Dredging and Excavated Soil of The Project

Items	Biomass (m^3)	Excavated soil (m^3)	Total (m^3)
(1) Construction of University of Technology (appro. 8ha).	1,500	13,090	14,590
(2) Construction of the center of VNU (approx, 6.6 ha)	7,700	73,650	81,350
(3) Construction of institute, research center (22.89 ha)	800	6,045	6,845
Total	**10,000**	**92,785**	**102,785**

Table 1.5. Volume of Main Constructional Materials of The Project

Items	Volume								
	Cement	Sand	Stone	Bricks	Tiles	Asphalt	Concrete	Steel	Paint
	(ton)	(m^3)	(m^3)	Brick	M^2	(ton)	M^3	(ton)	(kg)
(1) University of Technology (8ha).	4,000	4,500	66,049	8,846,523	208,732	13,070	16,845	955,350	185,151
(2) Central area (6 ha)	57	68	12,277.5	18,915,334	446,555	4,096	35,840	2,031,118	373,445
(3) Institute, research center (22.89 ha)	1,200	1,500	25,253	3,500,120	104,366	8,360	8,422	4,700,630	92,575
Total	**12,250**	**14,060**	**223,959**	**31,261,977**	**759,653**	**60,815**	**61,107**	**7,687,098**	**651,171**

✓ **Power supply and water supply for construction:** As tap water is not available in the project area and ground water of good quality is available, the contractors will drill well for construction and domestic use. Power Supply will be from the connection with the existing Son Tay – Hoa Lac – Hoa Binh substation in Mieu Village, Thach Hoa commune.

✓ **Fuels for the project:** The fuels used for the project such as gasoline, diesel, fuel oil etc.... will be purchased from number of suppliers in Hanoi city and delivered to the project.

✓ **Raw material supply:** purchased from specialized material suppliers in Hanoi and neighboring provinces such as Hoa Binh, Vinh Phuc, Phu Tho, etc.

✓ **Material transportation route**: transportation route will avoid inner urban areas, densely populated areas, especially during rush hour. Materials such as cement, iron and steel are transported by 15-ton vehicles to the project on the routes of Thang Long, Hoa Lac - Hoa Binh and Highway 21A (Ho Chinh Minh road). These are the main roads, which are operating well and convenient for the process of transporting materials, the distance from the source of raw materials to the project area is about 40km. However, the most affected area by the material transportation is Hoa Lac - Hoa Binh road section in front of Vietnam National University Hanoi in Hoa Lac.

✓ **Zone 1:** There is an existing soil road which is an old transport route of previous constuction . It is located next to the construction materials yard, there are no households living around. The road is about 300m long.

✓ **Zone 3:** This area has one existing earth road,. The road has two ways leading to Hoa Lac - Hoa Binh road. At the interchange of this road and Hoa Lac - Hoa Binh road, there are several business households. The total length of the road is about 1.35 km, the cross section is from 4 - 6m.

✓ **Zone 4:** Currently, it is a soil road linking to Bai Dai road, which is about 1km long.

Figure 1.4: The Material Transport Route Zone 3

Figure 1.5:Transport Route Zone 1

Figure 1.6: Transport Route Zone 4

1.7. Disposal Site

Top soil will be transported to and reuse at the existing nursery ground located within the University boundary. The site is about 3 ha, has low ground elevation. Non-recyclable materials such as biomass and solid construction wastes such as mortar droppings, packaging materials, broken bricks, etc. will be collected and stored in temporary storage yards (to be indentified)). At the present, there is no disposal site for waste construction materials in Thach Hoa commune and Thach That district. For all other local construction works, Minh Quan High Technology Investment and Development Joint Stock Company is contracted for waste collection and treatment. After being collected, the construciton and domestic waste will be transported to Nam Son (Soc Son district) concentrated waste treatment area of Hanoi City. This is the centralized waste treatment area of the entire Hanoi city, managed by Urenco Hanoi, with sufficient conditions to ensure waste treatment according to regulations.

Figure 1.7: Location of Nursery Garden of VNU-HN

1.8. Project Area of Influence

The project's affected areas are mainly determined by the construction sites of the project, and also other auxiliary areas such as solidwaste stockpiles and drainage system. The project's affected area is beyond the scope of actual construction sites, primarily through existing infrastructure systems such as drainage and sewage, dust and noise caused by the construction process and treated wastewater receiving sources of wastewater treatment plants. In addition, the material transportation and disposal will also affect regional transportation. However, the project site is located in a separate area without sensitive structures (temples, temples, hospitals, schools, etc.), and with scattered households, so the level of impacts will be greatly reduced.

Traffic routes affected by the construction:

- Internal transport: route 11, route 3, route 1, route 4, route 5, route 6.
- External transport: Hoa Lac - Hoa Binh expressway, Thang Long national road, Highway 21, ...

Table 1.6. The Area and Sensitive Objects Affected by The Project Construction Activities

No.	Item	Affected areas and sensitive entities	
		Social entities	**Natural entities**
1.1	Zone 1	VNU-HN guesthouse, residential area hamlet 6 - Thach Hoa commune	Da Lat lake, arable land, hamlet 7, Thach Hoa commune
1.2	Zone 3	VNU-HN guesthouse, residential area village 6 - Thach Hoa commune	Muc lake, close to residential area hamlet 6 - Thach Hoa commune, adjacent cultivated land, green fence in the West of zone 3 nearby Road No.11
1.3	Zone 4	VNU-HN guesthouse, residential area village 6 - Thach Hoa commune	No.1 stream, Da Lat lake, grassland and large trees - core zone 4.

Figure 1.8: Location of Sensitive Areas and Locations Affected by The Project

1.9. Project Implementation Schedule and Budget

Total project cost:

Total expected investment: 2,967,646.78 million dong, equivalent to 126,070 million USD.

- Duration: 2021-2025. – Operation period: from 2026.

Table 1.7. Project Schedule

No.	Contents	Milestones
1	Detailed design, bidding documents for 30% of investment value (University of Technology, VNU center)	6-11/2020
2	Approval of Detailed Design, Bidding Documents for 30% of investment value	12/2020
3	Construction for 30% of investment value	01-6/2021
4	Detailed Design, Bidding Documents for 70% of investment value (institute and research center, institutional capacity enhancement)	1/2021
5	Approval of Detailed Design, Bidding Documents for 70% of investment value	6/2021
6	Procurement, construction, acceptance and handover for 70% of investment value	7-12/2021-12/2025

1.10. Project Implementation Organization

Vietnam National University Hanoi is the project executive agency responsible for administering, organizing and assigning subordinate units to prepare and implement the project including implementation monitoring with environmental, social, safety and health compliance monitoring.

During the construction phase, the basic construction division will assign 2 officers in charge of environmental, social, safety and health management.

Upon completion, the project will be directly managed and operated by Vietnam National University Hanoi in which the facility management unit will manage the technical staff to operate the electromechanical system in the university, which is planned to have 2 technical staff in charge of environmental sanitation, operating the treatment plants, including 1 engineer and 01 bachelor. Environmental, Health and Safety Officers will also be appointed for managing EHS risks of the laboratories.

CHAPTER 2. NATURAL, SOCIAL AND ECONOMIC CONDITION

2.1. NATURAL CONDITION

2.1.1. Geographical Location and Topographical, Geological Condition

❖ Geographical location:

The project is constructed on an area of 37.5 ha within 1,000 ha of land under management of Vietnam National University – Hanoi in Hoa Lac, Thach That district which is 35 km west of Hanoi city . The land area of Vietnam National University – Hanoi is about one kilometer from the runway of Hoa Lac airport in the North, adjacent to National Highway No.21 in the east, Lang Hoa Lac road in the south and adjacent to Mieu village, Thach Hoa commune and Than Lan mountain in the west.

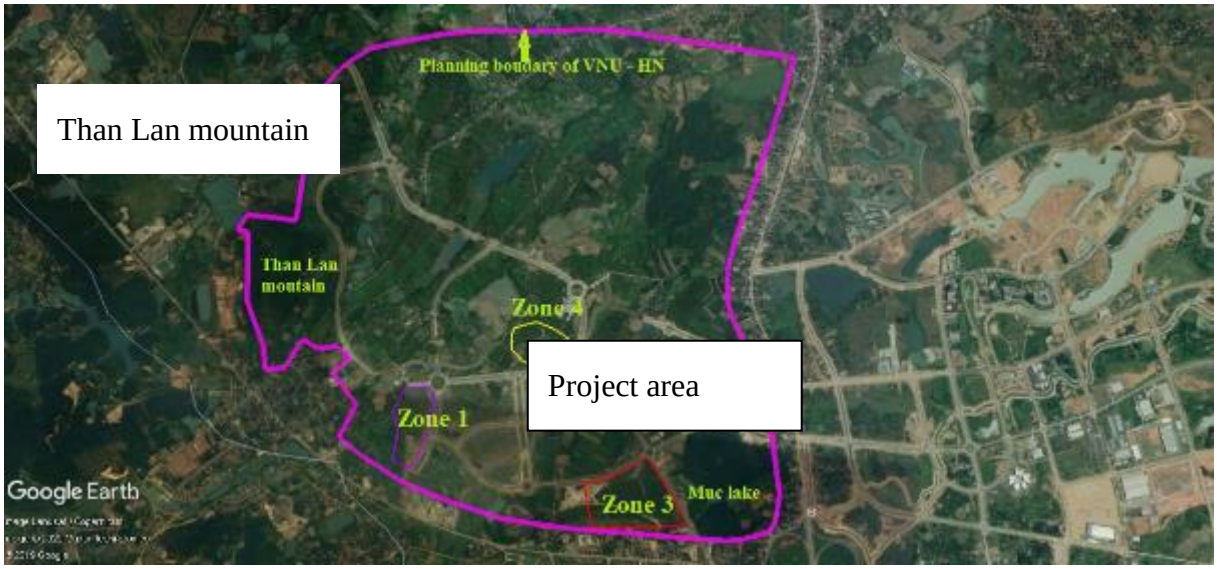

Figure 2.1: Location of The Project Area

❖ Topographical characteristics:

The project is located in a semi-arid area with terrain of low hills interlacing with low-lying fields and streams and inclining from West to East, from Southwest to Northeast. Ground elevation varies from + 12 m to + 43.0 m (except for Muc mountain where the elevation is + 99.81 m, and slope > 20%). The average elevation of the area is + 25.0 m. The lowest position is the upstream valley area of Hoa Lac Bridge in the northeast of the project area (adjacent to National Road 21A). The central part of the project area is a shallow valley between two high-lying land strips stretching from the southwest to the northeast. As a result, the project area has relatively flat terrain and convenient location that should be maintained when designing the elevations.

❖ Geological and hydrological characteristics:

According to results of the geological survey conducted in 2005 by Union of survey and construction One member limited company (Usco), the geological condition of the project area meets level 3 of complexity. The preliminary stratigraphy from the geological survey results as follows:

- Layer 1: Topsoil: arable land, the thickness varies from 0.2 m ÷ 0.5 m, mainly composed of clay mixed with roots;

- Layer 2: Clay, loam. The thickness varies mainly from 0.5 m ÷ 3.5 m, the main components of the layer are clay loam, yellow gray, soft plastic state;
- Layer 3: Clay, loam; plastic state mixed with grit. The elevation of surface layer varies from 19.17 m to 33.52 m. Layer thickness varies from 1.2 m ÷ 5.7 m;
- Layer 4: Clay, loam; hard plastic state with yellowish brownish grayish white color, hard plasticity state. Thickness varies from 1.5m ÷ 5.0m;
- Layer 5: Gravel and pebbles; Moderate tightness
- Layer 6: Clay mixed with pebbles; flexible plastic state
- Layer 7: Sand and clay grit; Moderate tightness
- Layer 8: Mixed clay; plastic state hard and gritty
- Layer 9: Mixed clay; flexible plastic state
- Layer 10: Mixed clay; hard plastic state
- Layer 11: Mixed clay; semi-rigid state
- Layer 12: Strong weathered clay

Conclusion: The natural geology of the area is generally suitable for construction of multiple storey building.

❖ Earthquake condition: The project area is located in the region with risks of being affected by seismic activity up to 7 degree in intensity.region.

2.1.2. Climate and Meteorological Characteristics

Thach That District is located in the climate zone with four distinct seasons including spring, summer, autumn and winter in a year. The summer is hot and rainy, lasting from May to September. The winter is cold and dry lasting from November to March of the following year. subjected to extreme weather such as local rain, heat inversions and the effects of winds from the sea blowing into the North region. The hottest month is July with temperature ranging from 28^{o}C – 30^{o}C, the difference between the hottest month and the coolest month is only about 2 – 3^{o}C.

Table 2.1. Average Temperature in Months (^{o}C)

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Temparature	17.7	17.2	22.4	23.9	28.5	29.9	29.5	28.4	28.2	25.2	23.2	19.2

(Source: Statistical yearbook 2018 of Ha Noi city)

The average annual humidity is from 76% - 91%, the atmospheric humidity varies strongly by season, especially at the transition time from summer to winter of the year. In general, the humidity over the years has fluctuated but not significantly. March is the time with the highest humidity of 87% - 91%, this is the time to change the season from summer to winter.

The average annual rainfall is 1,803 mm; the highest precipitation appears in July, August and September with an average rainfall of 133 mm – 713 mm; lowest precipitation is in November, December and February with an average rainfall of 1.6 mm – 218 mm/month

Table 2.2. Average Rainfall in Months

Unit: mm

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	19.1	2.4	42.8	107.1	187.5	149.3	523.2	440.4	126.2	157.4	54.1	100.1

(Source: Statistical yearbook 2018 of Ha Noi city)

The average number of sunny hours is 1,217 hours. The month with the highest number of sunshine hours is from May - August with about 114 –241 hours/month. In general, there is rather big gap in the hours of sunshine over the years.

2017 was the year where there were many storms, tropical depressions operating in the East Sea, the rainfall was higher than the annual average and has reached a record in recent years. In particular, there were storms No. 2 and No. 10 directly affecting Hanoi, especially due to the weakening of the tropical depression in the north, combined with high-intensity of the east wind, there were heavy rains in Ha Noi causing serious losses and damages to life and production of people in some communes bordering Hoa Binh province, including Thach That district.

2.1.3. Hydrology, Water Resources

The project area is directly affected by the hydrological regime of the Tich river. The Tich river is a secondary tributary of the Red river, which runs exclusive within Vietnam teritory. The Red river is an international waterway as passing China and Vietnam. The Tich River is also called the Tich Giang River or Con River, which the primary tributary of the Bui River, originating from the Ba Vi mountain range, the watershed of the streams Suoi Hai and Dong Mo. The river runs from Northwest - Southeast direction, on the right bank of Day River, through districts and towns of former Ha Tay province (now in Hanoi) such as Ba Vi, Son Tay, Phuc Tho, Quoc Oai, Chuong My and Thach That districts. The Tich river's main tributary is 91 km long (the total length including branches is 110 km), the area of the river basin is 1,330 km^2. On the Tich river basin, there are Dong Mo - Ngai Son lakes (1,260 ha), Suoi Hai lake (671 ha), Xuan Khanh lake (104 ha) contributing water to this river.

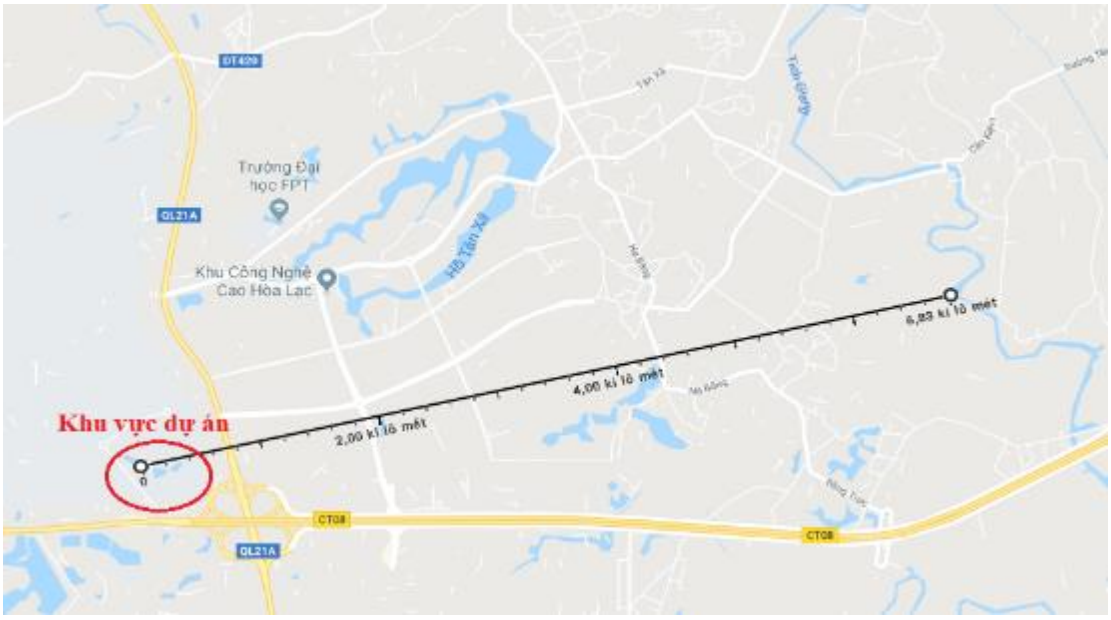

Figure 2.2: Location of The Project Area in Relation with the Tich River

The slope of the river is very low, only about 1/20,000 to 1/30,000, but the slope of the stream branches is quite high, from 10m to 20 m/km on average and even up to 30 m/km at some streams. Therefore the formation of flood water of Tich River is rather fast. However, due to the characteristics of small basins and meandering river beds while the banks and terrace are wide, floods on tributaries are often out of phase. The Tich river bed is small but its terrace is quite wide, on average about 2-3 km and even up to 5-6 km at the largest position. This river has abundant aquatic resources: shrimp, fish, clams, snails, mussels, ... for

people living in the river basin. In 2018, the highest water level on the Tich River reached 9.35 m. The distance from the project area to Tich river is 6.8 km.

Maximum water level of Dong Lac stream - Hoa Lac area: Flood trace at Hoa Lac bridge wall is 13,025 m. Flood trace at the northern side of the VNU-HN Ring Road is 14,954 m.

The Tich river and stream system includes the following main branches:

- Cot Cu stream: originated from the western mountainous region bordering Dong Mo and Ngai Son lakes. The stream mainly flows from West to East and joins with the Dong Lac river, about 5 km downstream from Na Muong Lake. Na Muong lake has a weir and an area of about 5 ha.
- Vai Nghieng - Dia stream: the first section is also known as Dong Vai stream, originating from Cot Co mountain creek (peak + 230.5 m) and Dong Lua mountain (+ 223 m). The stream flows from southwest to northeast, flowing into Na Muong lake and continues to flow from southwest to northeast then receives the flow from the Nà Mường stream, about 2.2 km from the Na Muong weir;
- Vai Ca - Na Muong stream: the stream originates from Trai Vai mountain (+ 194 m), flows in the southwest - northeast direction, then passes through Cot Co - Yen Ngua mountain creek before joining with Dong Lac river (the downstream section is also known as Nà Mường stream). This is the longest river in the basin area.
- Hoa Lac Airport Stream: The stream originates from a natural lake south of Hoa Lac airport. It receives water from the lake and a part of its natural area on the banks. It flows from West to East and joins with the Dong Lac River at the farm 1A area.

Basic characteristics of all river basins flowing into the area of VNU-HN

Table 2.3. Basins of Rivers and Streams in The Project Area

No.	Name of river and stream basin	Area of the basin (ha)	Length of the river/stream (m)	Slope of river/stream bed (%)
1	Basin of Cot Cu stream	324	3,400	0.0055
2	Basin of Vai Nghieng – Dong Lac stream	1,163	13,800	0.0060
3	Basin of Vai Ca- Na Muong stream	1,099	7,300	0.0070
4	Basin of Hoa Lac airport stream	417	2,475	0.0030
	Total	3,003		

Four streams above have water all year round, but the water level changes quite significantly and can lead to flooding in the surrounding low-lying areas due to the lack of flood protection facilities. Normally, the width of branches is from 5 m ÷ 10 m, the depth is 0.5 m ÷ 1 m.

There areother small streams in the project area, with negligible flow, generally dried up in dry season.

There are 6 sub-basins in the VNU area in Hoa Lac, including:

- Basin 1: Flv = 228ha, area in the West, draining to Cu Cot stream.
- Basin 2: Flv = 100ha, draining to streams, Dong Vai lake.
- Basin 3: Including the entire basin of Vai Nghieng - Ngoi Dia before pouring into the project plus the basin inside the project, Flv = 873ha draining to Na Muong stream and lake.
- Basin 4: Including the entire Na Muong fuse basin before pouring and the project plus the basin inside the project Flv = 1177ha draining back to Na Muong.
- Basin 5: Flv = 2992ha, including the Hoa Lac river basin plus the entire 4 stream branch basin through the merging project area at Dong Lac stream in the north of the project area and discharged directly to Dong Lac stream.

Basin 6: Flv = 177ha, the East and Southeast areas adjacent to NH21A, draining through sewers through QL21A to the high-tech zone.

In the project area, there are also a number of lakes including: Da Lat Lake with an area of 11.5 ha, Cong Binh lake with an area of 3 ha, Cot Cu lake with an area of 1.35 ha, Muc lake with an area of 3.8 ha; and a series of lakes No. 1 ÷ 4 located at the foot of the Than Lan mountain, lakes number 5 ÷ 8 belong to Dong Vai lake system with large water reserve capacity. In addition, there are other small ponds and lakes in the VNU-HN area.

Wastewater from VNU-HN village area after being treated by wastewater treatment plants will be discharged into No.1 stream and Muc lake in the project.

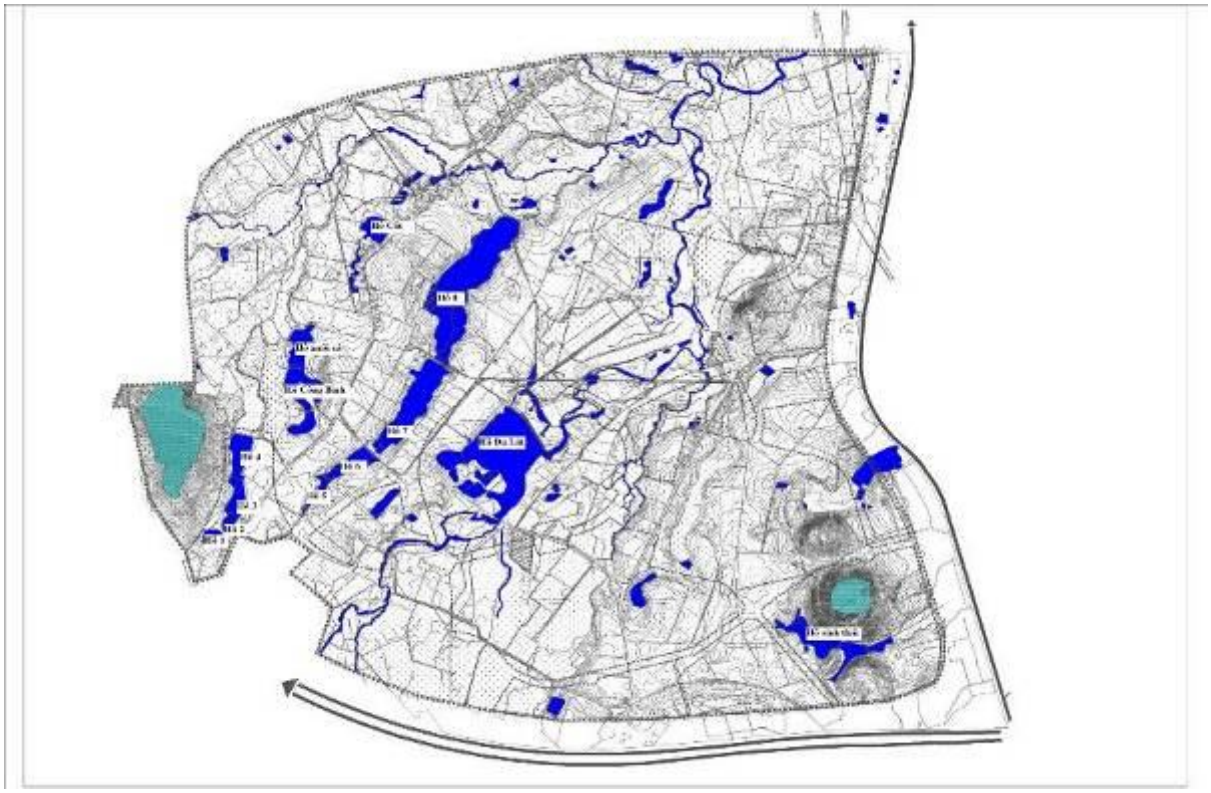

Figure 2.3: Location of Lakes in The Project Area

Through the survey and survey in January 2020, the downstream area of Na Muong and Dong Lac creeks only uses water for drainage purposes in the rainy season and for irrigation for agricultural activities. Karma; There are no fishing activities and households living by fishing in the Tich River and the downstream of the basins are considered. Common types of fishes in the area were consulted as: carp, carp, perch, ... Aquatic plants in the ecosystem of the receiving area were: water hyacinth, water bamboo. The regular water level measured at Tich River is 9.00 m; at Dong Lac stream is 1.5 m. Therefore, with the purpose of using water and the flow of the downstream river system, it is possible to receive wastewater from WWTPs after the WWTP reaches Column A QCVN 14: 2008 / BTNMT with the flow of 2,500 m^3/d.

No.1 stream Muc lake

Figure 2.4: Current status at downstream of WWTP receptor

The water receptors of two2 WWTPs are currently used for irrigation, not for domestic/drinking water supply.

Tich river is responsible for supplying irrigation water for about 16,000 ha of agricultural land in districts and towns that flow through and drain flood waters in the rainy season.

Groundwater[3]

Groundwater in the survey area has a close hydraulic relationship with water from major rivers in the region (Red River, Day River, Nhue River, Tich River). Elevations of groundwater tables vary with the seasons. The underground water table has pressure on rainy season (from March to September, it is usually found at the base -9 m to -11 m. In the dry season (from September to 3 years later), the underground water has normal pressure at the base from -10 to - 11 m, shallow shallow groundwater, usually 1 ÷ 1.5 m above the ground. Through the survey, exploration and assessment of groundwater in the construction area of step 1, phase I (5 bores with a drilling depth of 90 – 101 m/hole) shows that the area is in a mixed development area with water sources. Underground water is abundant. Through 5 drills, there are 3 drills capable of exploiting from 2500 ÷ 2700 m^3/day. This underground water source is mainly at a depth of 40 ÷ 100m, high and stable water column in terms of water flow, fast recovery water level, clear water quality, the content of impurities below the permitted level.

2.2. BASELINE ENVIRONMENT QUALITY

In order to quantitatively evaluate the local baseline environmental quality, a monitoring program has been implemented since October 31, 2019. The monitoring parameters are shown in the Table below.

Table 2.4. Samples and Parameters

No.	Type of sample	Number of sample	Analyzing parameters
1	Air	10	Dust, noise, vibration, NH_3, H_2S, CO, NO_2, SO_2.
2	Surface water	5	pH, turbidity, total suspended solid (TSS), dissolved oxygen (DO), Chemical oxygen demand (COD), biochemical oxygen demand (BOD_5),

[3] Source: http://open_jicareport.jica.go.jp/pdf/11932068_02.pdf

No.	Type of sample	Number of sample	Analyzing parameters
			Nitrate (NO_3^-), Cu, Pb, Zn, Fe, Grease, Total Colifom
3	Groundwater	2	pH, hardness (by $CaCO_3$), chemical oxygen deman (COD), Chloride (Cl^-), Nitrate (NO_3^-), lead (Pb), Zinc (Zn), Iron (Fe), Total Coliform
4	Wastewater	3	pH, BOD5, total suspended solid (TSS), total dissolved solids, H2S, ammonium, nitrate (NO_3^-) by N, grease, total surfactants, phosphates (PO_4^{3-}) (by P), total Coliforms
5	Soil	6	Cu, Zn, Cd, Pb
6	Aquatic	2	- Phytoplankton; zooplankton; benthos

2.2.1. Air Quality, Noise and Vibration

The air sample was taken on October 31, 2019 in a sunny, light breeze weather condition with temperature 27-30^{o}C and humidity of 60-80%. The monitoring results are shown in the Table below

Table 2.5. Air Quality, Noise and Vibration

No.	Parameter	Unit	Result										QCVN 05:2013/BTNMT[4]	QCVN 06:2009/BTNMT[5]	QCVN 27:2010/BTNMT[6]	QCVN 26:2010/BTNMT[7]
			KK1	KK2	KK3	KK4	KK5	KK6	KK7	KK8	KK9	KK10				
1	Temperaturee	^{0}C	26.2	26.2	26.5	26.8	26.8	26.3	26.5	26.8	26.2	26.2	-	-	-	-
2	Moisture	%	67	68	67	67	66	68	65	67	67	67	-	-	-	-
3	Wind speed	m/s	1.6	1.2	0.9	1.5	1.4	1.2	0.8	1.1	0.9	0.8	-	-	-	-
4	TSP	µg/m^3	138	96	65	121	92	136	124	138	94	86	**300**	-	-	-
5	NO_2*	µg/m^3	68	51	45	58	45	53	48	42	52	55	**200**	-	-	-
6	CO*	µg/m^3	6510	3680	3260	4240	3620	4210	3350	3480	3820	3510	**30,000**	-	-	-
7	SO_2	µg/m^3	126	<108	<108	<108	<108	124	<108	<108	52	55	**350**	-	-	-
8	Lead particle	µg/m^3	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	-	-	-	-
9	H_2S	µg/m^3	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	**42**	-	-
10	CH_4	µg/m^3	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	-		-	-
11	O_3	µg/m^3	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	**200**	-	-	-
12	LAeq	dBA	67	51	58	63	62	68	65	64	62	58	-	-	-	**70**
13	Vibration	(m/s^2)	65	45	41	52	56	51	58	47	47	51	-	-	**55**	-

Sample	VN 2000 coordinate system		Sampling location
	X	X	
K1	2321862	553904	At the intersection of Thang Long Highway and the turn into the university village
K2	2322101	553626	At the location of thw wastewater treatment plant in zone 3, near road 11
K3	2322447	553435	At the guest house of Vietnam National University Ha Noi, along road 11
K4	2322261	552967	At zone 3, along road 3
K5	2323118	552730	At zone 4, along road 5
K6	2323242	552485	At the end of zone 4, near VNU university of Science which is under construction
K7	2322861	552188	At the general wastewater treatment plant, along road 5
K8	2322691	551822	At zone 1, near the turnaround
K9	2322168	551799	At the end of zone 1, along road 1
K10	2321862	553904	At zone 1, along road 4

+ Note: the indicators marked with * are not yet recognized according to ISO 17025: 2005

[4] QCVN 05:2013/BTNMT: National technical regulation on ambient air quality
[5] QCVN 06:2009/BTNMT: National technical regulation on hazardous substances in the ambient air
[6] QCVN 27:2010/BTNMT: National technical regulation on vibration
[7] QCVN 26:2010/BTNMT: National technical regulation on noise

Comments:

The analysis results show that all parameters of the ambient air (dust, gas, CO, SO_2, CH_4, H_2S) are within the allowable limits of QCVN 05:2013/BTNMT; micro-climate parameters (temperature, humidity, wind speed, noise) at the sampling locations are all lower and within the allowable limits of QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT). Content of hazardous substances in the air (H_2S) is also within the allowable limits of QCVN 06:2009/BTNMT.

2.2.2. Surface Water Quality

The surface water was sampled on October 31, 2019 for analysis. The results of quality analysis of surface water samples are shown in the Table below:

Table 2.6. Surface Water Quality

No	Parameter	Unit	Result					QCVN 08-MT: 2015/ BTNMT [8](Column B1)
			NM1	NM2	NM3	NM4	NM5	
1	pH	-	6.6	6.5	6.6	6.7	6.5	**5.5– 9**
2	Total suspended solids (TSS)	mg/l	18	16	15	16	20	**50**
3	Total dissolved solids (TDS)	mg/l	168	152	156	160	172	
4	Dissolved oxygen (DO)	mg/l	4.9	5.6	5.3	5.1	5.1	**≥4**
5	Biochemical oxygen demand (BOD_5) 20^0C	mg/l	12	9	9	11	9	**15**
6	Chemical oxygen demand (COD)	mg/l	21	17	17	19	15	**30**
7	Nitrate (NO_3), by N	mg/l	1.26	1.18	0.92	1.35	1.25	**10**
8	Nitrogen, by N	mg/l	0.28	0.21	0.22	0.24	0.2	**0.9**
9	Nitrogen, by nitrite	mg/l	0.02	0.01	0.01	0.02	0.01	**0.05**
10	PO_4^{3-}	mg/l	0.08	0.06	0.06	0.07	0.05	**0.3**
11	Cl-	µg/l	46	32	35	43	30	**350**
12	Sulphate	mg/l	23	17	19	22	22	**0.4**
13	Fe	mg/l	0.58	0.45	0.63	0.51	0.55	
14	Total Coliform	MPN/100ml	1,600	1,100	2,400	1,200	1,500	**7.500**
15	Grease	Mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	**1**

Sample	VN 2000 coordinate system		Sampling location
	X	Y	
NM1	2322169	553749	Surface water of Muc lake
NM2	2322290	553669	Surface water of Muc lake
NM3	2322924	552134	Surface water in the small stream flowing into Da Lat lake, at the construction site of the general WWTP
NM4	2212633	552688	Surface water of Da Lat lake
NM5	2212732	552814	Surface water of No.1 stream

Comments: The surface water quality data in the table above shows that there is no sign of pollution in the surface water at the sampling locations (lake, pond, stream) in the project area.

[8] QCVN 08-MT:2015/BTNMT: National technical regulation on surface water quality

All analytical criteria: DO, COD, BOD_5, NH_4^+, NO_3^-, ... heavy metals mentioned above at the time of sampling all met QCVN 08:2015/BTNMT (column B1).

2.2.3. Groundwater Quality

Groundwater samples were taken on 31/10/2019. Test results on the groundwater quality are presented in the following table.

Table 2.7. Groundwater Analyzing Results

No.	Parameter	Unit	Result		QCVN 09-MT: 2015/ BTNMT [9]
			NN1	NN2	
1.	Temperature	^oC	29	28	-
2.	pH	-	6.8	6.9	**5.5-8.5**
3.	Dissolved oxygen (DO)	mg/L	3.2	3.4	-
4.	Suspended solid (SS)	mg/L	11	14	-
5.	Hardness, by $CaCO_3$	mg/L	125	146	**500**
6.	NH_4^+ _N	mg/L	0.32	0.38	**1**
7.	NO_2^- _N	mg/L	0.06	0.08	**1**
8.	NO_3^-_N	mg/L	1.72	1.56	**15**
9.	Sulphate (SO_4^{2-})	mg/L	12	18	**400**
10.	Chloride (Cl^-)	mg/L	56	45	**250**
11.	Cadmium	mg/L	<0.002	<0.002	**0.005**
12.	Mercury	mg/L	<0.0004	<0.0004	**0.001**
13.	Arsenic	mg/L	0.001	0.001	**0.05**
14.	Iron	mg/L	1.26	1.08	**5**
15.	Manganese	mg/L	0.18	0.13	**0.5**
16.	Coliform	CFU/ 100ml	KPH	KPH	**3**
Sample	**VN 2000 coordinate system**		**Sampling location**		
	X	**Y**			
N1	2322506	553463	At the guest house area of Vietnam National University Hanoi		
N2	2322910	553965	At the dormitory No.4		

- Comments :

The analysis results show that the quality of groundwater in the study area is relatively good, there is no sign of pollution. At the sampling locations, the parameters are all within allowable limits in the standard QCVN 09-MT: 2015/BTNMT.

2.2.4. Wastewater Quality

Wastewater samples were taken on 31/10/2019. Analysis results on the wastewater quality are presented in the following table.

[9] QCVN 09-MT:2015/BTNMT: National technical regulation on groundwater quality

Table 2.8. Wastewater Analyzing Results

No.	Parameters	Unit	Result			QCVN 14:2008/ BTNMT (Column B) [10]
			NT1	NT2	NT3	
1	Temperature	^oC	28	27	29	-
2	Ordor	-	KKC	KKC	KKC	-
3	pH	-	6.5	6.3	6.7	**5-9**
4	BOD_5 (20^0C)	mg/L	28	31	36	**50**
5	COD	mg/L	53	68	75	**150**
6	Suspended solids	mg/L	48	57	61	**100**
7	Sulphate#	mg/L	26	35	38	-
8	Ammonium (by N)	mg/L	2.2	3.1	2.9	**10**
9	Nitrate (by N)	mg/L	12.4	13.5	11.8	**50**
10	Total Fe	mg/L	0.68	0.45	0.79	**5**
11	Arsenic	mg/L	<0.0004	<0.0004	<0.0004	**0.1**
12	Manganese	mg/L	0.22	0.16	0.31	**1**
13	Cadmium	mg/L	<0.002	<0.002	<0.002	**0.1**
14	Copper	mg/L	<0.02	<0.02	<0.02	**2**
15	Total nitrogen	mg/L	15.2	17.6	14.8	**40**
16	Total photphorus	mg/L	1.62	1.16	1.45	**10**
17	Total grease and mineral oil	mg/L	1.6	1.9	2.5	**20**
18	Coliform	MPN/ 100ml	4,200	4,200	4,600	**5,000**

Sample	VN 2000 coordinate system		Sampling location
	X	Y	
NT1	2322514	553475	At the guest house area of Vietnam National University Hanoi
NT2	2322622	553406	At the area of Hoa Lac PMU
NT3	2322923	554026	At the dormitory No.4

Comments on the results: The wastewater in the project area is pre-treated with septic tank system and gives relatively good results. The quality of treated wastewater is within the alllowable limits of column B QCVN 14:2008/BTNMT.

2.2.5. Soil Quality

The soil samples were taken on October 31, 2019. The analyzing results of soil quality are shown in the Table below.

Table 2.9.Soil Analyzing Result

No	Result	As	Cd	Cu	Pb	Zn	Hg
1	Đ1	2.5	<0.32	12.6	8.2	16.5	<0.032
2	Đ2	3.6	<0.32	14.5	5.7	11.8	<0.032
3	Đ3	4.8	<0.32	16.7	9.1	13.7	<0.032
4	Đ4	1.9	<0.32	11.6	6.5	9.6	<0.032
5	Đ5	2.4	<0.32	8.6	4.8	8.5	<0.032
6	Đ6	2.7	<0.32	12.9	8.6	11.2	<0.032
7	Đ7	3.2	<0.32	13.8	9.5	15.2	<0.032
8	Đ8	2.9	<0.32	11.6	6.4	10.1	<0.032
9	Đ9	5.7	<0.32	14.2	8.9	12.4	<0.032
	QCVN 03-	**20**	**5**	**200**	**200**	**300**	**-**

[10] QCVN 40:2008/BTNMT: National technical regulation on domestic wastewater

	MT:2015/BTNMT						
Sample	**VN 2000 coordinate system**		**Sampling location**				
	X	**Y**					
Đ1	2322132	553085	At zone 3, near road 3				
Đ2	2322139	553613	At zone 3				
Đ3	2323145	552395	At zone 3, at the wastewater treatment plant				
Đ4	2323142	552706	At zone 4, at the agricultural cultivation area				
Đ5	2322893	552206	At zone 4, near road 5				
Đ6	2322648	551712	At the wastewater treatment plant				
Đ7	2322525	551839	At zone 1, near road 4				
Đ8	2322132	553085	At zone 1, near road 1				
Đ9	2322139	553613	At zone 1, near road 1				

(Source: Analyzing results of baseline environment quality in the project area)

The analyzing results of the soil samples taken in the project area show that the quality of the soil here is very good, the analysis parameters of metals are much lower and within the allowable limits in QCVN 03-MT:2015/BTNMT.

2.2.6. Aquatic Environment

Samples of the aquatic environment were taken on 31/10/2019. Analyzing results are presented in the table below.

Table 2.10. Analyzing Results on The Aquatic Environment

No	**Species**	**Sample**	
		TV1	**TV2**
1	***Phytoplankton***		
1.1	*Bacillariophyta*	*Bacillariophyta*	*Bacillariophyta*
1.2	*Cyanophyta*	*Lyngbya birgei*	*Lyngbya birgei*
		Gomphosphaeria sp.	*Gomphosphaeria sp.*
1.3	Chlorophyta	*Closterium intermedium*	*Closterium intermedium*
		Endorina elegans	*Endorina elegans*
		Pandorina charkoviensis	-
		Eudorina elegans	*Eudorina elegans*
		Dictyosphaerium tetrachotomum	*Dictyosphaerium tetrachotomum*
		Monoraphidium caribeum Hindák	*Monoraphidium caribeum Hindák*
		Monoraphidium contortum (Thuret)	*Monoraphidium contortum (Thuret)*
		Oocystis naegelii Braun	*Oocystis naegelii Braun*
		Oocystis solitaria Wittrock	*Oocystis solitaria Wittrock*
		Selenastrum gracile Reinsch	*Selenastrum gracile Reinsch*
		Selenastrum rinoi Komárek and Comas	*Selenastrum rinoi Komárek and Comas*
1.4	*Euglenophyta*	*Phacus sp*	*Phacus sp*
2	***Zooplankton***		
2.1	*Arthropoda*	*Alonella excisa*	*Alonella excisa*
		-	*Metapolycope hartmanni*
		Daphnia pulex	*Daphnia pulex*

		Heterocypris repetans	*Heterocypris repetans*
		Hyperia macrocephala	*Hyperia macrocephala*
2.2	*Mollusca*	*Clione antarctica*	*Clione antarctica*
		Clione limacina	*Clione limacina*
		Paraclione longicaudata	*Paraclione longicaudata*
		Acteon candens	-
		Acteon candens	*Acteon candens*
		Chrysallida cancellata	*Chrysallida cancellata*
		Eulimella nitidissima	*Eulimella nitidissima*
		Platydoris angustipes	*Platydoris angustipes*
2.3	*Chordata and Bivalviva*	*Doliopsis bahamensis*	*Doliopsis bahamensis*
		Cyclosalpa affinis	*Cyclosalpa affinis*
		Solen sp.	*Solen sp.*
		Solecurtus cumingianus.	*Solecurtus cumingianus.*
		Solen viridis	-
		Solecurtus sanctaemarthae	*Solecurtus sanctaemarthae*
3	***Benthos***		
3.1	*Mollusca*	*Pomacea canaliculata* L.	*Pomacea canaliculata* L.
		Corbicula sp.	*Corbicula sp.*
		Pila polita	*Pila polita*
3.2	*Annelida*	*Cirratulus cirratus*	*Cirratulus cirratus*
		Phyllochaetopterus anglicus	-
		Glycera abranchiata	*Glycera abranchiata*
		Aricia cuvieri	*Aricia cuvieri*
		Eunoe pallida	*Eunoe pallida*

Sample	**VN 2000 coordinate system**		**Sampling location**
	X	**Y**	
TS 1	2322169	553749	Muc lake
TS 2	2323336	552347	Da Lat lake

- **Comments on the results:**

Phytoplankton species such as Lyngbya sp, Coelosphaerium sp, Pediastrum duplex and Cyclotella meneghininana indicating the oxygen generation ability were found in water samples in moderate quantities, which is consistent with the analysis results that content of the dissolved oxygen in water at most sampling locations is> 4 mg/l. This proves that water has normal ability to produce oxygen for underwater organisms existence (besides dissolved oxygen from in the air).

The zooplankton species are not as diverse as *Arthropoda, Mollusca and Chordata.* The number of species reflects the changing trend of water quality in the surveyed areas. The number of zooplankton increases as the water's turbidity tends to increase.

A large group of benthos was also found in the bottom of the water body such as Mollusca, Annelida. This proves that the water in this area is suitable habitat for protozoa and some benthic species.

2.2.7. Biological Resources in the Project Area

Ecosystem consist of grasslands, shrubs, scattered timber trees, agricultural ecosystems, aquatic ecosystems and garden lands. The project area used to be the 1A farm.

1. Types of ecological systems in the project area:

- ***Scattered grassland, shrubs and sparse trees ecosystems:*** This type of ecosystem accounts for a relatively large area, scatteredly distributed throughout the project area. The grassland consists of tall grasses such as *Imperata cylindrical, Saccharum spontaneum,* shrubs including *Ageratum conyzoides, Mimosa diplotricha, Pteridophyta, ...*

- ***Aquatic ecosystem:*** This type of ecosystem is distributed in rivers, streams, lakes, lagoons and ponds scattered in the area.

- ***Residential area ecosystems:*** The main plant species in the rural area are: *Agertum conyzoides, Eclipe prostrata, Oxalis cornyculata, Cynodon dactylon, Althernantherra sessilis, Commelina communis, Plucheinpldica;* timber trees such as *Melia azedarach, Eucalyptus*, acacia; Fruit trees such as custard apple, longan, jackfruit, sapodilla ... planted in home gardens. In fact people already received compensation so these plants are not regularly cared, becoming stunted and having low output, getting invasive by some wild vines such as mistletoe, etc.. There are livestocks such as buffaloes, cows, chickens, ducks, pigs, geese, .. The main wildlife species are rats, some species of birds, amphibians, reptiles ... Existence of this ecosystem is also due to presence of a few households who asked to stay at the site to make use of the existing gardens while waiting for the construction works to be carried out by VNU-HN.

- ***Agricultural ecosystem:*** The agricultural ecosystem mainly consists of land area for cultivation of wet rice (one or two crops), cultivation land of tea trees and land for vegetable or short-term industrial crops and fruit trees (mainly longan and litchi trees which have large canopy but stunted due to lack of regular care and investment). The agricultural ecosystem here is monoculture of rice and tea, so it has lost biodiversity. The flora and fauna here are mainly aquatic animals such as fish, shrimp, eels. Living on the bottom there are a number of types such as edible snails, trapdoor snails, crabs, mussels, ... Amphibians, reptiles are often colubrids, Ptyas korros, frogs

2. Biological Resources in the Project Area (3 zones)

a. Terrestrial animals

- **Animal:** According to the results of the field survey, references and interviews with local people in public consultations, there are few caves and forest (planted forests) in the area. Thus, there is only small population of animals. Despite of better management and protection measures for the planted forest in recent years, there has not been much changes in species and quantity of animals in the area. The major species of animals in the project area include:

- **Reptiles, amphibians**: From the results of the survey, research and reference to previous research documents, reptiles and amphibians in the project area are mainly common local speciese and exist in small quantities, including: *Hemidactylus frenatus, Amphiesma stolata, Xenopeltis unicolor,* the grass snake (*Rhabdophis*), the green snake (*Viperidae*), *Najaatra, Limnoneetes limnochasis, Hyla simplex, Limnonectes limnocharis, Polypedates leucomystax, Hoplobartrachus rugulosus,* toad species like *Bombinatoridae, Rama guentheri, Rana Macrodacrtyla, ...*

- **Birds:** The forest ecosystem in the project area is mainly planted forest ecosystem and is affected by human activities. In the project area, there are birds such as: *Amaurornis phoenicurus, Anas crecca, Dendrocygna javanica, Ixobrychus cinnamomeus, Streptopelia chinesis, Halcyon smyrnensis, Pycnonotus jocosus, Copsychus saularis, Saxicola torquata, Stachyris nigriceps, Rhipidura albicollis, Dicaeumn melanoxanthum, Dicaeum concolor*. Survey results as well as regional biodiversity documents show that no species is included in Vietnam's Red Data Book.

- **Insects:** According to the survey results of the project owner and the Consultant carried out in October 2019, combined with research documents on biodiversity in the area, the local insect system is quite diverse, including harmful insects and beneficial insects. Specifically, beneficial insects and harmful insects are as follows:

- *Harmful insect*s: mainly agricultural pests such as rice stink bugs of the family Coreidae, Pentatomidea, Tettigoniella; beetles harmful to cucurbits, melon ... such as *Aulacophora femoralis, A. Cattigarensis, Cassida circumdata of the Chrysomelidae family,* and harmful to peas like Meloidae species; some tea pests such as Carpicornes of the Carambycidae family, the stink bugs belong to the Miridae family. There are also butterflies of Piceridae, Hesperidae families but no major damage has been seen to agricultural crops. The insects that eat plants mostly are those of Cerambycidae, Chysoelidae families, butterflies (Lepidoptera), stink bugs (Heteroptae), aphids of Homoptera. In general, these insects are harmful in agriculture and forests but occur on a small scale and do not cause epidemics in the project area.

- *Beneficial insects:* beneficial insects in the project area are primarily honey bee species: Two main popular species of honey bees here are: *Apiscerana and A.dorsata* (Apidae), they give honey and pollen good for the health of people, their pupae are a very good food. Other honey bees are *Bombus montivagus (Apidae), Amegilla zonata, Anthopora pulcherrima, Xylocopa Basalis, X. collaris and X. verticalis (Anthophoridae)* pollinate flowers. The venom of these bees and species of *Vaspidae* can be used as a cure for arthritis (*Vespa spp., Polisstes spp*.). The common parasitic insects in the region are the Ichneumonidae family of the Hymenoptera, which parasitize in worms and pupae of plant pests. There are predatory insects of the family Carabidae, Coccinellidae (except for some plant pests), Epilachma spp. (Epiachninae), Cicindelidae (Coleooptera), bees of Vespidae family, stink bugs of the Reduviidae family (Heteroptera). There are also insects that use plant feces as food belonging to Scaradaeidae including *Synapisis spp., Catharsius spp., Copris spp., Onitits spp., Onthophagus spp.*) in the project area.

b. Terrestrial plants

The vegetation of the project area is mainly grassland, including tall grasses such as *Imperata cylindrical, Saccharum spontaneum*, shrubs including *Ageratum conyzoides, Mimosa diplotricha, Pterdophyta* .... There are no rare or valuable plants. The forests in the area are mostly planted forests, mainly eucalyptus, eucalyptus (*Eucalyp Cneorifolia*), Acacia auriculiformis (*Acacia auriculiformis*). No rare timber species in Vietnam's Red data book is found in the project area.

c. *Aquatic plants and animals*

Aquatic animal

- **Zooplankton:** Zooplankton in the project area are mainly Copepoda, Cladocera and Rotifera. Common species are Copepoda (*Mongolodiaptomus birulai Rylop, Phyllodiaptoums tunguidus, Mesocyclops leuckarti Claus, Microcyclops varicans Sars*), Cladocera (*Moina dubia* de Guerne et Richard, *Ceriodaphnia rigaudi* Richard), (Scapholeberis kingi Scars), Copepoda (*Brachionus urceus* Linnaeus, *B. angularis* Gosse).
- **Benthos**: Benthos in the project area are mainly snails, clams, mussels. According to the survey results combined with reference to the existing documents, there are mainly: *Pila polita, Pila conica, Pomacea insularum, Lissachatina fulca, Angulyagra polyzonata, Sinotaia aeruginosa, Corbicula messageri, Corbicula bocourti, Sinanodonta jourdyi, Cristaria bialata, Oxynaia jourdyi, Lanceolaria grayi*.
- **Fish:** Field survey results and reference documents show that, in small streams and lakes, ponds in the project area, there are some goby species such as: *Acentrogobius Bleker* belonging to subspecies *Gobiinea*, besides there are some common natural fishes such as *Anabas testudineus, Carassius, Clarias, Chanodichthys* ... There are also some households who contracted to use ponds for farming of fishes such as *Mylopharyngodon Peters; Ctenopharyngodon Steindacher; Cyprinus linneaeus; Cirrhinus oken; Clarias scopoli; Tilapia (Oreochromis Gunther*).

Aquatic plants

Phytoplankton in the project area are found mostly in water bodies, lakes, ponds, canals. Aquatic plants here are mainly hyacinths, algae such as *Eichhornia crassipes, Lemna minor, Pistia stratiotes, Chlorophyta.*

2.3. SOCIO-ECONOMIC CONDITION

2.3.1 Thach That District

Thach That District has a total land area of 187.44 km^2, low population density of 1,104 people/km^2 (2018). The district consists of 23 administrative units with 01 town namely Lien Quan and 22 communes: Binh Phu, Binh Yen, Cam Yen, Can Kiem, Canh Nau, Chang Son, Dai Dong, Di Nau, Dong Truc, Ha Bang, Huong Ngai and Huu Bang. , Kim Quan, Lai Thuong, Phu Kim, Phung Xa, Tan Xa, Thach Hoa, Thach Xa, Tien Xuan, Yen Binh and Yen Trung.

Table 2.11. Land Distribution and use of Thach That District

No.	Type of land	Area (ha)	Rate (%)
	Natural area		
1	Agricultural production land	74.69	39.8
2	Forestryland	25.86	13.8
3	Specialized land	55.37	29.5
4	Residential land	19.02	10.1
5	Other land	31,52	6.7

Thach That is a suburban district, so the population is mainly rural population, the percentage of urban population is very small. In general, the population in both urban and rural areas has tended to increase over the years, but the urban population has remained unchanged from 2017 to 2018, remaining at 6500 people.

Table 2.12. The Population of Thach That District is Classified by Urban and Rural Areas

Unit: thousand people

Year	2010	2015	2016	2017	2018
Urban population	5,7	6,1	6,2	6,5	6,5
Rural population	175,1	193,2	195,9	198,8	200,5
Total	180,8	199,3	202,1	205,3	207

(Source: Statistical Yearbook of Hanoi City in 2018)

Labor source: The number of people in working age in Thach That district accounts for over 60% of the population. This shows that a relatively abundant labor force, if used well, will actively contribute to boosting the local economic development; It will also create job creation challenges, increase income and reduce unemployment for workers.

Unemployment rate: From 2010 to date, the district annually organizes vocational training for more than 4,100 rural workers including cultivation, husbandry, aquaculture, industrial apparel, embroidery...

Thereby, raising the percentage of rural labor of the district through vocational training reaches 61.82% / year; at the same time, creating new jobs for 4,000 to 5,000 laborers/year. In 2018, Thach That District organized vocational training for 4,187 rural workers, reaching 102.1% of the year's plan and creating jobs for 5,015 workers.

Thanks to the good implementation of vocational training for rural laborers, accumulated from 2010 to present, Thach That District has created jobs for 42,978 employees, increasing the percentage of employed laborers in the whole district to 98.3%.

The standard of living of people has been improved significantly year by year. This is reflected in the annual per capita income index. According to the 2018 socio-economic report of Thach That district: the average income from 14.1 million dong/person/year (in 2010) increased to 58 million dong/person/year (in 2018). In 2010, 82% of families and 60.3% of villages and hamlets achieved cultural titles, but by 2018, they have increased to 88.2% of families, 78% of villages and villages achieved and maintained cultural titles, 61.9% of communes achieved the title of commune meeting new rural cultural standards.

Economic conditions: The socio-economic situation in the district is stable and developed, the economic structure The total production value of the whole year 2018 reached VND 19,008,183 million. Total district budget revenue in 2018 is estimated at 1,588,875 million VND. The proportion of economic value of the district achieved a relatively high and stable growth as shown in the table below.

Table 2.13. The Proportion of Thach That District's Economic Sectors in 2018

No.	Sector	Rate	Production value (million VND)
1	Industry - handicraft industry	69.2%	13,147,818
2	Trade - services - tourism	22.3%	4,247,365
3	Agriculture - forestry - fishery	8.5%	1,613,000

Access and service conditions: The administrative houses and socio-cultural centers of Thach That district are about 4.1 km away from the project area. Thach That district has 06 big markets: Hunt market, Cau market, Ne market, Chang market, Go Gong market, Huong Ngai market. The market closest to the project area is Go Goi Market, 4 km southwest.

2.3.2 Thach Hoa Commune: Thach Hoa is a project commune in Thach That district of Hanoi city, about 4.1 km from the center of Thach That district. The commune has an area of 33.31 km^2 and a population of 11,643 people (2,588 household). Thach Hoa commune borders with Co Dong commune - Quoc Oai district in the north, adjacent to Tan Xa and Ha Bang communes in the east; Yen Quang new urban area of Yen Binh commune in the west, Dong Xuan commune - Quoc Oai district in the south.

The economic structure of Hoa Thach commune has been developed along the direction of "Trade, services, transport - Handicraft, construction - agriculture". The total value of production and business per year is estimated at 1,612.33 billion VND, in which the value of agricultural production is 75.8 billion VND, production and business value of industry - handicrafts - trade and services is 1,536.53 billion VND.

The average income per capita is 1,800,000 VND/person/month. The number of poor households in the commune in 2019 accounts for 0.4% of the total number of households (10 households), the number of policy beneficiary households accounts for 4.6% (120 households).

There are schools in Thach Hoa commune such as: Political University, Thang Long Vocational College, Vietnam Trade Union Vocational College, Thach Hoa Kindergarten, Thach Hoa Primary School, Junior High School Thach Hoa Department.

Health: The commune has 01 health station, 02 doctors and 03 nurses.

2.3.3. VNU-HN village

VNU-Ha Noi village occupies an area of 1,100ha of agricultural land in Thach Hoa commune. Total 609 households were affected by land acquisition of 1,100ha and compensated and handed

over land to the University in 2007 according to requirements[11]. According to the results of the survey, most of the households have stabilized livelihoods after receiving compensation and assistance.

Currently, in the Northeast of VNU campus (about 1.1 km to the nearest site of subproject), there are 244 households who have received compensation but are still temporarily cultivating on the idle land to earn extra income. They will be notified at least 06 months in advance to stop cultivation and harvest crops.

The survey of 244 households with a total of 867 people. Among these, the gGroup of under 15 years old accounts for 12% (equivalent to 101 people), 16 – 22 years old accounting for 18%(equivalent to 159 people), 22-55 year olds accounting for 64% (equivalent to 555), and 52-over 55 years old accounting for 6% (the lowest proportion, with 52 people).

- ***Educational level***

The heads of surveyed HHs is mainly graduated from high school (88 household heads, accounting for 36%), secondary school (73 household heads, accounting for 30%), primary school (29 household heads, accounting for 12%), Vocational secondary school (18 heads of households, accounting for 7.4%) and college/university (36 heads of households, accounting for 14.8%). Educational attainment of the family members is generally quite high. Especially, the age group of 22-50 graduated from college level, university and vocational training is counting for 67%, equivalent to 370 people. This characteristic shows that the ability of people to adapt to changing livelihoods is quite high.

- ***Occupational characteristics***

Main occupation of people: The main occupation of the people, (the working age of people in the report is from 18 to 60 years old) are in four main groups,namely worker (37.8%), business/trade (31.2%), public servants (17%), agriculture production (8%), in addition, 6% have other occupations (housewife, seasonal waged job and retired person). The main agricultural group belongs to the elderly group, above 55. The main agricultural activity of this group is the salvage of agricultural products on the recovered land and the cultivation of green vegetables for family use. Income from agriculture, therefore insignificant.

- **Income and Expenditure**

The average income of the households living in VNU village area is 8,000,000 VND/household/month. The highest income level is VND 20,000,000/household/month and the lowest is VND 3,000,000/household/month.

According to the household's assessment of the level of stability of income sources, 69.4% of the households rated their income as stable, these are mostly Ministry of civil servants, officials and business, trade. 30.6% of households self-assess their income sources as unstable, these are households whose main income is from agriculture, hired labor, and small businesses.

The average expenditure of households is 5,000,000 VND/household/month. Most households have savings or business capital.

- **Living conditions and access services:**

[11] *Decision No. 488-QĐ/UB dated 05/5/2005 by Ha Tay PPC (former) on approving the plan of compensation, assistance and resettlement for construction of VNU Hanoi in Thach That district*

The surveyed households also have access to adequate social services such as electricity (national grid through low voltage station in Thach Hoa commune), roads (3-5m wide concrete road). , school (Thach Hoa kindergarten, Thach Hoa primary school, Thach Hoa secondary school), Thach Hoa commune health station, well water system (dug well) of each household. Currently, to connect with utilities outside the university village area, the households here use the existing concrete roads connecting to Highway 21 and Lang - Hoa Lac Expressway (not the routes). roads are built in the VNU master plan), these roads are in relatively good condition. These routes are also the shortest routes to connect people with the outside areas, so the need to use the inner roads of VNU - HN is very small.

Currently, these households are concentrated in three cluster of the Northeast of VNU village, not in the scope of the subproject, the distance to the nearest site of zone 4 is 1.1 km to the Northwest.

Figure 2.5: Location of residential areas in VNU-HN village

2.3.4 Cultural and Social Characteristics

In Thach That district, there are many significant cultural and historical works, but these works are far from the project area. No works will be affected during the project construction process. The nearest work is Yen Lac temple which is located 8 km west of the project area. Some typical cultural and historical works around the project area are:

- Yen Thon temple is a miniature museum of ancient architecture with high educational and cultural significance. In an overall view, Yen Thon temple includes the following architectural works: Dai Bai temple, sanctuary, Ta Vu house (the house for civil mandarins), Huu Vu house (the house for military mandarins), gate and surrounding walls.
- Yen Lac temple is located on a high-lying area shaped like a tiger's jaw, facing to the Tich river. The temple worships three tutelary gods namely Trung Cong, Hoang Cong and Dung Cong.
- Phung Khac Khoan spirit house is located in Bung village, Phung Xa commune, Thach That district, far from the center of Hanoi.
- Phung Thon pagoda with the name "Kim Lien Tu" is located in Phung village, Phung Xa commune, Thach That district, about 25 km from Hanoi center.

- Chang Son pagoda is located in Chang Son commune, Thach That district, with name as "Chan Long Tu". The pagoda was built in the year of the Horse, the reign of Thinh Duc 2 (1654) on a high-lying ground, which is a place of worshiping the Buddha. The pagoda faces to the West and was built with 18th century art style.

In addition, the district also has many other spirit houses such as Vinh Loc, Thon Voi, Truc Dong, Phu Da, ...

2.3.1. Related infrastructure and services

2.3.4.1. Transport system

Currently, the national highways linking the center of Hanoi Capital with the planned area of VNU-HN include:

❖ **External transport:**

– Thang Long Highway: is an important transportation axis connecting Hoa Lac with the central city, running through the southern area of the project area. The road is being upgraded to expand the scale from 2 lanes (12 m wide) to 6 high-speed lanes and 6 lanes to serve people on both sides (total size 140 m).

– The section of Thang Long Boulevard passing VNU is still quite good quality. On both sides of the road, there are residences and businesses. The main types of vehicles on the road are large vehicles: passenger cars, container trucks, tank trucks, circulation with the permitted speed of 80km/h ... Besides, this is the route that allows motorcycles and vehicles. rudimentary operation should be quite complicated traffic. Traffic is relatively large, about 1,000 vehicles / day and night.

– National Highway 21A: is the road connecting important cities such as Bac Giang, Song Cong town, Vinh Yen, urban chains Son Tay - Hoa Lac - Xuan Mai - Mieu Mon, Hung Yen town, Hai Duong city, Sao Do town. The National highway No.21A is planned to be upgraded to meet the standard of grade-III delta road with width of 12 m. In the future, this road will serve as a longitudinal axis connecting the urban centers of Son Tay - Hoa Lac - Xuan Mai. On both sides of the road, there are residences and businesses. The main types of vehicles on the road are large vehicles: passenger cars, container trucks, tank trucks, circulation with the permitted speed of 60 km/h ... Traffic is 700 vehicles / day and night.

– These routes are all accessible to VNU-HN village areas through planned turns at locations that determine VNU-HN village gates or other people's roads.

Figure 2.6: **Existing Status of Lang – Hoa Lac Road**

Figure 2.7: **Existing Status of National Highway 21A**

❖ **Local transport:**

Currently, VNU-HN in Hoa Lac has invested in constructing 7 roads including: roads 1, 3, 4, 5, 6, 9, 12.

Figure 2.8: Transport System in the Area

The roads built inside the area of VNU-HN village are asphalt roads and have associated technical infrastructure such as sidewalks, rainwater drainage, sewage drainage, lighting, technical tunnel, cable tunnels. These existing roads have a width of 15 – 55 m. However, the roads wer constructed long ago with insufficient maintenance, so some sections of the road have been degraded, sidewalks have been invaded by plants and road structure has been destrusted.


Figure 2.9: Existing Status of Internal Transport

2.3.4.2. Electricity and Water Supply

❖ **Electricity supply:**

Currently, there are 6 10/0.4 kV grid substations under the management of Thach That Electricity. Specifically:

- 01 permanent substation is located right next to the state farm, next to NH 21A, with capacity 320 kVA to supply electricity to the agricultural farms and residents along the NH 21A.
- One substation with capacity of 180 kVA, located in the middle of Farm 1A, supplying electricity to workers of some production teams of the farm.
- 04 hanging substations serving the farm's production teams, the capacity of each substation is 50 kVA.
- In addition, there is a 35 KV line from the Son Tay 110 KV substation to the Thach That 3 intermediate substation running through a part of the eastern boundary, adjacent to NH21A.

The power supplies are close to the project area:

- Xuan Mai - Hoa Lac - Son Tay 110 KV double electrical transmission line, AC185 wire, about 2 km from the design boundary to the East.
- The Hoa Lac High-Tech Park 110 KV substation (Thach That) located near VNU-HN with the current main transformer of 110/35/22 kV - 1x25 mVA. This station is expected to supply electricity for the appliances of Hoa Lac Hi-Tech Park and a part of the urban area.

Electricity for project activities is expected to be connected to the transformer station of Xuan Mai - Hoa Lac - Son Tay station.

❖ **Water supply:**

At the present, there is still no piped water supply system in the project area. Households and buildings in the area of VNU-HN subproject are using water from dug wells (with depth of 8-20 m) or drilled wells (with a depth of 10-20 m). The socio-economic survey results of the project show that 83% of the households living in the area of VNU village use the source from the well and 17% use the dug well; 100% of households rated the water quality of the household as good; No household said that water shortage or water scarcity occurred. Through a survey of the environmental conditions of the project area in October 2019, the quality of groundwater in the project area compared with **QCVN 09-MT: 2015/ BTNMT** [12] is within the allowed limits. During the construction phase of the project, tap water has not been able to serve activities for living and construction yet. Therefore, the contractors will drill wells to exploit the groundwater used for these purposes.

[12] QCVN 09-MT:2015/BTNMT: National technical regulation on groundwater quality

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The Hoa Lac area is located about 10 km from the Da River water treatment plant. Da River water treatment plant has capacity of 300,000 m^3/day using water tanks sitted on the hills with height of 70 m and supplying treated water to Ha Noi through D1600 mm water supply pipeline. There is a D1600 mm water supply pipeline in the south of the VNU-HN subproject. VINACONEX, the water supply operation authority, has agreed in principle in writing at a letter dated 8 August 2013 that Hanoi VNU can connect to the existing water supply system being operated by VINACONEX to get 7,000 m3/day by 2016 and 20,000 m3/d by 2025. But VNU-HN has not yet connected to this water supply system.

2.3.4.3. Medical Services

Results of the survey of the disease situation in the village village area showed that: About 58% of the households surveyed in the past 3 months had sick people. The diseases that households suffer are mainly common diseases such as: cold / fever (54%); Digestive is (32%); Dengue fever (54%); Respiratory (28%); Injury (56%) and other illnesses (12%). This is a fairly high and worrying indicator of the health of the people in the project area compared to the general level of health status and health care conditions are getting more and more present.

Currently, there are no medical centers or clinics in the area of NU-HN Village. Staffs and students working and studying at VNU-HN in Hoa Lac are using local health facilities such as Thach Hoa commune medical station and Thach That district general hospital. The commune's medical station has 2 doctors and 3 nurses. Thach That District General Hospital is located on DT419, about 8km northeast of the VNU village area, capable of receiving 70 patients at the same time. Thach Hoa commune health station is located in hamlet 6, Thach Hoa commune; 2km away from VNU village area to the Southeast, capable of receiving 5-7 patients at the same time.

Social evils in the area: In Thach That district, 131 cases of HIV have been confirmed in 22/23 communes. Through consultation with authorities and local people, there are still social evils, diseases such as drug addiction, prostitution, HIV/AIDS, syphilis… in the project area . Staffs' regularly check found no drug users as well as used needles and syringes in the area of VNU-HN village.

2.3.4.4. Drainage, Wastewater Collection and Treatment

- Rainwater drainage

The drainage network of VNU in Hoa Lac is arranged on all frame infrastructure roads, with cross-sectional width ≥32m and boundary roads. Rainwater drainage system is designed to flow independently of wastewater, design slope i≥1 / D (where D is the diameter of the drainage pipe). With frame lines using box culverts, the sewer system is arranged under sidewalks close to the pavement on both sides of the road to the outlet at the main streams such as Na Muong stream, Dong Lac stream, Vai Tilt - Ngoi Dia stream, Hoa Lac stream, ...With the drainage ditches with a width of the bottom width B = 0.40m, 0.60m and 0.80m flowing out of existing drainage lines or into internal pipelines. The construction area of the subprojects has been constructed with framework infrastructure, including roads and storm water drainage systems.


Rainwater drainage system is built submerged on the pavement

- Collection and treatment of wastewater

For wastewater discharged from the existing buildings, the wastewater is collected and treated by a septic tank before being discharged to a combined drainage system to flow together with rainwater toward water bodies in the area. Currently, the area has built sluice gates waiting for connection with wastewater treatment plants. The sewage collection pipeline system will be built in the internal area of each area and brought to treatment stations as planned, so far there is no such system .

2.3.4.5. Management of Solid Wastes

Currently, Thach Hoa commune has a functional unit to collect and treat domestic waste of people. The unit hired to collect and treat domestic waste in the area is Minh Quan High Technology Investment and Development Joint Stock Company.

At present, the collection of solid waste in the area of VNU-HN in Hoa Lac is mainly implemented in the office area of VNU-HN PMU, guest house area and dormitory No. 4. Collections of solid waste are implemented by VNU-HN staffs and treated by Minh Quan High Technology Investment and Development Joint Stock Company. Every week, Minh Quan Company collects and transports waste to Nam Son landfill which is 60km from the project area. It is expected that domestic waste of workers in the project will be collected by mobile waste bins placed on the site and hired Minh Quan High-tech Co., Ltd. to collect and treat periodically. The project for construction of University of Natural Sciences which is being implemented on the project site also uses waste collection and treatment services from this Company.

2.3.2. Markets

Thach That district has 06 big markets namely: San market, Cau market, Nua market, Chang market, Go Choi market, Huong Ngai market. In addition to these 6 large markets, there is a system of small markets in the communes. Implementing the Decision No. 5058 / QD-UBND dated November 5, 2012 of the City People's Committee, approving the Planning on wholesale and retail networks in Hanoi city up to 2020, with orientations to 2030; Accordingly, in Thach That district, 16 existing markets will be kept intact, newly built 08 third-class markets in communes without markets. Through field surveys, it can be seen that this market network has met the needs of the local people in their daily life.

The market closest to the project area is Go Choi market, 4 km southwest. In addition, there is a dense system of grocery stores and small markets around the VNU-HN project area.

Figure 2.10: Location of Small Stores and Markets in The Area

2.3.2.6. Types of existing laboratories in VNU

VNU-HN currently has 8 types of science and technology activities, including: 34 laboratories , 43 research centers, 10 experiment rooms , 3 museums , 2 science and technology company , one service center two Workshops; one Center of Technology Transfer (01). Types of scientific and research activities allocated by research fields including: Natural Sciences and Medicine, Social Sciences & Humanities; Science Technology & Engineering ; Interdisciplinary Science .

2.4. SPECIFIC CHARACTERISTICS OF THE PROJECT AREA

Figure 2.11: Location of the Proposed Work Items

Hoa Lac Airport

Hoa Lac Airport is a military airport located in Thach Hoa Commune, Thach That District, Hanoi City. The airport has 3 runways, each of which is about 2,200m long. Currently the airport is used as a military airport.Hoa Lac Airport is about 5.6 km northwest of the project area.

Figure 2.12: Hoa Lac Airport

Some construction started in 2003 in an area of over 1,000 hectares, so far only a few work items have been built in VNU-HN's new campus. Specific environmental and social conditions in the project areas are described below:

Table 2.14. Existing Status of The Existing Works in VNU-HN Village

Main characteristic	Main characteristic
 Road No.1, the guest house area, the PMU office area and Muc mountain are on the entrance to VNU-HN village, about 1 km from the gate. This is the area with the most complete infrastructure in the area.	 The guest house area, the PMU office area, is located about 1 km from the VNU-HN village entrance, and has been used for 10 years. This area includes meeting rooms with a capacity of 250 people, sports and fitness rooms and high standard rooms.

.
No.6 road. Some roads under construction within VNU-HN village area. The area is mostly vacant land covered with grass, bushes or crop trees.There are some lakes and streams in the area

No.8 lake area
These are the households who have received compensation and resettlement but have not moved. Scattered in VNU-HN village area.

HT1 building belongs to the project of constructing a VNU university of natural sciences (QG-HN07)

2.4.1. Zone 1 – Area of the University of Technology

The area proposed for the construction of the University of Technology of VNU-HN in Hoa Lac borders with the internal road No.01 (55 m wide) and the area proposed for the University of Natural Sciences and the International University in the East; with the No.7 village in the West (300m); adjacent to an isolated green area of 110m and Hoa Lac - Hoa Binh expressway (140 m wide) in the South; adjacent to the internal road No.04 (32 m wide) and the of the proposed Hanoi School of Business and Management in the North..

The Zone 1 has an area of about 8 ha, which is vacant land, there is no exsiting houses or on-land structures. The typical vegetation in this area is ***grasslands, shrubs, timber trees*** scatterly grown. Grasslands include tall grasses such as: *Imperata cylindrical, Saccharum spontaneum;* shrubs include *Ageratum conyzoides, Mimosa diplotricha, Pteridophyta*, ... A few fruit trees (about 30 trees) such as longan, litchi, mango, ...), and forest trees (acacia, eucalyptus, ...) growing alternately with grasslands, shrubs.The species observered in the bushes in Zone 1 are Mimosa pudica, Bidens pilosa, Imperata cylindrica) and some big trees like longan, acacia, areca.. In addition, some households living elsewhere have been cultivating short-term crops such as vegetables, maize, sweet potatoes and cassava. These trees are planted scatteredly on a small scale. Some photos of vegetation in Zone 1 are shown below.

Due to typical flora are grasses, shrubs, the fauna in Zone 1 are mainly reptiles and frogs of some types like: *Hemidactylus frenatus, Amphiesma stolata, Xenopeltis unicolor, Rhabdophis, Viperidae, Najaatra, Limnoneetes limnochasis, Hyla simplex, Limnonectes limnocharis, Polypedates leucomystax, Hoplobartrachus rugulosus, Bombinatoridae, Rama guentheri, Rana macrodacrtyla*, ...In addition, there are some insects, butterflies, worms, ...

Thus, in zone 1, the ecosystem is mainly grassland, shrubs, no rare animals or endangered fauna and flora species. **It is noticeable that Mimosa is an invasive floral species.**

Around Zone 1, the side adjacent to the asphalt road is bound with sidewalks and technical infrastructure such as electricity, water and technical trenches (awaiting for future cables)..

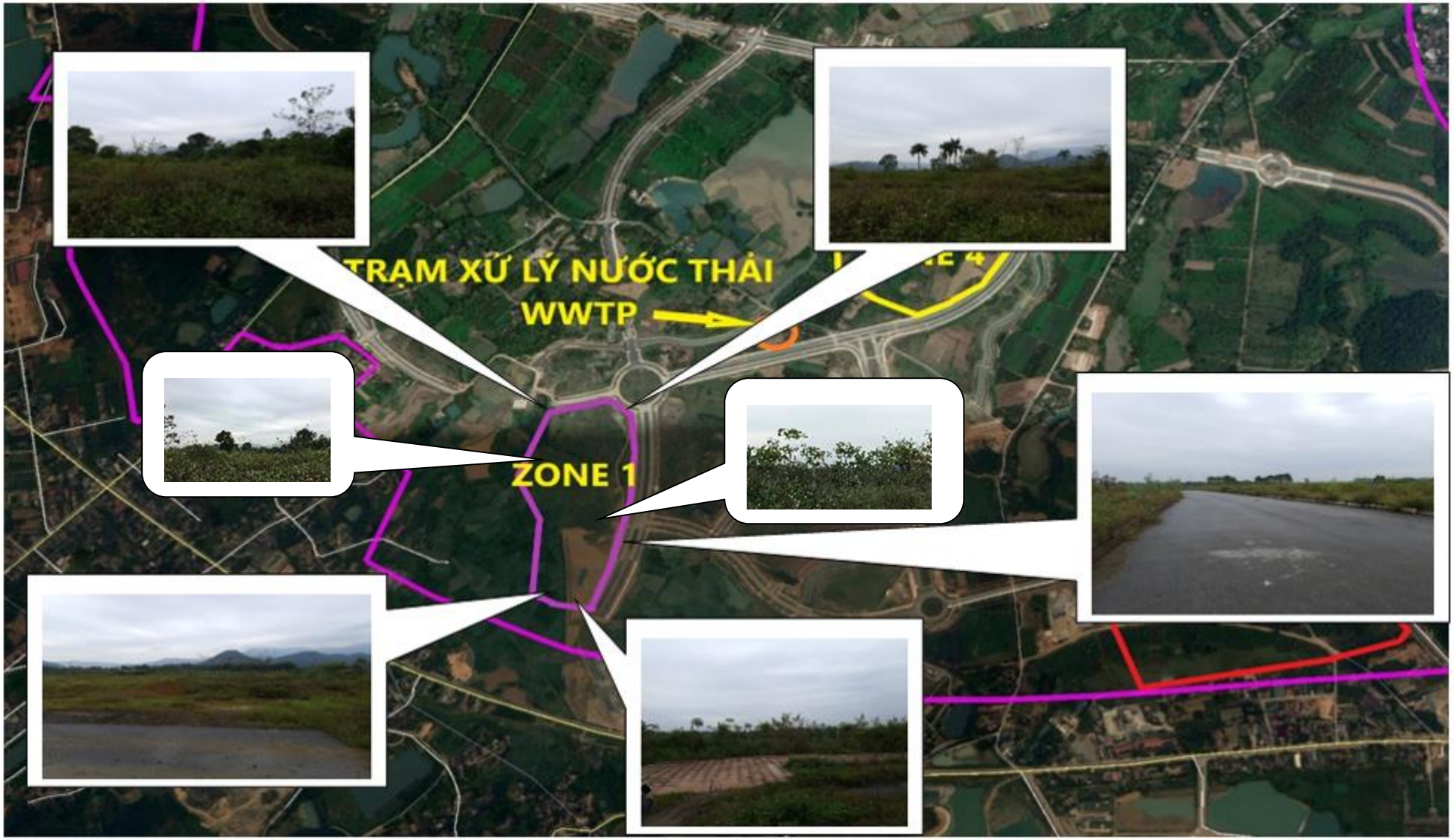


Figure 2.13: Location of the University of Technology - Zone 1

Table 2.15. Existing Status of Zone 1

Location	Photo taken at the site
Zone 1 is accessible by roads number 1 and 4 where sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.) were built. There is no house or structures on the land. Typical flora and fauna are grass, shrubs, scattered timber trees, reptiles and frogs.	
Northeast, Adjacent to the roundabout of Road No. 4 and Road No. 1 	Northwest, adjacent of road No.1 
Southeast of Zone 1 	
South west of Zone 1 	
Vegetation cover is mainly bushes with some invasive plant (Mimosa pudica, Bidens pilosa, Imperata cylindrica) and some big trees like longan, acacia, areca…	
	

2.4.2. Zone 3 –Proposed for Research Institute and Center

The area borders with the road No. 04 in the north; with the No.6 village – Thach Hoa commune residential area in in the south (50m); road No. 01 and the VNU guest house area in the east (90m); and the area for student's dormitory in the west. At present, zone 3 is vacant land, there are neither any houses nor structures there

The site has land area of 22.89 ha, occupied mainly by fruit trees and timber trees including longan, litchi, mango, ... and plantation timber trees such as acacia, eucalyptus, ... Currently, the fruit trees have large canopy with a diameter of 5-10 m, the trunk is high, but quite stunted due to nutrient deficiency; Planted trees such as acacia and eucalyptus with a height of 20-30 m and trunk's diameter of 15-20 cm can be harvested. There is an area of 2,300 m^2 tea farm being cultivated by local households formerly belonged to Farm 1A. In addition, some nearby households are also cultivating short-term crops such as vegetables, maize, potatoes, cassava but on small scale and scattering around the area.

The fauna community in Zone 3 is more diverse than that in Zone 1 with birds, reptiles, frogs, insects, butterflies, etc as a common local ecological feature. snakes, rats, bees and other harmful insects in the area which may attack human also present in the project area. .

In zone 3 area, there is one temporary material gathering yard and two existing trails. The material gathering yard is being relocated and the sites is being reinstated. There are two existing trails is 5-7 m wide, previously were used by local people and staffs of VNU-HN PMU in Hoa Lac. These two routes can be used as internal roads for the construction phase.

The south of zone 3 has a natural pond with an area of 1.8ha. Ponds have less abundant aquatic flora. In consultation, there were no big fishes, only species such as: herring, perch; The water level and surface area of water in the rainy and dry seasons are quite large

The receiving body of effluent from the WWTP capacity 600 m^3/day in the zone 3 is the Muc lake then flows along the horizontal sewer system of Highway 21 to the wastewater collection system of the high-tech zone. The ecological lake at the foot of Muc mountain is the second largest of 13 natural lakes in the VNU-HN area in Hoa Lac. The lake has an area of 3.8 ha. The main use purpose of the ecological lake is to create landscapes and is the regulation lake for the south area of VNU-HN. The ecological lake and other lakes in the VNU-HN area are connected by small streams and culverts.

Figure 2.14: Location of the Research Institute – Zone 3

Table 2.16. Existing Status of the Zone 3

Location	Photo taken at the site
The North: adjacent to road No. 6 with sidewalks, lighting, electricity, water supply, fire hydrants, technical trenches, etc. built). 	The South: borders with the Lang - Hoa Lac road. There are some production establishments and workshops in the area between the University and Lang - Hoa Lac road, about 200 m from zone 3. 
The East: borders with road No. 01 and guest house. The guest house has been being used as office and reception of VNU-HN. Road No.1 has built sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, etc.). There is a row of big longan trees on the east of zone 3, which can be reserved for shading and landscape.  	Central area - zone 3: old farm land still exist, mainly tea and fruit trees  
The West: Student's dormitory, existing condition is similar to zone 3. This dorm will be invested with other sources of VNU	Muc lake

South: 1.8ha natural pond

2.4.3. Zone 4 – Central Area of VNU-HN

Among the project's three zones, Zone 4 has the smallest land area, about 6.6 ha. The central area of VNU-HN borders with the Da Lat lake in the north, with the road No. 6 in the east and south; with the site for construction of the WWTP (capacity of 1,475 m^3/day) in the West.

Zone 4 has very rich vegetation interspersed with mixed garden plants. The area for tea trees is quite large (2.8 hectares), accounting for 1/3 of the total area of the zone. In addition, there are about 45,500 fruit trees (longan, litchi, mango, ...) and timber trees (acacia, eucalyptus, ...) in this zone. The timber trees are very high, about 30-40 m with straight trunks. It is noted that there are vines and invasive plants in the area because the land has been left vacant for a long time. At many areas, vines have grown strongly into thick bushes covering timber trees and become ideal places for snakes and reptiles to live. In addition, some households are still cultivating short-term crops such as vegetables and maize, potatoes, cassava on small scale and scattering around the area. There are two households who already received full compensation and no complaints, but still living in the aera to make use of the garden and fish farming at Da Lat lake - right next to the land.

There are no rare and endangered species in the area. Some big fruit trees such as longan and litchi trees near Da Lat lake area if being reserved during site clearance and construction process will be worth in providing shadow and beautiful landscapes for the area around the lake as well as for the approved general scenery.

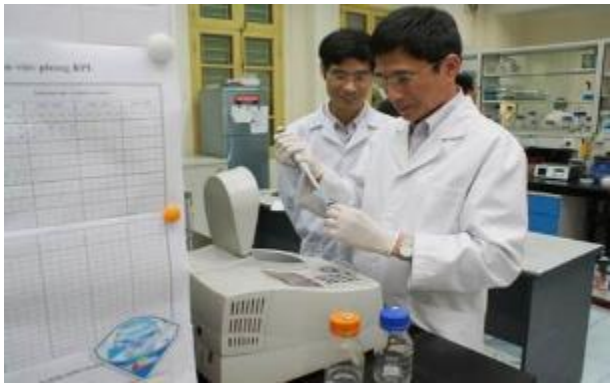
Figure 2.15: Location of the Central Area of VNU-HN -Zone 4

Table 2.17. Existing Status of the Zone 4

Location	Photo taken at the site
The East and South: Adjacent to Road No. 6 The road already has sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.). 	The west: There is an earth road. This is an old trail being used by for tracking. There are houses without occupancy after local people have relocated. 
North: About 300 m from Da Lat lake 	
Central area of zone 4: Old farming area, mainly tea, fruit trees and vegetables. There are a lot of big trees and beautiful grasslands, which can be kept for landscaping. There is also a big fig tree that can be valuable for bonsai purpose and can be displaced to a plant nursery and re-planted at the site after construction.	
	
	

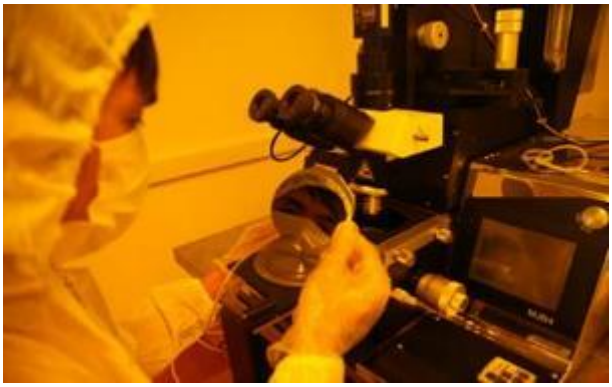
2.4.4. Existing Laboratories

VNU-HN already have existing well-set up laboratories crossing various field. The focus labs are under the management of senior HNU leaders including HNU directors faculty managers. The laboratories have been well operated and managed. OHS rules are in place and followed strictly. Below are some images of the existing laboratories proposed to be relocated to the new campus, additional information is provided in the Annex.



National-focused Enzym and Protein Lab at the University of Natural Science, VNU-HN

Organic chemistry pharmacy lab of Chemical Department of the University of Natural Science



Micro-nano lab at the University of Technology

Some Equipment at the Environmental Analysis Lab

CHAPTER 3. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

3.1. POSITIVE IMPACTS

In general, the VNU-HN subproject will bring significant positive impacts. The creation of new infrastructure will help VNU HNU to improve the quality of teaching and research through enhanced infrastructure, technology, and governance. The teachers, students and the researchers at the University of Technology, the benefited Institute and the Research Center and the staff of VNU HN working in the newCentral zone of VNU-HN in Hoa Lac will be the beneficiaries of the Project. It is estimated that the number of beneficiaries of VNU HN subproject is 8,807 people, among these 12.9% are women. During construction phase, the project will bring about job opportunities and additional income for local people who are hired by the contractors for shorterm jobs during construction phase or by the University for cleaning and maintenance during operation phase;

Beside the significant positive impacts, there would be also some negative environmental and social impacts and risks during the pre-construction, construction and operations of the infrastructure provided under the subproject.

3.2. NEGATIVE IMPACTS AND RISKS

There will be some potential adverse environmental and social impacts and risks during construction and operation of facilities provided in Component 1 and 2. These potential negative impacts and risks are classified as follows:

Significant impact (S)

- Impact on large areas of land, important areas, or changes in environmental conditions for more than two years;
- Impact beyond the permitted standards and regulations. Long-term impact and large scale;
- Changes in ecosystems, impacts on large area ecosystems or medium impacts (lasting more than two years) requiring 10 years for recovery of affected ecosystems;
- Impact on people's health;
- Potential social and environmental impacts only be controlled and mitigated if appropriate mitigation measures are taken.

Moderate Impact (M)

- Impact on large areas over a period of 6 months to 2 years;
- Change of local ecological systems or ecological functions in a short time and resilience is good. The level of impact is similar to the current changes but such effects may have cumulative effects;
- Impacts may (or may not) affect the health of the people, affecting the people in the surrounding area;
- The impact is moderate, localized and temporary and mitigation measures need to be implemented.

Low impact (L)

- Social and environmental impacts that cause significant changes in less than six months or average changes in less than two years;

- Impacts are within the permitted standards and regulations, causing minor changes in the present. The impact can be completely controlled;
- The impact may affect daily activities but not hindering the community;
- Minor impacts on people's health and living standards;
- The impacts are small, localized and can be ignored.

Negligible impact (N)

- Impacts that are unrecognizable or cannot be identified that may be caused by daily activities;
- No social and environmental impacts.

The types and scope of environmental negative impacts and the risks are classified in **Table 3.1** below.

Table 3.1. Level of Negative Impacts

Work item	**Physical impact**			**Biological impact**			**Social impact**			**Other impact**		
	Air, noise, vibration	*Soil, water*	*Solid waste, sludge*	*Forest, natural habitat*	*Fish, aquatic species*	*Indigenous group*	*Land acquisition, resettlement*	*Tangible cultural resources*	*Livelihood, community disturbance*	*Traffic safety*	*Side effects*	*Labor influx*
Item: Construction of University of Technology, about 8ha (Zone 1) i. Administration and operation buildings (8-floor building; 3,000 m^2 of floor); ii. Academy block (8-floor building; 6,000 m^2 of floor); iii. Lecture hall building (8-floor building; 10,000 m^2 floor); iv. Specialized library buildings (5 5-floor buildings; 7,500 m^2 of floor); v. Building for practical activities and laboratory (3-floor building; 6,000 m^2 floor); vi. International Conference Center and Hall (2-floor building; 5,000 m^2 floor); vii. Multi-function sport building 1,000 seats (5-floor building; 1,500 m^2 of floor); viii. Service area (2-floor building; 2,000 m^2 floor); ix. Academic-business cooperation area (5-floor building; 1,500 m^2 of floor); x. Agricultural practice area (greenhouse, net house) (area of 1 ha); xi. Outdoor experimental area (unmanned aircraft, self-propelled vehicles, measurement of radio waves) (area of 1 ha); Technical infrastructure system and internal facilities (area of about 5.08 ha).												
Preparation	N	N	N	N	N	N	N	N	N	N	L	L
Construction	M	M	M	N	L	N	N	N	M	L	L	M
Operation	L	N	M	N	N	N	N	N	L	L	L	L
Item: Construction of area for research institute, research center (22,89 ha) (Zone 3) i. The building of an interdisciplinary laboratory system (including 5 large laboratory: advanced materials and components laboratory; AI and ICT technology laboratory; technology manufacturing and decoding laboratory; laboratory for environmental quality monitoring, food and sustainable development) (5-floor building; 19,590 m^2 floor) ii. Buildings for key laboratory system (high-performance computing center; key laboratory for multi-scale simulation of complex systems; Nano and energy centers; Accelerator laboratory; key laboratory for bio-energy development; key laboratory for UWD advanced materials in green development; key Laboratory for environmental and food safety testing; Research centers to develop the application of analytical science; Center for environmental technology and sustainable development; Laboratory of Enzymes and Protein; Center for life science on geology and response to climate change; marine and island research center; laboratory for geological and geotechnical resarch and mitigation; center for environmental hydrodynamics; environmental monitoring and modeling center; environmental analysis laboratory) (5-floor building; 22,800 m^2 floor);												

Work item	**Physical impact**			**Biological impact**			**Social impact**			**Other impact**		
	Air, noise, vibration	*Soil, water*	*Solid waste, sludge*	*Forest, natural habitat*	*Fish, aquatic species*	*Indigenous group*	*Land acquisition, resettlement*	*Tangible cultural resources*	*Livelihood, community disturbance*	*Traffic safety*	*Side effects*	*Labor influx*
iii. Blocks of institutes and research center (4 buildings of 5 floors; 16,825 m^2 of floor); iv. Lecture hall building for pos-graduate educationl (5-floor building; 23,165 m^2 floor); v. Workshop (2-floor building; 11,500 m^2 of floor); vi. Building for services, conference, sports, and auxiliary items (1 building area of 5,000 m^2; 1 building with 2 floors, 10,000 m^2 floor; 1 building with 3,964 m^2 area); vii. Internal infrastructure (yard, internal roads, landscapes, trees, garages, other auxiliary items ...) (construction area of 20 ha). viii. WWTP with capacity of 600 m^3/day												
Preparation	N	N	N	N	N	N	N	N	N	N	L	L
Construction	M	M	M	N	L	N	N	N	M	L	L	M
Operation	L	N	M	N	M	N	N	N	L	L	L	L
Item: Construction of central area of VNU-HN (about 6,6 ha) (Zone 4) i. Central operation building of VNU-HN (1 block of 735 m^2; 1 12-floor building, 8,816 m^2 of floor); ii. Central library building (1 area of 2,288 m^2; 1 5-floor building, 11,439 m^2 floor); iii. Internal infrastructure (yard, internal roads, landscape, trees, garage, other auxiliary items ...) (construction area 6.16 ha). WWTP with capacity of 1,475m^3/day												
Preparation	N	N	N	N	N	N	N	N	N	N	L	L
Construction	M	M	M	N	L	N	N	N	M	L	L	M
Operation	L	N	M	N	N	N	N	N	L	L	L	L
Note	- The site has been cleared, no resettlement impact - Impact level are minor to medium and can be mitigated through the application of technical solutions (ECOPs). - No impact on sensitive receptors; no impact on PCRs; No impact on agricultural land.											-

3.2.1. Pre-Construction Phase

The main issues during pre-construction phase of infrastructure projects are land acquisition and the risks of unexploded ordinances left from the war that happened in the past.

Regarding land acquisition, the total land area of the subproject is 37.49 ha, land acquisition was already completed in 2007. Due diligence review on Resettlement has been done and details are presented in the Due Dilligence Report. At the present, this area is managed by the VNU HN. There were 144 households affected by land acquisition, mainly production land (land for fruit trees, tea, annual crops and a small part of other land) and assets on-land (fruit trees, tea trees and crops). Currently, some households are still cultivating and animal raising to get additional income while construction has not been implemented. The Project will inform these households at least 6 months priror to construction commencement.

Unexploded ordnances: The site used to be affected by the war and boming in the past, thus some UXO may have been left in the ground after the war. Clearnce of unexploded ordnances has been implemented in the project area in accordance with Decision 2270/QD-BQP dated September 22, 2001 of the Minister of Defense on approving the plan for detection and clearance of unexploded ordnances in the construction area inHoa Lac - Thach That - Ha Tay. The total cost for the detection and handling of boms, mines and explosive objects in the VNU HN area in Hoa Lac was accepted and settled under the Decision 224/KHTC by VNU-HN's President of VNU with amount of VND 29,385,961,000. Mine clearance has been implemented and completed from October 2001 to September 2004 by Technology Center for Bomb and Mine Disposal - BOMICEN, Command of the Engineer – Ministry of National Defence. It can be seen that there is no risk of mines and UXO because the clearance has been completed.

3.2.2. Construction Phase

-
- The activities that will be conducted during the construction phase mainly include:
- Clear vegetation cover, the trees;
- Remove topsoil, leveling the ground;
- Set up camps and Site office;
- Establish a storage area for construction waste and hazardous waste
- Mobilize construction machines and workers to the construction site;
- Transport and gather construction materials at the construction site;
- Construct foundations;
- Erect formwork and scaffolding
- Construct formwork beams, floors, roofs;
- Construct items of great height;
- Construct water supply and drainage in the project's construction blocks
- Construct electrical systems;
- Construct grounding - lightning protection systems;
- Construct and install transformers;
- Construct and install medium voltage cables, electrical cabinets

The above activities will cause environmental and social impacts during construction. including: increased level of dust, noise and vibrations due to earth works; generation waste and waste water; localized flooding and sedimentation, biological impacts with losses of vegetation cover, trees and some green space, occupational health and safety risks for the workers, particularly when working at high above the ground, community health and safety risks; traffic disturbance and increased traffic safety risks , damage to existing infrastructure and public services, and social issues relating to labor influx especially community disturbance and social risks related to gender-based violence, sexual harassment and abuse, and child labor.

The *sources and receptors of these impacts are listed in **Table 3.2** below*

Table 3.2. Receptors and Scope of Impacts

No	Impact/risk	Source	Receptor	Scope of impact
1	Air quality degradation: increased dust and emissions, noise and vibration.	- Dust generated from excavation, loading and transporting of construction materials (soil, sand, stone, cement) and waste. - Emissions from cars, trucks, excavators, cranes ... - Noise from motors of vehicles, from loading and unloading stones on temporary material yards, - Vibration during pile driving	- People living along Lang - Hoa Lac road in VNU-HN area - People living along the material transportation route - Workers on the construction site; - Infrastructure (technical tunnel, existing sewer) 50 - 100m from the project	M
2	Generation of wastewater	- Rainwater runoff over construction sites, which contain a high amount of mud - Domestic wastewater from worker camps. - Wastewater from stone processing stations, construction materials, concrete processing stations, concrete pouring areas, wastewater from pile drilling process containing cement, sand, ...; washing water and cooling water for construction machinery and equipment containing leaking grease, sand and soil, water mixed with mortar; car wash water entering and leaving the construction site.	Surface water in the project area (Da Lat lake).	M
3	Generation of solid waste, including hazardous wastes	- Soil generated from earthwork. - Domestic waste from workers' camps; - Construction solid waste, including cardboard, wood scraps, packaging materials, and mortar. - Hazardous waste such as waste oil from maintenance of vehicles and equipment.	Worker. Environment of soil and water	M
4	Degradation of surface water quality	- Rainwater runoff on the construction sites contains high solid content (TSS). - Wastewater from camps has high BOD, nutrients (N, P) and e coli; - Wastewater from washing construction vehicles has high turbidity and oil.	- Along the stream area of the project. - Da Lat lake water surface, ecological lake for the WWTP.	M
5	Degrade landscape values	Currently the project area is quite green, some places have beautiful landscape with lakes, watersurface, trees, and grassland. Construction may disturb or damages these locations if not avoided or no mitigation measures are implemented	- Central zone and zone 3	M

6	Impact on biological resources	- Site Clearance will remove existing vegetation cover and trees in an area of about 37.5 ha - ha, mainly shrubs and trees of low value. - temporary loading of materials will also disturbe ground and existing vegetation cover. - Bush fire risks in dry season in relation to the workers' behavior such as indiscriminate burning of rubbish, - Untreated Wastewater from the camps flows into the lakes affecting aquatic lilves	- Some vegetation and trees; some terrestrial species (reptiles) - Aquatic ecosystem of Da Lat lake and ecological lake.	Low
7	Traffic disturbance and increased traffic safety risk	- Vehicles transporting materials and waste in the Project. - Transportation of raw materials on Hoa Lac - Hoa Binh and NH21 will increase the traffic density, leading to traffic safety risks a entrances and along transportation racte within the University.	- People participating in transtrort, pedestrians - Local community - Traffic on Hoa Lac - Hoa Binh road.	M
8	Increased localized flooding and sedimentation risks	Earthworks, loading of construction materials and wastes, construction activities may disrupt the existing drainage pattern and cause localised flooding to the construction sites and the surounding area. Rainwater may wash gralunar materials may block drains, cause sedimentation in streams, lakes and rivers. Soil, stones and wastes on drains and ditches in and around the construction area blocking the drainage system.	- Surface water in the project area (Da Lat lake) - Infrastructure (technical tunnel, existing sewer) 50 - 100m from the project - Projects under construction Worker	M
9	Landslide, erosion risks	There will be landslide and erosion risks at slopes created from deep excavation or sharp filling.	- Worker	M
10	Social impacts related to labor influx	At the peak time, there could be 1000 workers (of which 70% are local people, 30% are immigrants) working in three zones of the projects. There will also be followers (mostly for cooking and cleaning). The concentration of the workers and followers may cause social disturbance to the area where currently there are limited population, additional domestic solid waste and wastewater will also be generated. Epidemic, if happen, will also be issues to both the workers and the communities. Interactions between the workers and local people may also lead to some conflicts due to differences in job, incomes and behaviours	- Local community	M
11	Gender issue	Discriminating against women in work assignments. Sexual harassment risk	- Female worker	M
12	Increased pressure on local existing resources and services	The labour influx may cause increased pressure to the existing infrastructure and related services such as water and power supply, food, health care, solid waste and wastewater management services etc. if the contractors can not manage properly.	- Local community	L

13	Damage to existing infrastructure and/or disruptions to related services	- Power cuts may be required due to demolition or relocation of existing infrastructure. - Damage to power lines, internet cables or telephone lines due to crane operation.	- Current infrastructure, including: Power lines, water supply pipes, internet cables, telephone lines	M
14	Workers' health and safety	All construction activities are dangerous to workers, especially: + Falling in a deep hole + Risks when construction on high floors (slip, insecure labor protective measure ..) + Electric shock + Drown when have swim in lakes + Bitten by insects, snakes	- Worker	Low

The impacts on environment from the above mentioned sources are considered negative but mostly at low to moderate level. And these impacts only occur during construction, so the impacts on the environment during the construction phase are considered medium to short-term and localised.

3.2.2.1. Environmental Impacts and Risks

Impacts on Air quality: Dust, gas emission, noise, vibration will be generated from earthworks such as excavation, operations of construction plants and equipment, transporation, and construction activities such as piling. Details are discussed below.

a. Dust and Emissions

Dust is generated mainly from activities such as excavation, backfilling, unloading of construction materials and movement of vehicles on transportation routes. Gases like NOx, SO_2 and CO come from the exhaust pipes of machines and equipment such as bulldozers, excavators, generators, rollers, etc.

Dust generated from excavation and leveling

The Sutton model is applied to calculate and determine the average concentration of dust and emissions along the project's material transportation routes.

$$C(mg/m3) = \frac{0{,}8E.\left\{\exp\left[\frac{-(z+h)^2}{2\sigma_z^2}\right] + \exp\left[\frac{-(z-h)^2}{2\sigma_z^2}\right]\right\}}{\sigma_z.u}$$

Where:

- C – Concentration of pollutant in ambient air (mg/m^3)
- E – emissions from sources (mg/ms).
- z – Designed height (m); z = 0.5m
- h – height of road surface compared with surrounding ground level (m);
- u – average wind speed in the project area (m/s); wind speed in the dry season in the project area,
- u= 1.8 m/s, the prevailing wind is southwest, in rainy season, u=3 m/s, prevailing wind is the northeast wind
- σ_z – Diffusion coefficient in z direction (m).

Table 3.3. Forecast on Dust Content at Construction Sites

(base content C = 82-196 µg/m³)

L (m)	W (m)	1.5	3	6	9	12	15	QCVN 05:2013/BTNMT (TB 1h) (µg/m³)
		H= 1.5m	H= 3m	H= 6m	H= 9m	H= 12m	H= 15m	
Construction of University of Technology (Zone 1)								

L (m)	W (m)	1.5	3	6	9	12	15	QCVN 05:2013/BTNMT (TB 1h) (µg/m^3)
		H= 1.5m	H= 3m	H= 6m	H= 9m	H= 12m	H= 15m	
5	5	137	121	113	111	110	109	300
10	10	121	113	110	108	108	107	
20	20	113	110	108	107	107	107	
50	50	109	107	107	106	106	106	
Construction of the VNU-HN central area (Zone 4)								
5	5	197	197	196	196	196	196	300
10	10	197	196	196	196	196	196	
20	20	196	196	196	196	196	196	
50	50	196	196	196	196	196	196	
Construction of library, Research institute (Zone 3)								
5	5	213	200	194	192	191	191	300
10	10	200	194	191	190	190	189	
20	20	194	191	190	189	189	189	
50	50	191	189	189	189	189	188	

From the table above, it can be seen that the concentration of dust in the air including the amount of dust dispersed from the area during construction is within the allowed limits. At a distance of 5 m, the maximum dust content is 213 µg/m^3 for the construction of central area of VNU-HN but still below the allowed limit which is 300 µg/m^3. The lowest amount of dust arises from the work of Zone 1. The amount of dust in the air generated in the construction sites is within the allowed limits because the amount of materials and waste is not too large while the ground conditions are low (82 - 196 µg/m^3). However, attention should be paid to the effects of dust on workers as they have not been able to adapt to the increase in the amount of dust although it is still within the permissible limits.

The nearest residential cluster is 300 - 500 m south from the construction area of Zone 3. The prevailing wind direction of the region is the Southeast monsoon from May to September, the northeast monsoon from November to March. If the construction time is from November to March, attention should be paid to the influence of dust on residential clusters. When the Northeast monsoon appears, it will sweep and blow the dust towards residential clusters, which may affect people's lives and activities.

Dust from transportation of construction materials and waste

The main route for transportation of materials and disposal are NH 21 and Thang Long Highway which are shown in Figure 3.1.

Figure 3.1: Main Transportation Route of Material and Waste

The total volume of stone, waste, excavated and leveling materials for construction of work items is 102,785 tons. This volume needs 5,710 trips of 18-ton trucks.

The value of pollutant diffusion is calculated by Slade model, with atmospheric stability B and distance X (m) between calculation point and emission point, taking into account wind direction determined according to the following formula: $\sigma z = 0.53 \times 0.73$ (m).

The results of calculation of dust concentration in the dry season (from October to April) at distances X = 25, 50 and 100 m from the emission source (considered to be beside the roads) during transportation and earthwork process is shown in **Table 3.4** below:

Table 3.4. Calculated Dust and Emissions from Materials Transportation (18-ton Truck)

No	Item	Distance (m)	Generated emissions (µg/m.s)			
			Dust ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)
			H=3m			
1	Construction of University of Technology (Zone 1)	25	113	40	33	827
		50	113	40	33	827
		100	113	40	33	827
2	Construction of library, Research institute (Zone 4	25	113	22	29	654
		50	113	22	29	654
		100	113	22	29	654
3	Construction of the VNU-HN central area (Zone 3)	25	113	42	43	1,012
		50	113	42	43	1,012
		100	113	42	43	1,012
QCVN 05:2013/BTNMT			**300**	**350**	**200**	**30,000**

Comments on geration of dust and gas emissions:

In general, the concentration of dust and emissions in the air on the transportation route (concentration of emissions from transport vehicles + baseline concentration) does not exceed the applicable standards according to QCVN 05:2013/BTNMT. The workers at the site and the households along the transportation routes would be the main receptors affected by dusts and exhaust emission and noise. The concentration of dust and emissions decreases along the distance from the source. It can be seen that dust concentration is much lower than the allowable limit in the standard QCVN, which will not cause significant effect on the health of workers if they are well-equipped with labor protectitive equipment (helmets, caps, masks).

However, the above calculations are only for dust generated by vehicle engine and do not include dust from the road surface due to wheel movement, or from materials or waste that falls/spills out of a tank during transportation. This amount of dust depends heavily on the tightness of the trunk, weather conditions, quality of road surface, sanitation condition of vehicles and roads as well as wind. Therefore, the impact of dust generated on the transportation route will certainly be higher due to these additional factors.

In addition, the calculations are based on the assumption that only take into account operation of project's vehicles on those roads, but not include emissions from other vehicles traveling on the same route. In fact, the dust concentration may increase more than the calculated results. Besides, the dust concentration also depends on the frequency of construction and mobilization of Contractor's vehicles from time to time. Sometimes when the construction progress needs to speed up so additional equipment, machinery and vehicles will be required, leading to increase in the impact of dust.

National Highway 21, Thang Long highway and Hoa Lac - Hoa Binh Expressway are the main transportation routes of project's materials. These roads will be more affected by dust from vehicles carrying granular materials with about 30 trips per day. According to Chapter 2, the existing quality of ambient air in these areas is still quite good. Impact due to dust from Project activities will be significant. However, such impacts are only temporary during the construction phase and can be mitigated. These impacts can only cease when the transportation and construction phase of the Project is completed.

Figure 3.2: Sensitive Receptors along the Transportation Route

Sensitive receptors to dust will be the workers at the construction site, road users, shops, offices, army and sport training institutions (not belong to VNU HN) restaurants and households located along the transportation routes, near the material loading areas . pollution can constrain operation of business and service because customers will be more willing to choose other cleaner places to eat, drink and buy goods.

Table 3.5. Sensitive Receptors

Name/photo	Name/photo
Viettel sport center  **1,000 m from the project area**	Political university  **1,200 m from the project area**
Dormitory of the Political University  **1,500 m from the project area**	Neighboring area  **1,000 m from the project area**

The potential impact of dust is short-term, temporary, reversible and can be mitigated by the mitigation measures such as the use construction plants of which emission levels meet applicable standards, watering the sites, covering under constructed buildings, trucks and materials dumps, provide PPEs including face masks for the workers to use etc. Such measures together with the others for addressing common construction impacts are presented in the form of Environmental Codes of Practices (ECOP) and Workers Codes of Conducts presented in Chapter 5**.**

b. Noise

Noise can be generated from vehicles, machinery and equipment. Noise level from transport and construction stages is calculated by the following formula:

$$Lp(X) = Lp(X0) + 20 \log10(Xfl/X)$$

Where $LP(X_0)$: noise at the distance of 1m from the source (dBA)
LP(X): noise at the calculated location
X: calculation location X_0 = 1m

For each work item, resonance noise will be estimated from the individual noise level of each machine and equipment. Resonance noise is calculated using the following formula:

$$Ly = 10 \times Ig \quad 1\ 0\ °'1Li$$

Where: -LI: resonance noise
-Li: source of noise i
- n: number of sources of noise

Opted distance for evaluation of impact of noise is from 0m-150m from the surrounding residential areas.

Table 3.6. Lists of Machinery and Equipment

Machinery/equipment	University of Technology	Rresearch institute andcenter	Central area of VNU-HN
Single bucket excavator	10	10	11
Bulldozer 108 CV	8	8	9
Vibrator 10T	4	4	6
Pneumatic road roller 16T	4	4	5
Vibrator 25T	4	4	5
Crane 10T	5	3	7
Water spraying vehicle $5m^3$	2	2	4
Asphalt spraying vehicle 7T	2	2	3
Mortar mixer	10	10	9
Pump	4	4	5
Asphalt concrete paver	2	2	3
Pile driving machine	4	4	5
Hauling truck	5	5	6
Steel bending/cutting machine	4	4	5
Electric welding machine	5	5	6
Rammer	4	4	5

Assessment of individual noise level caused by the construction machinery and equipment, personal vehicles as well as the resonant noise level are estimated and are shown in Table 3.7 below.

Table 3.7. Noise Generated from Construction Machinery and Equipment

Work item	***Number of machinery***	***Distance from the source (m)***						
		1	***15***	***30***	***60***	***90***	***120***	***150***
University of Technology	*77*	*105*	*79*	*72*	*66*	*62*	*59*	*57*
Cntral area of VNU-HN	*75*	*107*	*81*	*74*	*67*	*64*	*61*	*59*
Research institute and center	*78*	*106*	*81*	*74*	*67*	*63*	*61*	*59*
QCVN26:2010/BTNMT (6h-21h)		***70dB***						
QCVN26:2010/BTNMT (21h-6h)		***55dB***						

Calculation results show that at a distance of 60 m from the source, noise is within the allowable limits of QCVN 26:2010/BTNMT. At a distance of less than 30 m, the noise level exceeds the allowable limits at the construction sites of the three works. There are almost no houses around the buildings, the nearest residential area is about 500 m. The potential impact of noise is at moderate level and can be mitigated by the mitigation measures presented in detail in Chapter 5.

c. Vibration

The operation of construction equipment and machinery can cause vibration. This vibration propagates in the soil environment, but will decrease significantly with distance. Construction equipment includes pile driving machines, compressors, bulldozers and heavy trucks as shown in the following two tables. The distance that can be significantly affected by vibration is about 10 meters from the source

Table 3.8. Vibration Caused by Some Types of Construction Machinery

TT	Machine/equipment	PPV at 7.62 m	Lv at 7.62 m

TT	Machine/equipment	PPV at 7.62 m	Lv at 7.62 m
1	Pile driving machine		
	+ High level	**0.463**	112
	+ Medium level	**0.196**	104
2	Compressor	0.064	**94**
3	Hammer drill	0.027	**87**
4	Bulldozer	0.027	**87**
5	Drilling machine	0.027	**87**
6	Heavy truck	0.023	**86**
7	Drilling machine	0.011	**79**
8	Small truck	0.001	**58**

Source: D.J. Martin. 1980, J.F. Wiss.1974, J.F. Wiss. 1967, David A. Towers. 1995.

Table 3.9. Impacts of Vibration

No	Description	PPV (mm/s)	Estimated Lv (VdB)
1	Reinforced concrete, steel, wood (no plastic)	0.153	102
2	Engineering concrete, ordinary constructions (no plastic)	0.092	94
3	Unmachined wood and large brick works	0.061	98
4	Sensitive structure under vibration	0.037	90

Source: Swiss Consultants for Road Construction Association, "Effects of Vibration on Construction," VSS-SN640-312a, Zurich, Switzerland, April 1992

Compaction and piling are the most common activities causing vibration during the construction phase of a project. Vibrations make people feel uncomfortable or even unsafe. However, the construction project area is more than 500 m from the nearest residential area so the potential impacts of vibration on local people will be limited.

Vibration can also affect the stability of the existing structure. Surrounding the construction site are vacant land and technical tunnels of existing roads (with technical infrastructure such as electricity, water, telecommunications), people's houses and official houses, guest house etc. These existing pavement and technical trench may subject to risks and cracks due to vibration from piling work.

In short, the potential impact and risks of construction activities on air quality is short-term, temporary, and can be mitigated by appropriate mitigation measures to be applied as part of construction and labour management procedure as detailed in ECOP in Chapter 5.

d. Wastewater

The main sources of wastewater generated during the construction phase are:

- Surface water runoff through construction sites carrying materials and waste to canals, lakes and surface water sources around the area;
- Domestic wastewater from workers' camps with high content of BOD and nutrients affecting water quality at receiving sources such as canals, lakes and other surface water bodies around construction sites;

- Construction wastewater with high turbidity, grease and oil can also affect the water quality at the receiving water.

Surface Water runoff

Surface water runoff is mainly formed by rainwater runoff on the ground before entering receiving sources. If water is not drained appropriately, surface runoff can cause local flooding. After flowing through disturbed surface areas, the water becomes very turbid and contains high contents of suspended solids. Most suspended solids will be deposited along drains, the rest will flow to receiving sources such as canals, lakes and other surface waters around construction areas. Heavy rains can wash more suspended solids into waterbodies such as stream and lakes. Surface runoff with high turbidity and suspended solids may reduce water quality, cause sedimentation and affecting aquatic lives.

To calculate the rainfall runoff through the construction areas of the project, the following formula can be used:

$$\mathbf{Q = \Psi \times F \times q\ (m^3/s).}$$

Where:

Q: Flow rate (m3/day);

Ψ: Flow factor, depending on terrain, slope...

According to the terrain of the project area, Ψ = 0.3

S: area of the land (m2)

q: Rain intensity = 166.7 x i (mm/minutes), I is the highest water level in the month with most rains. According to the region's hydrological data, the highest annual rainfall is 523.2 mm in September (Chapter 2), and the average number of rainy days is 17.5 hours per day, i = 0.1 mm/minute.

Using the above formula, the volume of water that flows through the project area is calculated as follows:

Table 3.10. Calculated Average Runoff at the Construction Sites of the Project

TT	Item	Land Area (m^2)	Discharge (m^3/s)
1	University of Technology	80,000	3.12
2	Central area of VNU-HN	71,000	4.33
3	Research institute, research center	228,900	4.17

Data in **Table 3.10** shows that flow rate of surface runoff at the construction site ranges from 1.58 to 4.33 m^3/s. These may cause localised flooding in the area during construction phase, after the ground have been levelled but without adequate drainage. The impact can be considered medium and requires strict management measures.

Domestic wastewater

The number of workers to be mobilised by the contractors will be varied during construction phase depends on work progress. It is during the peak period, it is expected that 300 workers will be mobilized at the site of University of Technology, 400 workers at the Research institutes and center, 250 workers at the central area and 50 workers at the WWTP. Therefore, during the peak construction phase, the project will have 1,000 workers working at the sites if all work items are executed simultaneously. Consultation with the HN07 project of which construction is on-going within VNU HN campus in December 2019 shows that 70% of the workers were local labor who go home everyday, and 30% of the workers come from other places thus lived at the camps provided by the contractors. Therefore, it is anticipated that there will be upto 300 workers living at the campus within VNU-HN during peak period.

Water use rate is 70 liters/person/day,the rate of domestic wastewater emission is 80% of the input water. Based on the number of construction workers and the emission factor, the forecast of domestic wastewater is as follows:

Table 3.11. Generated Domestic Wastewater

No	Work item	Number of workers (people)	Number of workers living in camp	Volume of wastewater (m^3/day)	Volume of wastewater (m^3/week)	Volume of wastewater (m^3/month)
1	University of Technology	300	90	5.04	35	150
2	Central area	300	90	5.04	35	150
3	Research institute, research center	400	120	6.7	47	201
	Total	1,000	300	16.72	117	501

Domestic wastewater contains high levels of suspended solids, organic substances, nutrients and microorganisms. Pollutants in wastewater without collection and treatment system is shown below **Table 3.12**:

Table 3.12. Pollutants in the Domestic Wastewater

No	Parameter	Load (kg/day)
1	BOD_5	0.45-0.54
2	COD	0.702-1.02
3	TSS	0.7-1.45
4	T-N	0.06-0.12
5	T-P	0.008-0.04
6	Cl^-	0.04-0.08
7	E coli	10^5-10^6

(Source: WHO, 1993)

Thus, the total amount of domestic wastewater generated each day from worker camps during the construction period will be from 5 to 6.7 m^3/day at each camp. Calculations show that the amount of wastewater generated per day in each camp is relatively large. Without proper management, the amount of wastewater discharged from the worker camp will be from 35 to 47 m^3/week and will be 150 to 201 m^3 in a month. Environmental pollution will be serious if the wastewater becomes stagnant and flooded around the worker's camp. Stagant water will cause unhygienic condition and pollution in the area. Stagnant wastewater will become an environment for mosquitoes to grow and affect the health of workers and people. Currently, the surrounding area is covered with vegetation, with addition of wastewater (with relatively high BOD and N, P), the soil will be polluted, grass will overgrow and facilitate development of insects and water-born disease vectors. After a period of being flooded, grass will die and its decomposition process will cause more pollution to the stagnant water. This will adversely affect the health of the community and workers. The contractor will The contractors will be required to build sanitation facilities with septic tanks on-site for collecting and treating domestic wastewater before leaving the and camps. Therefore, the impact of domestic wastewater is considered to be moderate.

Construction wastewater

Construction wastewater is generated from activities such as washing materials, cleaning

machinery, processing concrete ... Construction wastewater will contain high levels of soil, sand, and suspended materials, even oil and grease. The volume of construction wastewater will depend on many factors such as the area of construction site, the time of year, workers' perceptions, construction methods and applied technologies, and quality of construction materials. .

Construction wastewater can also be generated from washing, mixing materials and concrete settin. Wastewater from concrete will contain sand and suspended materials but only generated on hot and dry days in very limited quantities. Wastewater from concrete treatment can be used to clean areas to reduce dust.

In general, construction wastewater is mainly from washing trucks at construction sites. Every time the truck leaves the construction site, dust and dirt must be cleaned. To wash a wheel requires an average of 10 liters of water, in one wash the car needs an amount of 60 liters of water. The daily amount of wastewater generated from washing of the wheels at the works can be calculated as follows:

Wastewater from washing of trucks' wheels often contain dirt, sand and suspended materials but do not contain oil or grease.

It is estimated that, once in every 5 days, the truck will be fully washed, depending on weather conditions and vehicle condition. The wash will be done in professional car garages in the town, not on the construction site. Each time of washing wil generate about 200 liters of wastewater per truck. Wastewater from the truck will consist of soil, sand, suspended materials and oil. Therefore, for the preliminary treatment of wastewater from washing vehicles, oil and grease separation tanks will also be required in addition to deposit tank.

Impacts and risks of construction wastewater during construction phase can be considered at an moderate level, can be managed through collection and treatment sytems to be created at the construction sites. Rainwater overflowing at the construction site will also be controlled through the drains and sedimentation traps to be installed at the site for localized flooding risks and sedimentation control.

e. Solid Waste

Excavated material

It is estimated that earthwork (excavation and leveling) for construction of the Project's items will generate a total of 102,785 m^3 of material. The amount of earthwork material created from each item is listed in **Table 3.13** below:

Table 3.13. Quantity of Earthwork Material (Unit: m^3)

Content	Volume of biomas, (m^3)	Excavation and disposal (m^3)	Total (m^3)
(1) University of Technology, 8ha.	1,500	13,090	14,590
(2) Central area (about 6.6ha)	800	6,045	6,845
(3) Research institute and center (22,89 ha)	6,500	63,650	70,150
(4) WWTP, capacity 1,475 m^3/day	1,200	10,000	11,200
Total	**10,000**	**92,785**	**102,785**

Construction activities will generate 92,785 m^3 of excavated materials. The analysis results on soil samples collected in the project area show that the contents of heavy metals (Pb, Zn, As,

Cd, Zn) of all samples are within the allowable limits in QCVN 03-MT:2015/BTNMT. Therefore, excavated materials can be reusable.

The surplus amount of soil during the construction of the project can be gathered at a suitable location and use for leveling. It can be gathered at It can be gathered at the nursery garden of the VNU-HN next to road No. 3, 1.5 - 2 km from the entrance of VNU in Hoa Lac.

Such wastes will be generated and require space for loading/disposal. As discussed in Chapter 2, the heavy metal contents in the soils in project area are within allowable limits of QCVN 03-MT:2015/BTNMT, therefore the excavated materials (10,000 m^3) will be reused at the existing nursery ground or for ground levelling. The impact of solid waste from excavated soil is assessed to be medium and requires appropriate management measures.

Construction Solid Waste

Solid waste from construction activities includes waste from construction materials such as packaging material, scrap iron and steel, wooden fragments, empty boxes, etc. This waste includes inert and non-hazardous substances, some may be recycled for other purposes. The construction solid waste from the project is estimated at 25,500 m^3. This volume of construction waste must be collected daily at the construction site, separated and and treated in accordance with applicable law and regulations. The impact of construction solid wastes is assessed to be moderate and requires strict management measures.

Domestic Solid Waste

The total number of workers living in the camps will be about 300 (during peak period) if all work items are constructed at the same time. Each worker is estimated to generate about 0.5 kg of daily solid waste during his/her working hours at the construction site. This means, the total amount of solid waste generated per day is 150 kg or 4.5T per month. Accumulation of domestic wastes would generate bad odour-generated gases and leachates containing nutrients, heavy metals and pathogens, attract insects and other disease-causing agents such as flies and rats. Without proper management, domestic waste would cause nuisance and pollution affect public health and. The impact of domestic waste is assessed to be at moderate level and manageable, given the waste can be temporarily in closed containeres on-site and the availablity of solid waste collection in the project areas that the contractors can use for collection and disposal management of domestic wastes from camps. Solid waste management measures are proopsed in Chapter 5.

Hazardous Waste

Hazardous wastes generated include waste oil, oil contaminated materials, .. Used oil is classified as hazardous waste according to hazardous waste management regulations. The amount of oil and grease released during construction will depend on the following factors:

- Number of vehicles, construction machines at the construction site
- Amount of oil and grease removed from the vehicle and construction machine;
- Frequency of oil change and maintenance of machinery and equipment

On average, the amount of waste oil generated from vehicles and construction is about 7 liters for each oil change. Once in every 3 months, the oil change and machine maintenance will be conducted. The number of transport vehicles and construction machinery that need oil change in the project areas at the same time is 53 (including 15 trucks and 38 construction equipment). Therefore, the average total volume of waste oil and grease generated in construction works, if done on-site, would be: (53 vehicles x 7 liters/time)/3 months = 123 liters of waste oil/month. In addition, about 60 kg of oil rags and waste oil will be generated from construction work. Without proper management, this amount of hazardous waste,

especially oil-containing waste, will contaminate the soil and surface water. To avoid the negative impacts of waste oil and oil-containing maerials, machine maintenance will be done in registered workshops and garages only, on-site maintenance will not be allowed. Thus, it is expected that the amount of hazardous waste generated at the site would be very small, mainly from urgent repair of construction machinery and maintenance of very small items such as generators, mops ... . Therefore, the risks and potential impact from hazardous waste can be considered to be at moderate level and manageable through the licensed hazardous waste collection and treatment providers.

Drill wells for water supply

The contractor will have to drill a well to supply living water and construction works.

The phenomenon of deteriorating the quality of underground water from exploitation works: The widespread exploitation of underground water due to lack of knowledge about the subjects exploiting also reduces the quality and quantity of exploited water.

In the course of well drilling construction, if the construction techniques and methods do not meet the requirements, it will lead to pollution of the exploited aquifers due to the aquifers with underground water in the upper layers of inferior quality, leakage. from shallow groundwater or contaminated surface water.

Phenomenon of land subsidence: Exploitation of underground water creates potential environmental changes that deform the ground in the mining area. During use, land subsidence of well drilling areas can also lead to damage of casing pipes, which pollute groundwater. After using it, it will not back cover and will cause water to leak.

f. Impacts on Biological Resources

Construction activities will be implemented in areas previoulsly modified by farming activities (tea, acacia, eucalyptus plantations) fruit trees, part of those were abandoned in recent years and become bush land. Construction may cause some negative impacts on biological resources such as:

The existing grasslands, shrubs, and trees scatteredly distributed in the 37.5 ha of the project area would be loss due to top soil removal and excavation for construction. Some perennial trees with shade and landscape values may also be lost due to construction. However, the impact can be minimized by conserving the areas with biological/landscape values, minimising land area to be disturbed through careful layout design during feasibility studies. Or the and the affected vegetation can be partly re-established through greening and landscaping the spaces between the buildings.

During the construction in the dry season, construction workers may be careless in welding, cutting steel to give off sparks, burning construction waste or living without permission to make bushes catch fire. This leads to destruction of surrounding vegetation and shrubs, damaging the landscape.

Nearby the construction asrea there are Than Lan and Muc mountains, and some lakes. These areas are relative well-vegetated could be homes of some wildlife particularly birds, reptiles and fish. Although not directly disturbed by construction activities, the presence of the workers in the project areas may also cause some risks to the trees, vegetation, the birds, fish and repltiles due the workers'behaviours if they are not trained properly. For example, trees may be cut down or damaged, fish and reptiles may be caught, birds and other wildlifes may be hunted for food, consumption or keeping in cage by the workers. Bushfire may happen if the workers set fire without authorization. This risk is at moderate level and can be mitigated by the introduction and application of Worker's Codes of Conducts which also cover prohibited actions toward nature as listed together with the ECOP in Chapter 5.

An area with beautiful landscape should be reserved in zone 4

- The potential impacts on aquatic system during construction phase will also be limited as there is no rare and endangered aquatic species in the project area. However, the fish may be caught by the workers. On the other hand, as mentioned above, rainwater runoff containing high concentration of suspended solids after passing construction sites would cause increased turbidity of the water, which can negatively affect respiratory and photosynthesis capability of aquatic species..This risk is small as the existing water bodies are at some distance from the disturbed areas, andand can be mitigated by appropriate mitigation measures such as site management including creation of ditches and sedimentation traps and treatment of wastewater from workers' camps before discharging into the environment.

g. Impacts on Traffic Inside and Around the VNU-HN Area

One of the main causes of traffic disturbance and traffic safety risks is the increase in traffic density when vehicles and construction machinery are mobilized to work. The traffic works such as bridges and roads in the area are of quite good quality and are regularly maintained According to estimates based on the volume of materials and waste, there are about 30 trips of 18-ton trucks entering the site per day on average. With the number of trips, the traffic on the roads in Thach Hoa commune will be disturbed by the traffic contributed by the Project would not be significant.

However, traffic conflicts and traffic safety risks will increase significantly in the area near VNU-HN entrance, on the transportation routes and around buildings.

Table 3.14 below details the routes significantly affected during the construction phase of the Projec

t.

Table 3.14. Roads Potentially Affected during Construction Phase

No	Affected road	Current Status	Impact
1	National highway 21	- This is a road segment has high traffic density, accommodate complex fleet including heavy trucks and many rudimentary vehicles participating in the traffic on this road.. - There are many businesses on both sides of the road	- Transportation of construction materials lead to increased risks on traffic safety. - Affect business activities of households on the two sides of the road mainly with dust and noise
2	Thang Long highway	The road is wider than 20m with business establishments on both sides of the road	- Transportation of construction materials affecting traffic safety
3	Hoa Lac - Hoa Binh Expressway	- The road is wider than 20m with business establishments on both sides of the road	- Transportation of construction materials affect traffic safety, especially in the area of Viettel Sports Academy and the Political University. - Affect business activities of households on the two sides of the road mainly with dust and noise
4	**Zone 1**: Currently, there is a soil road which is an old transport route when building VNU –HN village 	- This road is located next to construction materials yard, there are no households living around. The length of the road is about 300 m	- This is the transportation route for the construction of Zone 1. However, there will be few impacts as this road is relatively sparsely inhabited

No	Affected road	Current Status	Impact
6	**Zone 3:** This area currently has an internal soil road.  	- This is an old road when constructing VNU-HN village. The road has two ways leading to Hoa Lac - Hoa Binh street. At the intersection of this road and Hoa Lac - Hoa Binh road, there are several households doing business on the road. The total length of the road is about 1.35 km, the cross section is from 4 – 6 m	- This route is planned for the transportation of construction materials and waste for disposal during the construction of all items. The impacts will be high on this thickly-populated area.
7	**Zone 4** 	- At the present, this is a soil road connecting to Bai Dai road with length of about 1 km	- This is the transportation route for the construction of Zone 4. However, there will be few impacts as this road is relatively sparsely inhabited.

No	Affected road	Current Status	Impact
			

Regarding traffic safety in the area, the most risky point is at the intersection from Thang Long Boulevard to the school and the road to transport materials to the site. This impact will be considered in the specific impact assessment.

The impact level is assessed as medium and can be mitigated by appropriate traffic management measures.

3.2.2.2. Social Impacts

In addition to land acquisition and related impacts, the Project will cause some other negative social impacts on communities and households who are not affected by land acquisition. These include:

- Community disturbance due to construction impacts (increasing dust, noise and road traffic, obstructing access ...)
- Social impacts and issues related to migrant workers.

Labor influx and social impacts

The project will mobilise up to 1,000 workers during the peak period, 300 of those may come from other localities to live and work in the project area during the construction period of 2 years, most of them are males. Their stay and the project area may lead to social disturbance or even conflict to arise due to pollution and disturbance from construction and transportation, competition for jobs and incomes, accessibility to public infrastructure, disturbance and/or damages to cultivation activities surounding the construction site, increased burden on local health services, gender-based violence, inflation of prices, increased in traffic and safety risks. Social conflicts may also happen due to worker's language and/or behavior not suitable to local customs particularly if they involve in drinking, gambling, sexual harassment or prostitution. Construction impacts, waste and wastewater generation from camps causing nuisance, disturbance or even disruption of daily activities of local communities may also lead to social conflicts. Besides, child labor force may be abused in case contractors recruit workers with ages lower than 15 or between 15 and 18 without agreement of their families/patronizers according to Law on Labor, 2012. Some aspects are discussed in detail below.

Through consultation with the construction contractor who is implementing project HN02 in the project area, the number of local workers who can mobilize is about 70%. These people do not stay at the construction site, after finishing work they go home. The remaining 30% will be concentrated in camps built on site. The rate of local labours and immigrant works in this project is expected to be similar to the HN02. .

Community Conflict due to construction impacts: Households living and doing business along the transportation routes and near construction sites will be disturbed by dust, noise, vibration, and disruption of accessibility. These impacts can cause affected families to change/modify their daily activities such as learning (in children), cooking, eating, resting, recreation ... On the other hand, traffic disturbance and increased traffic safety risks can affect the travel habits of family members.

Around the construction site, a number of services such as groceries and eating places of local people can be opened to serve the needs of workers after work. In the course of the transaction, there may arise problems of debt, recording books, conflicts between workers and local people when eating at the restaurant.

However, those impacts are short-term, discontinuous and can be minimized if appropriate measures are taken.

Social Impacts and Issues Related to Influx of Workers

(i) Language used by the workers, their behaviours or ways of living not suitable to local culture/customs, particularly if they involve in drinking, gambling, sexual harassment or prostitution;

In terms of the language and behavior of workers, because there are no ethnic minority groups living in the project area and this area has economic and cultural exchanges with the surrounding area, there is no differences in culture or customs between workers and local communities. However, social conflict can be a problem if workers use slang language inappropriately.

In addition, the local government in the project area has regulations on temporary residence, to manage temporary residence of people and temporary residents in the area. This will contribute to maintaining social security in the project area.

(ii) Construction impacts, particularly waste and wastewater, cause nuisance, disturbance or even disruption to daily activities of local communities;

In terms of construction impacts, the areas which will be heavily disturbed by construction activities are all located within the planned VNU-HN campus. This area is adjacent to the roads which will be regularly affected (transportation routes) or only affected for a relatively short period of time. On the other hand, the people in the project area have been informed and consulted about the project proposal and their related impacts so they should also understand the benefits of the project and may accept temporary negative impacts during the project's construction.Therefore, social conflicts due to construction impacts should be minor.

Regarding camp conditions, the contractor will set up several camps for workers to live in the construction phase. If the workers' residences cause local pollution, cause nuisance and affect the health of nearby households, they will lead to social conflicts.

(iii) Increased risk of communicable diseases and burden on local health services - Gender-based violence;

Social conflict would be serious if workers harassed local women or engaged in drinking and gambling. Especially serious long-term health effects if workers engage in prostitution activities because it is the cause of sexually transmitted diseases, HIV/AIDS.

In fact, construction contractors often apply certain rules to manage workers, prohibit inappropriate behavior and enforce a healthy lifestyle. Such regulations will be useful for managing social impacts. However, existing regulations may not be sufficient to manage all social risks/impacts and need to be strengthened if the contractor wins the bid in the project.

(iv) Local inflation of prices;

Due to the concentration of accommodation workers, the contractor in charge of buying and selling food from distributors, the concentration of workers is assessed as not causing scarcity of goods or raising prices in the area.

(v) Child Labor

It is worth noting that Vietnam's Labor Law (Article 165) stipulates that employers cannot use people under 18 for transportation of heavy objects, work at construction sites, work demolition, or work underwater. Therefore, contractors should check the working age for recruitment process during the construction phase of the Project to meet this regulation.

In general, potential social impacts and risks of the subproject will be predictable, mitigable and manageble by the measures described in Chapter 5 so that the social risk and impact of the project could be rating from low to medium and can be managed by the measures described in Chapter 5.

(vi) *Gender Based-violence*

With a large number of workers concentrated over a period of time, there may be potential risks of sexual harassment, in the construction site environment, female workers usually subjected to this risk, because the ratio of males is usually much higher. At the time of consultation with the construction site of the HN02 project which is under construction in the VNU-HN village area, female workers accounted for a small portion of the construction workers (from 10-20 people). In addition to female workers, the project's gender risks are local women and 244 households living on university campus.

To assess capacity for handling with potential risks, adaptive capacity and management capacity were assessed based on VNU-HN capacity. VNU-HN currently manages more than 20 component projects from 2003 to present. Therefore, VNU-HN has had good experience in responding to potential risks of construction projects in order to minimize negative and and promote positive potential and the project's efficiency. The network of functional units with direct responsibility includes: VNU-HN, district and grassroots local authorities, public security and social organizations at all levels.

Community's Health and Safety Risks

Construction activities are likely to be some health and safety risks for local communities as follows:

- Increasing traffic volume on roads, emissions, dust and noise from construction activities will also pose risks to health and safety for local people.
- Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to local communities.
- Communicable diseases pose a significant public health threat. Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to the subproject personnel and residents of local communities. Health hazards typically associated with activities are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor influx are sexually-transmitted diseases (STDs), such as HIV/AIDSThe risk of accidents is highest at night and during peak hours in major transport routes such as NH 21, Thang Long Highway and Hoa Lac - Hoa Binh expressway.

The potential impacts and risks related to labour influx will be predictable, mitigable and manageable through the Workers Codes of Conducts, in which the importance of appropriate behavior, alcohol abuse, and compliance with relevant laws and regulations will be outlined for application. Each employee shall be informed of the Code of Conduct and bound by it while in the employment of the Client or Contractors. The Code of Conduct shall be available to local communities at the subproject information centers or other places easily accessible to the communities. To mitigate social impacts, the Contractor is responsible for registering workers with the local authorities for temporary residence and providing appropriate training to all staffs/workers according to their level of responsibility for environmental, health and safety matters.

Health and safety of workers

Potential risk during construction phase may be accident, fire. The risk of accidents often involves deep excavation areas, stockpiles of materials and waste, machinery and truck operations, bulky materials such as scaffolding, temporary open ditch areas, work on high-rise buildings, etc. .. Explosion hazards include transportation and storage of fuel, power lines or electricity consumption.

Workers' health will be affected by swimming in lakes, noise, dust and emissions from materials, waste and machinery.

> *Impact of dust and emissions:* Dust particles greater than 10 μm, if contacted with the eyes will cause eye damage, infection and allergies. Dust particles smaller than 5μm can enter the lungs and cause respiratory diseases such as: Asthma, pneumonia, long-term exposure to dust will lead to dust deposition and accumulation in the lungs; NO2 enters the lungs through the respiratory tract and absorbs into the pleura. Prolonged exposure to NO2 can cause pneumonia.
>
> *Negative Impact of Noise*: Noise can affect parts of the human body. The first is people's hearing. Direct effect of noise reduces the sensation level of the ear, reduces hearing and causes occupational deafness. In addition, noisecan cause headaches, tinnitus, dizziness, nausea, neurological disorders, cardiovascular disorders and diseases related to the digestive system. Especially for construction workers who are constantly exposed to noise and therefore will feel tired, hearing impaired, distracted during the labor process can cause occupational accidents.

Direct contact with toxic substances such as cement, gasoline, construction additives may result in skin corrosion or body absorption through the skin. Storing/using fuel at camps is a potential risk for fire, explosion, electric shock, affecting the health and safety of workers. Safety risks also come from the operation of machinery, excavation and slope construction. Workers who live in camps will be at risk if they do not have clean water, sewerage, and adequate facilities during their stay in the project area. Health risks can also arise from inadequate protection for workers from hot weather in summer or cold weather in winter. Workers may also be exposed to common infectious diseases in the project area such as dengue fever, malaria, eye disease, and gastrointestinal diseases, etc.

Insects, dangerous creatures such as snakes, poisonous spiders, Anopheles mosquitoes can appear in construction sites or campsite areas, they can bite/attack and cause injury to workers.

It should be noted that, Thach That district has confirmed 131 cases of HIV infection in 22/23[13] communes. Although local authorities are working on HIV/AIDS prevention and control, if workers engage in social evils such as prostitutes and drug addicts, they are at risk of becoming infected with HIV/AIDS or STDs (sexual transmitted diseases).

According to the medical information collected, the diseases that local people suffer are mainly common diseases such as: cold / fever (54%); Digestive is (32%); Dengue fever (54%); Respiratory (28%); Injury (56%) and other illnesses (12%). It can be seen that dengue is a disease that workers can catch if an epidemic occurs.

Drug addicts tend to find isolated places like unfinished construction works to gather and discard used needles indiscriminately, posing risks to HIV/AIDS exposure for workers when prepare construction ground.

Some workers will work at construction sites such as high-rise buildings. They are at risk of falling out of the high rise area. Workers can also subject to high risk in bad weather such as strong winds, not equipped with labor protection.

[13] Source: http://www.dangcongsan.vn/khoa-giao/thach-that-ha-noi-huy-dong-hon-140-trieu-dong-de-ho-tro-phong-chong-dich-benh-504080.html

Workers' health may also be affected if they are exposed to contaminants such as cement, gasoline, construction additives, exposed to hazardous/hazardous materials during excavation, welding operations, etc. This risk can be controlled.

Risk of fire and fuel leakage

Fire may occur during the transport, handling and storage of fuel or gas, or due to the temporary unsafe electrical supply system. Welding may also cause fire. Fire and explosion may cause damage to people and properties during construction.

These potential impacts on worker health and safety are medium and can be reduced.

3.2.2.3. Specific Impacts related to the construction of multiplestorey buildings

General Safety Issues in Construction of High-rise Buildings

In many high-rise civil constructions, the main issues are labor accidents and construction equipment such as:

- Construction contractors seriously violate labor safety standards during construction process.
- Insufficient provision of guidelines and instructions or training on labor safety or just provided for mere formalism
- Insufficient provision of labor safety measures during construction or just provided for mere formalism.
- Construction contractors do not pay proper attention to the protective equipment for workers; simple personal protective equipment such as helmets, safety shoes, safety belts when working at heights, etc. are rarely used.
- Construction workers awareness is low. Workers are often farmers who want to get additional income in their spare time, so they are very subjective, paying little attention to occupational safety for themselves.
- Long-term workers are often subjective because they rely solely on their experience, not fully equipped with knowledge about occupational safety for construction on scaffolding or for handling with injuries in accidents.
- Workers work on a height of 10-20m above the ground but do not wear safety belts,
- There is no protective net below.
- Using old scaffolding, not safe

Construction of high-rise building usually need tower cranes, hoists, scaffolding and suspended platforms to lift people. These devices are likely to cause occupational unsafety due to:

- Using too old tower cranes, hoists and hanging platforms which do not have regular maintenance can cause incidents or failures during operation leading to occupational accidents and unsafe.
- Tower cranes, hoists and hanging platforms are out of validity for operation.
- Workers who operate the equipment do not have the capacity and experience causing errors.
- Scaffolding with poor quality or reckless performance due to hush in construction progress, workers are inexperienced when setting up the foundation for scaffolding, laeding to scaffolding collapse.
- Scaffolding is not properly installed, scaffolding has no working platform or working platform is not safe, broken, collapsed; movement along the scaffholding, dazzling due to welding light; insufficient illumination at night; startling during

work...are all risks of not following the regulations on workwear, leading to a very high risk of falls.

- Fully equipped with labor safety devices such as safety belts, helmets, or protective clothing which are not suitable for overhead work, will cause unsafety to workers.
- Incompetent workers for working at height but still participate in the work leading to health risks, especially possibly death during construction.

Workers face the risk of falling at a height of over two meters; falling into operating machinery; toxic substances; or through gaps on the working platforms. Construction of 2- to 10-floor buildings and steel structures may cause high risk for accidents when moving and performing work at high altitudes.

There are four types of accidents when working at height, which are caused by scaffolding, people falling from the high platform, falling objects and factories and machines. The main accident of scaffolding occurs due to use of improper material, unskilled and careless operation or erection of scaffolding. Everyone in the construction site is at risk of falling anywhere and anytime, especially on higher floors. Lack of safety measures at construction sites is one of the causes of falls from height. Workers may be affected by personal devices, vehicles, dropping materials, vertical lifting materials and horizontal transportation materials. Incorrect method of operation can cause an accident.

Overload is one of the factors that will cause the crane to collapse in the construction of high-rise buildings. During the construction process, the allowable handling load of the crane is normally not controlled appropriately by the supervisor. Accident is an unpredictable and it can happen due to the following causes, lack of training, improper equipment and working platform, failure to comply with safety and inadequate hygiene measures, neglience in using personal safety equipment, and troublesome procurement or subcontracting process. Insufficient training on safety and technology knowledge for workers make the workers incapable to predict potential risks and how to avoid accidents. The use of unsafe working platforms can also put workers at risk when equipment is not used, maintained or stored properly. The reason why construction workers have unsafe working practices is because they lack of understanding and awareness of their risks, management, safety rules and work processes. Unsafe actions include failure to follow standard safety procedures, excessive construction and a decision to perform work in an unsafe condition.

Insufficient labor protection at the workplace can be considered a risk factor for occupational injury. Working without workwear can increase the likelihood of an unexpected accident. The various reasons for workers refusing to wear protective gear during work are like feeling uncomfortable with the machines while performing their job at the construction site and that can be considered as a concern for their work output. Subcontractors often have poor safety awareness at the construction site. Poor coordination, lack of proper guidance and misunderstandings among working professions can all lead to construction accidents. These impacts are considered to be very high if appropriate mitigation measures are not in place.

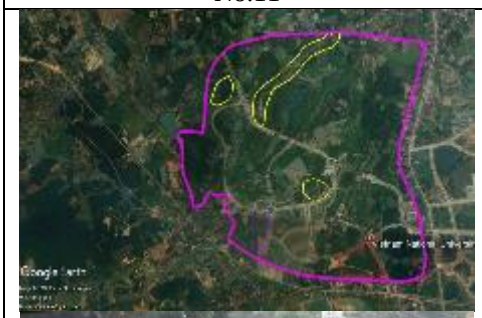
3.2.2.3 Impact on sensitive receptors

The construction of various subprojects will likely impact some sensitive receptors located near transport routes, including people's inconvenient accessibility when they want to go to these places; dust can become a trouble to local people; traffic safety risks and work related accidents. Survey shows that construction of the subproject can affect the learning and teaching of staffs and students of Viettel Sports Academy, Political University and life of the Political university's dormitory and neighboring communities along the way of material

transport. Some sensitive receptors should also be noted. The impact level is assessed to be medium, temporary and mitigable. Details of the objects within a radius of 1,500 m around the construction site of the subproject are described as follows: addition of VNU public housing area

Sensitive receptor	Description	Impact
Viettel Sports academy 	Located on Hoa Lac - Hoa Binh street, where there are many students and small shops; Located right on the transportation route. 1,000 m from the construction site	- Increase traffic to create unsafe conditions for students, teachers and staff at the entrance. - Increase emissions, dust, noise, vibration, construction waste, wastewater. - Risk of traffic accidents for students, teachers, staff and local people. - Ability to harm and disrupt access to the academy
Politicial university 	Located on Hoa Lac - Hoa Binh Street, where there are many students and small shops Located right on the transportation route. 1,200 m from the construction site	- Increase traffic volume to create unsafe conditions for students, teachers and staff at the entrance. - Increase emissions, dust, noise, vibration, construction waste, wastewater. - Dust, noise and emissions - Impact on students' learning activities - Traffic safety risks when students and staff go to the university
Dormitory of Politicial university 	Located on Hoa Lac - Hoa Binh Street, where there are many students and small shops Located right on the transportation route. 1,500 m from the construction site	
Training Center for national defense and security –VNU HN 	Located within the campus of VNU-HN, accessible by NH 21, where there are many students and small shops; Located right on the transportation route. 1,000 m from the construction site	
Neighboring residential areas	Located on the route of national highway 21, Hoa Lac - Hoa Binh road	- Dust, noise and emissions - Impact on people's activities - Traffic safety risks - Impact on business activities

		
 VNU-HN Guest house, residential cluster of village 6, Thach Hoa commune	Opposite to Zone 3	-- Increasing traffic density, creating unsafe conditions for students, teachers and staff at the entrance. - Increase emissions, dust, noise, vibration, construction waste, wastewater. - Dust, noise and emissions - Traffic safety risks
 Da Lat lake, cultivation land, Hamlet 7, Thach Hoa commune	cultivation land, Hamlet 7, Thach Hoa commune, in Zone 4	- Risk of drowning for workers when swimming in lakes -The risk of sedimentation if large volumes of surface runoff containing high solids entering waterbodies including river, stream - Some insects and reptiles may be lost or killed
 Wet land area	At the end of zone 3, close to residential area of hamlet 6 - Thach Hoa Commune	- Environmental pollution risk due to waste and wastewater from camps - Risk of being buried when dumping construction waste - risk of sedimentation when rainwater runoff over the construction area entails lots of mud
 Ecological lake at the end of zone 3	At the end of zone 3, close to residential area of hamlet 6 - Thach Hoa Commune	- Risk of drowning for workers when swimming in lakes -The risk of sedimentation if dumping construction waste into the lake - Some insects and reptiles may be lost or killed - Risks associated with workers' behavior: hunting, trading, consuming, confining wildlife (birds, turtles, reptiles ...) - Risk to workers when clearing - can be attacked by harmful insects - Risk of spreading invasive plants to arable land (mimosa,

		shame ...)
 Tree fence in the west of zone 3, near road No.11	in the west of zone 3, near road No.11	- Damage caused by machinery
  	The existing residential area is about 1km northeast of the project area	- Traffic safety risks - Social conflict with worker

a. Specific Impacts at Zone 1

Table 3.15. Specific Impacts in Zone 1

Location	Photo taken at the site	Main features	Specific impacts and risks
Northeast of Zone 1 Adjacent to the roundabout of Road No. 4 and Road No. 1		At present, the Zone 1 is accessible by road No. 1 and road No. 4. On the two sides of the road, there are sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.) There is no households and no structures on the land. The typical ecosystem in this area is grassland, shrubs, scattered timber trees. The animals in Zone 1 are mainly reptiles and frogs	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working - Damage to existing equipment such as water supply and drainage pipes, electric cables, telecommunication cables. - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when construction near dense areas, bushes.
Northwest of Zone 1 Adjacent to road No. 1			
Southeast of Zone 1			

Location	Photo taken at the site	Main features	Specific impacts and risks
Southwest of Zone 1	 		
		Construction work items: - Administration and operation building (8-floor building); - Academy block (8-floor building); - Lecture hall building (8-floor building); - Specialized library buildings (5 5-floor buildings); - Building for practical activities and laboratory (3-floor building); - International Conference Center and Hall (2-floor building);	- Risks to workers during the process of clearing trees, possible getting attacked/biten by snakes and insects. - Risks for construction workers on high-rise buildings regarding occupational accidents such as falling from high platform, falling into openings on working floors ... - Risk of fire and explosion when not complying with regulations on fire safety - Health risks of workers when not fully equipped with labor protection - Risk in construction process of electric systems, transformer stations, electrical

Location	Photo taken at the site	Main features	Specific impacts and risks
		- Multi-function sport building 1,000 seats (5-floor building); - Service area (2-floor building); - Academic-business cooperation area (5-floor building); - Agricultural practice area (greenhouse, net house) (area of 1 ha); - Outdoor experimental area (area of 1 ha); - Technical infrastructure system and internal facilities	connections is likely to occur in terms of electric shock, fire. - The risk of construction materials falling from the top of the building due to the carelessness of workers, due to old and insufficiently maintained machinery. - Impacts on health of workers operating tower cranes and hoists due to long-term working duration at height

b. Specific Impacts in Zone 3

Table 3.16. Specific Impacts in Zone 3

Location	Photo taken at the site	Main features	Specific impacts and risks
East of Zone 3 Adjacent to road 1 and the VNU-HN guest house area	 	The east side of Zone 3 is on the road No.1 entering VNU-HN village. The road has cross section of 32m. Facing to the area of VNU-HN guest house which is used as the office building for VNU-HN, welcoming guests and organizing of conferences.	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working - Damage to existing equipment such as water pipes, electric cables, telecommunication cables. - Impact of dust, noise and vibration on the operation of VNU-HN guest house
West of Zone 3		The west of Zone 3 has a some areas for plantation of tea, short-term crops that local people make use of the vacant land but not high economic efficiency. There is a soil road in the middle of Zone 3. There are currently a number of material yards for VNU-HN's on-going constructions. This soil road used to be a temporary road to transport materials and is expected that there will be no transportation activities on this road by 2020.	- Risks to workers by possible getting attacked/biten by snakes and insects when working at bushy area.

Location	Photo taken at the site	Main features	Specific impacts and risks
			
South of Zone 3	 	South of Zone 3 is adjacent to residential cluster along Hoa Lac - Hoa Binh road. The distance from the boundary of Zone 3 to the residential cluster is about 300 m.	Dust, noise and vibration impacts on residential cluster

Location	Photo taken at the site	Main features	Specific impacts and risks
North of Zone 3		The North side is adjacent to Road No. 4 with a 32 m section.	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working - Damage to existing equipment such as water pipes, electric cables, telecommunication cables.
Central area of Zone 3		There is an electric pole and existing line in the middle of Zone 3	- Safety risks of workers related to power lines. - Operation of construction machinery such as excavator, bulldozer can cause damage to electric poles and power lines
		Zone 3 is located right next to the road to VNU-HN.	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working
		Construction work items: - The building of an interdisciplinary laboratory system (5-floor building); - Building for key laboratory	- Risks to workers during the process of clearing trees, possible getting attacked/biten by snakes and insects. - Risks for construction workers on high-rise buildings regarding occupational accidents such as falling

Location	Photo taken at the site	Main features	Specific impacts and risks
		system (5-floor building); - Blocks of institutes and research cente (4 buildings of 5 floors); - Lecture hall building for post-graduate educationl (5-floor building); - Workshop (2-floor building); - Building for services, conference, sports, and auxiliary items (2 blocks; on 2-floor building); - Internal infrastructure (construction area of 20 ha). - WWTP with capacity of 600 m^3/day	from high platform, falling into openings on working floors ... - Risk of fire and explosion when not complying with regulations on fire safety - Health risks of workers when not fully equipped with labor protection - Risk in construction process of electric systems, transformer stations, electrical connections is likely to occur in terms of electric shock, fire. - The risk of construction materials falling from the top of the building due to the carelessness of workers, due to old and insufficiently maintained machinery. - Impacts on health of workers operating tower cranes and hoists due to long-term working duration at height - Safety risks for workers during the construction of WWTP infrastructure

Location	Photo taken at the site	Main features	Specific impacts and risks
Transportation route			- Conflict or disruption of traffic, increasing the risk of unsafe traffic.

c. Specific Impacts in Zone 4

Table 3.17. Specific Impacts in Zone 4

Location	Photo taken at the site	Main features	Specific impacts and risks
East and South of Zone 4. Adjacent to Road No. 6		The road already has sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.).	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working - Damage to existing equipment such as water supply and drainage pipes, electric cables, telecommunication cables. - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when working near dense areas, bushes..
In the west of Zone 4		There is a soil road in the middle of Zone 4. This is an old trail of local people and is being used by the VNU-HN PMU for tracking purpose in the area. In this area, there are old houses that local people left behind after they relocatedd in resettlement site.	- Risk of labor accident in the process of dismantling old and damaged buildings - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when working near dense areas, bushes..

Location	Photo taken at the site	Main features	Specific impacts and risks
North of Zone 4		About 300 m from Da Lat lake.	- The main risk in the construction phase is construction materials and waste flowing into the lake - Risk of accident for workers - falling and drowning when going to the lake
		Located in zone 4	- The impact of changing the landscape of the area in a negative direction - Loss of some valuable landscape trees due to planning or carelessness in using construction machines
		Construction items: - The operator of VNU center (12-floor building); - Library center building (1 5-floor building); - Internal infrastructure (construction area 6.16 ha). -	- Risks to workers during the process of clearing trees, possible getting attacked/biten by snakes and insects. - Risks for construction workers on high-rise buildings regarding occupational accidents such as falling from high platform, falling into openings on working floors ... - Risk of fire and explosion when not complying with regulations on fire safety - Health risks of workers when not fully equipped with labor protection - Risk in construction process of electric systems, transformer stations, electrical

Location	Photo taken at the site	Main features	Specific impacts and risks
			connections is likely to occur in terms of electric shock, fire. - The risk of construction materials falling from the top of the building due to the carelessness of workers, due to old and insufficiently maintained machinery. - Impacts on health of workers operating tower cranes and hoists due to long-term working duration at height

d. Specific Impacts at Construction Site of WWTP

Table 3.18. Specific Impacts at Construction Site of WWTP

Location	Photo taken at the site	Main features	Specific impacts and risks
South of WWTP. Adjacent to Road No. 6		The road already has sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.). Distance to the nearest private house is 1 km.	- Risks to workers during the process of clearing trees, possible getting attacked/biten by snakes and insects. - Construction materials can spill/fall in the nearby stream, blocking the flow - Surface runoff at the WWTP can disturb the existing drainage system - Surface runoff can affect quality of stream water - Environmental pollution from waste and wastewater generated from worker's camp - Safety risk for worker during construction of infrastructure for the WWTP
North and West of WWTP		The stream is about 10 m wide. The flow is directed towards Da Lat lake.	
		WWTP - Scope of service: The WWTP will collect and treat wastewater for industrial parks, central area, WWTP No. 1 and some other dormitories of VNU in Hoa Lac. - Location: the WWTP is located in Zone 3, - WWTP's area: 5,000 m^2 - Capacity: 1,475 m^3/day,	

		- Technology: Conventional Sequencing Batch Reactor (CSBR). - The quality of the output wastewater will meet the Vietnamese Standard QCVN 14: 2008/BTNMT (Column A) and discharge into No.1 stream.	

e. Specific Impacts of the Disposal Site

It is expected that waste soil in the process of removing the top soil layer (about 30-40 cm) will be gathered at a land adjacent to the zones or transported to the nursery of VNU-HN village to be soil for planting trees or covering at the small landscape site , creating landscapes for the area.

Construction solid waste such as waste rock, loose mortar, sand, gravel, packaging bags, iron and steel sraps, broken bricks, etc. will be stored in temporary storage yards and be removed from the project area by a specialized unit who is hired for collection and treatment of these wastes (Minh Quan High-tech Co., Ltd who have function of waste collection and disposal). After being collected, the waste will be transported to Nam Son concentrated waste treatment area of Hanoi City. This is the centralized waste treatment area of the entire Hanoi city, managed by Urenco Hanoi, with sufficient conditions to ensure waste treatment according to regulations.

The nursery area is currently used for planting all types of trees, and there are only nursery trees in this area. No rare animals and plants are found.

The specific impacts and risks of this disposal site are:

- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working.
- Materials may spill into drains causing flow obstruction
- Damage to existing equipment such as water supply and drainage pipes, electric cables, telecommunication cables.

The volume of biomass introduced into the nursery area is not large (about 10,000 m^3). According to calculations with construction time of about 2 years, vehicles transport materials into this area with a frequency of 2 times / day. This impact is assessed at a low level and can be controlled by appropriate measures.

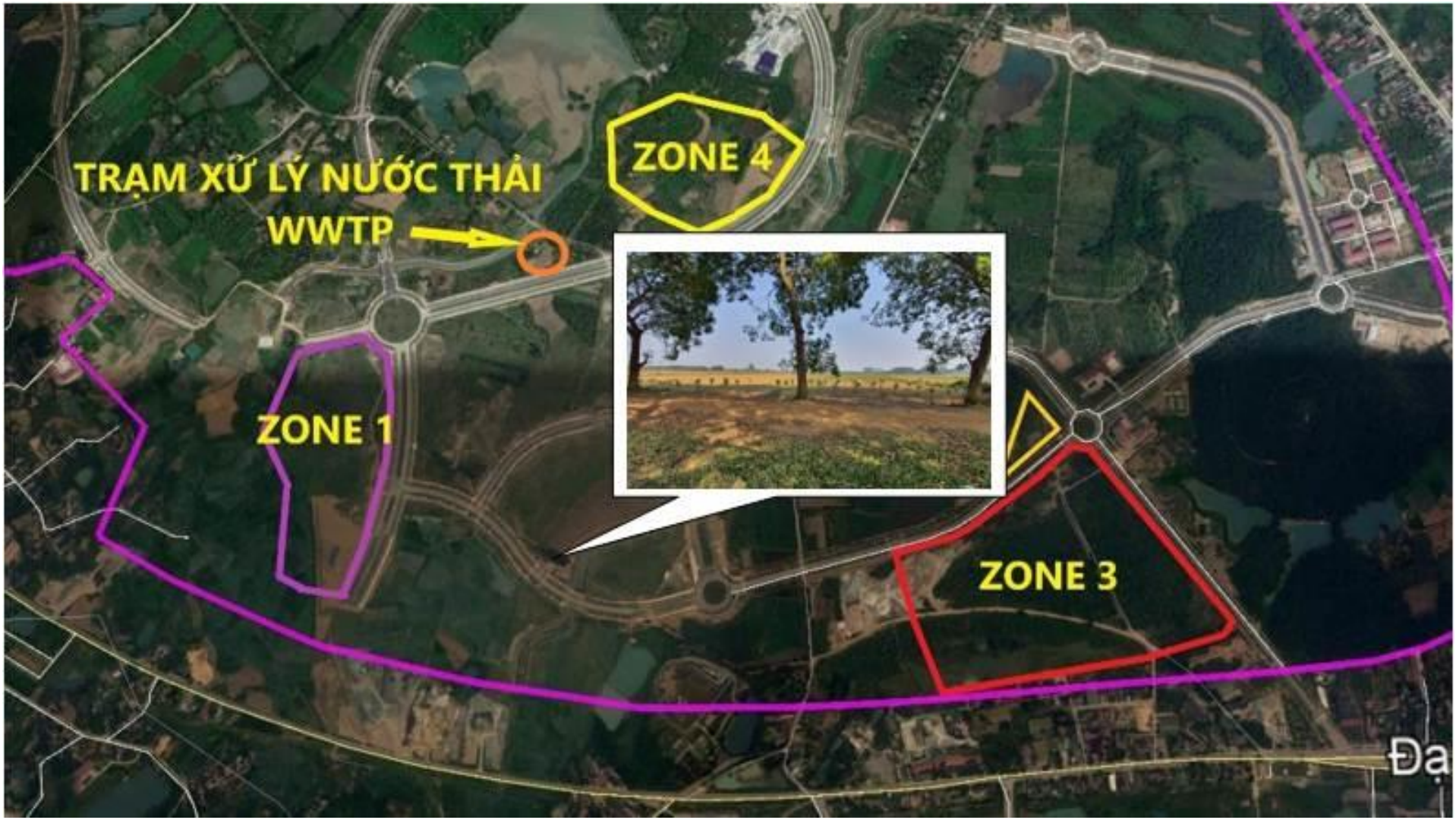


Figure 3.3: Disposal Site

3.2.3. Operation Phase

3.2.3.1. Environmental Impacts and risks related to Laboratory Operations

With the laboratory operations, Occupational Health and Safety risks, generation of wastewater, solid wastes including some hazardous wastes were considered to be the key issues. It is expected that only legtimate and reliable suppliers will be contracted by the project to provide equipment and setting up the new laboratories or do all the works needed for relocation of existing laboratories. In addition, VNU-HN also already had extensive experience in running and managing the existing laboratories including the hi-tech ones in the other operating campus for many years. More details are discussed below.

OHS and Safety Risks

Laboratory is a place for practice, study and research of students, students, lecturers and scientists. however, it is also a particularly dangerous place if the safety rules are not complied with, especially those on fire protection and safety for toxic chemicals and are likely to cause fires. In a chemistry lab, all effects of electrical current on humans are dangerous. Because in addition to electric shock, improper practices of students or researchers may lead to the drop, fall and break of tools, equipment and chemicals. Chemical spills, release of toxic gas, electrical shocks, fires, burnts etc. may also happen during the experiments. Exposure to these cases affect the safety and health of the operators. Therefore, there should be strict regulations for laboratories and monitoring arrangements should be in place.

Emissions from the Laboratory Area

Laboratories will use odorous and toxic chemicals such as chlorine, CH_4, H_2S, acids, and a number of different types of compressed air. The amount of vapor released during the experiments, though very small, will also directly affect the health of the students and staff working there. In order to minimize the impact of toxic chemical vapors, mitigation measures will be applied such as designing natural ventilation system, arranging, installing tables in an scientific manner, installing equipment for suction or de-toxic the gases at the locations where bottles or containers of chemicals are openned or where the tests are performed.

Wastewater from Laboratories

In addition to a large amount of domestic wastewater, there is a small amount of wastewater generated from laboratories, mainly in the processing and environmental departments, which contain chemicals during the experiment. The amount of laboratory wastewater containing chemicals is very small, including: waste liquid (the solution used to perform chemical reactions) and washing water for the first test equipment. This amoung of wasteater depends on the need for scientific research and the frequency with which students conduct experiments. Assuming that each day there are 200 students performing experiments, each student will generate about 10 litres of wastwater containing chemicals. Thus, the total volume of wastewater containing toxic chemicals is about: 2 m^3/day. Typical composition of laboratory wastewater is acidic or alkaline, containing metal ions, organic substances ... The composition, properties and concentration of pollutants in the experimental wastewater will vary according to frequency, purpose of performing different test samples. Analysing results of 01 sample of laboratory wasteater taken from the Institute of Science, Technology and Environment, Hanoi University of Science and Technology show the presence of metals with the following concentrations:

Table 3.19. Content of Some Metals in Wastewater Generated from the Laboratory

Metal	As	Cd	Cu	Fe	Pb	Zn	Ni	Mn
Content (mg/l)	0.12	0.15	1.75	25.5	0.0029	0.1	0.031	5.3

For the testing department of other faculties, wastewater is mainly generated during cooling, washing laboratory equipment and instruments. This source of wastewater is non-toxic and can be connected to a common drainage system.

Wastewater containing pollutants of similar nature will be separated and brought to the preliminary treatment clusters located underground in each building with laboratory layout.

Estimated amount of wastewater generated from laboratories is about 2 m^3/day.

In order not to affect the treatment process of the centralized wastewater treatment plant, the laboratory wastewater will be pre-treated before being connected to a common sewer system and sent to a centralized treatment station.

3.2.3.2. Environmental Impacts and risks related to VNU HN's generation operations and the buildings

a. Aviation safety

Pursuant to Decree 32/2016/ND-CP providing regulations on the height management of aviation objectives and the geographical management and protection areas in Vietnam, works with heights above the planning of the obstacle-restricted surfaces of the airport and the works located in the vicinity of the airport with an altitude of 45 meters or more above the airport height must be approved. about construction elevation management. However, the project does not have any building over 45 m high, so it will not affect the operation of Hoa Lac airport. However, it is also necessary to have warning signals from high-rise buildings in VNU-HN to ensure safety.

b. Wastewater

- ***Domestic wastewater***

Domestic wastewater is generated from studying and working activities of students, lecturers in the VNU-HN. Once the project comes into use, there will be 8,807 students, lecturers in total. As the standard TCVN 4474-87 (internal drainage), the standard wastewater volume for an individual is 20 l/person.day, therefore, the total domestic wastewater calculated is: 8,807 x 20 = 176.1 m^3/day.

Domestic wastewater contains residues, suspended solids (SS), organic compounds (BOD, COD), nutrients (N, P) and bacteria. When being released, the wastewater will cause environmental pollution unless mitigation measures are taken. The Nutrients (N,P) will cause eutrophication of water that affect the quality of surface water. Because the students only take a class half of the day, the wastewater mainly urine, washing water; the manure contained waste volume is lower than that of the residential area. The wastewater is treated by the treatment system, satisfying the standard of QCVN 14:2008/BTNMT, column A. Thus the impact is assessed to be low and mitigated by measures proposed by the VNU-HN in the mitigation measures to the Project's specific impacts.

Rainwater Runoff

When the project areas are completed and put into use, the soil's self-permeability will be reduced due to the concreting of the constructions, rainwater from the roofs, surrounding concrete and asphalt roads will increase pressure on the local drainage system. According to the plan, the existing roads have already had collection system and sewers for collection of water runoff. The rainwater runoff will be collected and discharged to streams through the road's sewer system. This sewer system is designed according to the plan, taking into account flooding so there is no risk of flooding surrounding areas.Therefore, this volume of wastewater is not considered a source of pollution and can be discharged directly into the drainage system. This impact is not significant.

Solid Waste

Daily operation of the VNU-HN will generate types of waste as follows:

Non-hazardous Waste:

This waste is mainly domestic solid waste from offices, canteen, accommodation of lecturers, guest houses and other public areas such as sports areas, parking lots, parks ... The main components of this waste are garbage, food (80%), garden waste (pruning, mowing the lawn), office paper, newspapers, plastic bottles, packaging, glass, carton. ..

The amount of domestic waste is estimated as follows:

Table 3.20. Estimation of Generated Domestic Waste

Generated by	Quantity	Emission factor per person (kg/person/day)	Solid waste generated per day (kg/day)
Student	7,860	0.75	5,895
Staff	947	0.50	474
Total amount of domestic waste per day (kg)		**6,369**	

Hazardous Waste

Waste considered hazardous waste must be collected and treated separately according to hazardous waste management regulations, including:

- Reaction chemicals generated from laboratories
- Greases, lubricants, waste refrigerants and oily rags from maintenance of machinery.
- Failed electrical and electronic equipment such as light bulbs, computers and electrical circuits
- Waste batteries and accumulators
- Insect spray
- Sludge from wastewater treatment system
- The failed light bulb
- Some medical waste such as blood tapes, needles generated from the university's medical room

These types of waste generate infrequently and their emissions are not high. The estimated amount of hazardous waste of the project is as follows:

Table 3.21. Esimated Quantity of Hazardous Waste

	Code	Type of waste	Hazardousness	Kg/month
1		Waste generated from laboratories:*:*		
	020101	Waste sulfuric acid, sulfurous acid	AM, OH, Đ, ĐS	
	020102	Waste hydrochloric acid	AM, Đ, ĐS	
	020103	Waste hydrofluoric acid	AM, Đ, ĐS	
	020104	Phosphoric acid, waste phosphor acid	AM, Đ, ĐS	
	020105	Waste Nitric acid, nitrous acid	AM, N, OH, Đ, ĐS	
	020106	Other types of waste acid	AM, Đ, ĐS	

	020201	Sodium hydroxide, ammonium hydroxide, potassium hydroxide waste and residue containing sodium hydroxide, ammonium hydroxide, potassium hydroxide	AM, Đ, ĐS	
	020202	Other types of waste bases	AM, Đ, ĐS	
	020302	Waste iron-based salt and salt solution	Đ, ĐS	
	020303	Waste heavy metal-based oxides	Đ, ĐS	
	020403	Waste has other heavy metals	Đ, ĐS	
	020501	Sludge contains hazardous components from the wastewater treatment process	Đ, ĐS	
	070101	Waste cleaning acid	AM	
	070102	Other types of waste acid	AM	
	070103	Waste cleaning base	AM	
2		Hazardous medical waste		
	130101	Infectious substance	LN	
	130102	Chemical waste includes or contains hazardous ingredients	Đ, ĐS	
	130103	Waste cell-harmful pharmaceutical products	Đ	
3				
	170601	*Waste greases, lubricants, refrigerant*	C, Đ, ĐS	
	170602	*Waste fuel and oil*	C, Đ, ĐS	
4	*180201*	*Greasy rags*	*Đ, ĐS*	
5	*160113*	*Electronic and electrical waste*	*Đ, ĐS*	
6	*160112*	*Waste batteries and accumulators*	*Đ, ĐS, AM*	
7	*160105*	*Insect sprayers, bottles for chemicals*	*Đ, ĐS*	
8	*160106*	*Failed fluorescent lamp*	*Đ, ĐS*	
		Total		

Note: Hazardous properties of waste (AM: Corrosive; OH: Oxidation; D: Toxic; DS: Ecotoxicity; N: Explosive; C: Flammable, LN: Infectious) .

All these wastes must be collected and treated the same as hazardous wastes and only transported and treated under the permission of the competent agencies. Mismanagement of hazardous solid waste will cause negative impacts on environment and diseases, especially infectious diseases through exposure to polluted wastewater and air resulting from aforementioned chemical - physical - biological factors. It is assessed as moderate and can be controlled.

c. Risks

- ***Fire and explosion***

Fire and explosion can be occurred in case of careless of temporary electrical supply system, causing damages on assets and people. The Project Owner will be responsible for taking out firefighting and protection measures, strictly complying with the measures to prevention of leaking and fire and explosion because the events can happen any time. However, the risks can be minimized by trainings and providing students, lecturers, officers with knowledge about firefighting.

- ***Electric explosion and short-circuit***

The University is in need of huge electricity demand for studying, especially operation of machines used in the labs or practical rooms. Thus, potential risks of electricity insecurity is likely to happen while materials used in the labs are combustible such as papers, tables, chairs, books, chemicals, etc. Fire prevention is always prioritized by the University leadership. This impact is assessed as minor and mitigable.

d. Social Benefits in the course of Operation

The project will bring about social benefits: (i) Identify the scientific HR supply and demand sources for the country; (ii) Harmonize of scientific and technical education system that is consistent with the traditional education and regional and international standards; (iii) Training for graduated officers and experts; (iv) Improve and increase the role of scientific and technological application; (v) Satisfy the living conditions for Vietnamese people – these are the key objectives in social development in the future.

3.2.3.2. Environmental Impacts relating to the WWTP with Capacity of 1,475 m^3/day

Impacts on Flow Rate

The design capacity of the WWTP is 1,475 m^3/d or equivalent to 0.017 m^3/s. The treated wastewater will be discharged to No.1 stream. The average flow rate in the No.1 stream in dry season is 3.1 m^3/s, it shows that at design capacity of 1,475 m^3/d, the proposed WWTP would add 0.5% into the flow of the No.1 stream in dry season, the potential impacts of the WWTP on the No.1 stream would be very small, negligible, thus will not be discussed further in this ESIA report.

Impacts on Water Quality of Receiving Water Body

The project would bring about the positive effect on the quality of the receiving water body when untreated wastewater is collected and treated to meet standard before being discharged into the No.1 stream. The volume of pollutants in treated wastewater at rate 1,475 m^3/day is indicated in **Table 3.22** below:

Table 3.22. Pollutants Treated by The WWTP with Capacity of 1,475 m^3/day

Parameter	Unit	Input	Output	Treatment	% Treatment
BOD_5	Ton/day	0.3	0.05	0.2	83.1
SS	Ton/day	0.3	0.06	0.3	81.9
Total N	Ton/day	0.1	0.04	0.02	32.2

Treated wastewater will meet QCVN 14:2008/BTNMT-Column A before discharged into the No.1 stream.

To assess the impact of the wastewater onto the quality of water in No.1 stream in project area, IPC model introduced by the WB and WHO is applied. The WWTP discharge rate 1,475 m^3/day, the flow rate at the No.1 stream is 3,1 m^3/s (in dry season).

In practice, there are some water quality models that can be used such as: IPC, QUAL, QUAL2EU, QUAL2K, SWAT, BASIN … However, the application of QUAL, QUAL2EU, QUAL2K, SWAT, BASIN is complicated and requires a lot of input data, resources and time. Therefore, in the scope of this ESIA report, IPC model was used for rapid assessment based on dilution model.

$$C = (Q_n * C_n + Q_s * C_s) / (Q_n + Q_s)$$

In which:

- C is the content of pollutant forecasted.
- C_n is the content of pollutant of the exhausted source.
- C_s is the content of pollutant of the receiving source.
- Q_n is the current of the exhausted source.
- Q_s is the current of the receiving source.

Table 3.23. Forecasted Pollutant Concentration in No.1 stream in Operation Phase

No.	Pollution parameter	Cs	Qs	Q_n	C
No.1 stream					
1	Total nitrogen	0.2	3.1	0.02	0.39
3	BOD_5	9			9.13
5	SS	20			20.19

The figures in the **Table 3.23** indicated that as the flow rate of the treated effluent from the WWTP is very small (0.017 m^3/s) compared to the No.1 stream flow rate (3.1 m^3/s), the contribution of pollutants from the treated effluent of the WWTP does not cause any changes to the water quality of the receiving water quality.

Wastewater Quality at Outlet When System Failed

The capacity of the WWTP is 1,475 m^3/day with a retention time of about one day.

According to Decree 40/2019/ND-CP, If designed wastewater volume is from 500 m^3/day (24 hours) to under 5,000 m^3/day (24 hours), it is required to build works to prevent and respond to wastewater incidents which are incident ponds having capacity to contain wastewater at least two days or the incident tanks having capacity to re-treat wastewater and ensure that the wastewater will not be discharged to environment in a case where a wastewater treatment system incident happens.

Therefore, the total water retention time after wastewater has passed through all the ponds to the discharge point of No.1 stream as calculated for the capacity of 1,475 m^3/day is:

Total water retention time (capacity of 1,475 m^3/day) = 3 (days)

The result of the above calculations means that after being built, it still takes three days for a wastewater drop to travel from the intake of the WWTP to the outlet. During that travel time, parts of the contaminants in the wastewater will be decomposed. As the result, even if the treatment facilities of the WWTP failed, parts of the pollutants in the wastewater are still be removed before the flow reaches the outlet after up to 3 days since entry.

3.2.3.3. Environmental Impacts relating to the WWTP with Capacity of 600 m^3/day

Impacts on Water Quality of Receiving Water Body

The project would bring about the positive effect on the quality of the receiving water body when untreated wastewater is collected and treated to meet standard before being discharged into the Muc lake. The volume of pollutants in treated wastewater at rate 600 m^3/day is indicated in below:

Table 3.24. Pollutants Treated by The WWTP with Capacity of 600 m^3/day

Parameter	Unit	Input	Output	Treatment	% Treatment
BOD_5	Ton/day	0.12	0.015	0.1	87.5
SS	Ton/day	0.14	0.02	0.1	85.2
Total N	Ton/day	0.02	0.018	0.01	25.0

Treated wastewater will meet QCVN 14:2008/BTNMT-Column A before discharged into the Muc lake.

To assess the impact of the wastewater onto the quality of water in Muc lake in project area, IPC model introduced by the WB and WHO is applied.

The load capacity of the lake is assessed by the following formula.

$$M_{tn} = (C_{qc} – C_{nn}) \times V_h \times 10^{-3} \times F_s$$

In which:

- M_{tn} is load capacity.
- C_{qc} is limit value of lake water.
- C_{nn} is the current of the receiving source.
- V_h is the volume of lake.
- F_s is the coefficient of safety .

Table 3.25. Forecasted The load capacity of the Muc lake in Operation Phase

Parameter	SS	BOD5	Total N
C_{qc}	50	15	0.9
C_{nn}	18	12	0.28
V_h	96,000	96,000	96,000
F_s	0.3	0.3	0.3
	922	86	18

The figures in the **Table 3.25** indicated that as the flow rate of the treated effluent from the WWTP is within the load capacity of the lake. The contribution of pollutants from the treated effluent of the WWTP does not cause any changes to the water quality of the receiving water quality.

In this period, the receiving source was identified as Muc lake. With reservoirs receiving lakes, there are still some concerns about the possibility of receiving and depositing pollutants. Therefore, the assessment of receiving sources continues to be assessed during the subsequent implementation of the project.

Wastewater Quality at Outlet When System Failed

The capacity of the WWTP is 600 m^3/day with a retention time of about one day.

According to Decree 40/2019/ND-CP, If designed wastewater volume is from 500 m^3/day (24 hours) to under 5,000 m^3/day (24 hours), it is required to build works to prevent and respond

to wastewater incidents which are incident ponds having capacity to contain wastewater at least 2 days or the incident tanks having capacity to re-treat wastewater and ensure that the wastewater will not be discharged to environment in a case where a wastewater treatment system incident happens.

Therefore, the total water retention time after wastewater has passed through all the ponds to the discharge point of No.1 stream as calculated for the capacity of 600 m^3/day is three days.

The result of the above calculations means that after being built, it still takes 3 days for a wastewater drop to travel from the intake of the WWTP to the outlet. During that travel time, parts of the contaminants in the wastewater will be decomposed. As the result, even if the treatment facilities of the WWTP failed, parts of the pollutants in the wastewater are still be removed before the flow reaches the outlet after up to 3 days since entry.

Emissions from the WWTP

The WWTP is a source of biogas which can disperse in the wind to distances of tens or hundreds of meters. Aerosols can contain bacteria and fungi that can be a cause of illness or allergies through breathing. These biogas will affect the air quality around the wastewater treatment plant. For the WWTP, gas will be generated from the regulating tank.

The table below shows the bacterial density near the WWTP as presented at the 7th International Conference on Environmental Science and Technology - Ermoupolis. *Formation of bioaerosol near the WWTPs.*

Table 3.26. Density of Bacteria in the Emission from WWTP

Bacteria	Value (CFU/m^3)	Average (CFU/m^3)
Total bacteria	0 – 1,290	168
E. coli	0 – 240	24
Gut bacteria and others	0 – 1,160	145
Fungi	0 – 60	16

CFU/m^3 = Colony Forming Units/m^3

The number of bacteria generated from the WWTP will vary significantly in each location, the highest level is foundat right at the place of the WWTP and the lowest level is at the distance from the WWTP.

Table 3.27. Number of Bacteria Generated from the WWTP

	Number of bacteria per/1 m^3 of air			
Distance	0 m	50 m	100 m	>500 m
At end of the prevailing wind	100 – 650	50 - 200	5 - 10	-
Facing into the wind	100 – 650	10 - 20	-	-

Source: 7th International Conference on Environmental Science and Technology – Ermoupolis. Bioaerosol formation near sewage treatment facilities, 2001

Odor from WWTP and Pumping Stations

Odors from the WWTP and pumping station are mainly generated from anaerobic digestion tanks. Aerobic decomposition also produces odor but at a low level. Gases emitted primarily from anaerobic decomposition include H_2S, Mercaptan, CO_2, CH_4, of which H_2S and Mercaptans are the main odors, while CH_4 is flammable if accumulated at a certain concentration.

Table 3.28. Ordorous Sulfur-Based Compounds Generated from Anaerobic Decomposition

Compounds	Formula	Typical ordor	Detection threshold (ppm)
Allyl mercaptan	CH_2=CH-CH_2-SH	Garlic, strong coffee smell	0.00005
Amyl mercaptan	CH_3-(CH_2)$_3$-CH_2-SH	Unpleasant smell, bad smell	0.0003
Benzyl mercaptan	C_6H_5-CH_2-SH	Unpleasant smell	0.00019
Crotyl mercaptan	CH_3-CH=CH-CH_2-SH	Skunk smell	0.000029
Dimethyl sulfide	CH_3-S-CH_3	Decayed plant smell	0.0001
Ethyl mercaptan	CH_3CH_2-SH	Rotten cabbage smell	0.00019
Hydrogen sulfide	H_2S	Rotten eggs	0.00047
Methyl mercaptan	CH_3SH	Rotten cabbage smell	0.0011
Propyl mercaptan	CH_3-CH_2-CH_2-SH	Unpleasant smell	0.000075
Sulfur dioxide	SO_2	Pungent odor, causes allergy	0.009
Tert-butyl Mercaptan	$(CH_3)_3$C-SH	Skunk smell	0.00008
Thiophenol	C_6H_5SH	Garlic smell	0.000062

Source: 7th International Conference on Environmental Science and Technology – Ermoupolis. Odor emission in a small wastewater treatment plant, 2001

There is a fundamental difference between sulfur-containing compounds in different wastewater treatment tanks. Increasse in H2S from two sources reducing sulfites (equation [1] and [2]) and sulfur DE of sulfur-containing organic substances (equation [3]).

$$SO_4^{2-} + \text{organic substance} \xrightarrow{\text{Anaerobic bacteria}} S^{2-} + H_2O + CO_2 \quad [1]$$

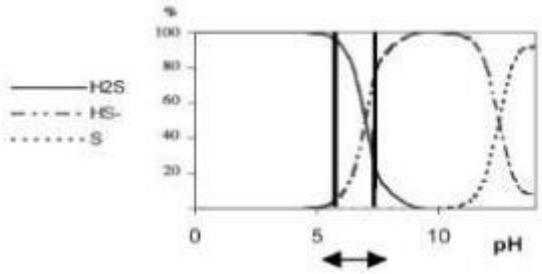
$$\longrightarrow S^{2-} + 2H^+ \longrightarrow H_2S \quad [2]$$

$$SHCH_2CH_2NH_2COOH + H_2O \longrightarrow CH_3COCOOH + NH_3 + H_2S \quad [3]$$

H_2S is easy to be extracted:

$$H_2S \xleftrightarrow{pH = 7.04} H^+ + HS^- \xleftrightarrow{pH = 12.89} H^+ + S^{2-} \quad [4]$$

Formation of H_2S:



There is ordor generated from anaerobic decomposition but at low level and can be negligible.

Table 3.29. H_2S Generated from the WWTP

Generated at	Level (g/s)	Emitted into the air (%)
Receiving chamber	0.019	0.1380
Garbage trap	0.005	0.0427
Sum pit	0.113	1.0000
Aeration tank	$6.08*10^{-27}$	0.1427
Sludge tank	$7.44*10^{-32}$	0.1928

Source: 7th International Conference on Environmental Science and Technology – Ermoupolis. Odor emission in a small wastewater treatment plant, 2001

Odor is mainly generated from pumping chamber and regulating tank but at a low level. In addition, the order at the pump stations will be minimal. This odor will affect workers directly working at the site. As described in the Project Description, the design of the WWTP includes a treatment tank to eliminate odor problems.

Generation of Waste

Waste generated by workers can be calculated based on the maximum number of employees working in the WWTP (about 5 people). The amount of solid waste generated is estimated to be 2.5 kg/day, based on 0.5 kg/person/day and assuming that workers are allowed to eat at the workplace.

Some waste will also be collected daily from sand settling tanks of the influent water.

This waste may cause nuisance, pollution and affect the health of workers. Waste and risks during operation of the WWTP and can be managed.

Environmental Hazards and the Risk of System Failure

Chemical Leaks

Chlorine will be used for wastewater treatment. Therefore, there is a risk of chlorine leakage from containers or an accident from chemical handling. If chlorine leakage is serious or an accident occurs, it will cause serious pollution of air, soil, water and health hazards for operators and residents. The risk of chlorine leakage and accidents will be controlled by the methods described in Chapter 5.

Other Risks and Issues

If sewer system is broken or clogged, untreated wastewater will leak on the ground and spill around to contaminate the soil and water.

Fire and explosion can occur due to electric shock, lightning ... and damage to people and property.

Occupational diseases of operators will also be of concern because they will be exposed to chemicals such as acids, corrosive soda and have health effects if workers are in direct contact. Sludge, if directly exposed, can also cause a number of health risks for workers

3.3. SUBSEQUENT IMPACTS AND ACCUMULATIVE IMPACTS

This section discusses the cumulative impact of the subproject. In this regard, the cumulative impact under consideration is defined as two or more individual affects that, when considered together, are considerable or which compound or increase other environmental impacts. The cumulative impact from several projects result from the incremental impacts of the proposed subproject when added to other closely related, and reasonably foreseeable, future projects. The impacts that do not result in part from the subproject will not be discussed.

In this ESIA, it is considered whether the subproject construction and operation may contribute to cumulative impacts on the Valued Environmental and Social Components (VECs) on which other existing or future developments within or nearby the subproject area may also have detrimental effects.

According to section *I.3. Related Projects and Plans* and *the University's Development Master Plan*, VNU-HN in Hoa Lac (total land area of 1100 ha) will be invested through 23 sub-projects (or 'component' project). By early 2020, 4 out of 23 component projects have been completed. The World Bank – financed project partcly cover three of these 23

component projects; 6 out of 23 projects on preparation phase[14] and remaining projects have not yet implemented.

- 4 out of 23 component projects have been completed including: (i) A part of the technical infrastructure project (QG-HN02); (ii) A part of the Dormitory Construction Project (QG-HN05); (iii) Public Housing Project (QG-HN06) and (iv) Natural Science University Project (QG-HN07) is under construction phase.
- Remaining projects on preparation phase such as: (i) Resettlement site project (QG-HN01); (ii) Multiple Purpose Education Center Project (QG-HN04); (iii) University of Social Sciences and Humanity Project (QG-HN09); (iv) International University Project (QG-HN13); (v) Education University Project (QG-HN14) and (iv) A remaining part of the technical infrastructure project (QG-HN02).

The subproject description reveals that within the geographical scope of proposed subproject area, with small to medium scales that are being planned to be constructed in 2025. These projects under the old plan will be implemented simultaneously with the VNU-HN project borrowed from the World Bank (from 2021 to 2025). However, due to difficulties in investment capital, according to the assessment at this time, 6/23 projects in the above-mentioned preparatory stage will be slower to implement than VNU-HN projects that borrow from WB. All the planned projects are under management of VNU-HN. Under the cumulative impact definition, the proposed subproject may contribute to cumulative impact on VECs on which these projects are being constructed or planned to be constructed in next year.

According to the results of reviewing the relevant documents and the subproject affected communities and stakeholder consultation combined with field studies, it is identified that the proposed subproject together with the projects that is being constructed or planned to be constructed in next year may not contribute to a cumulative impact on the water quality and its aquatic ecosystem and biodiversity in the subproject area. However, air pollution may be incremental in the subproject area and more traffic congestion and accident along local roadways may occur due to the current or planned construction of the other projects. Specific analysis of these cumulative impacts on these VECs is as follows:

Water quality and its aquatic ecosystem: The water quality as well as its aquatic ecosystem of the No.1 stream and Muc lakes is the VECs that are not considered to be cumulatively impacted during the subproject construction and operation phases. This is because the proposed subproject does not cause any significantly detrimental effects on the water quality and aquatic ecosystem during both construction and operational activities. Runoff and wastes discharged from the proposed civil works within the Zone 1, Zone 3, Zone 4 premises will be well managed through the Environment Codes of Practice (ECOP) during the construction phase, while in the operational phase, the wastewater discharged from the restrooms of proposed facilities will be collected and treated by the proposed WWTP with 1,475 m^3/day at Zone 4 before discharging into No.1 stream; WWTP with 600 m^3/day at Zone 3 before discharging into Muc lake. Definitely, no wastes are disposed of into these No.1 stream, Da Lat and Muc lakes during construction and operation.

Biodiversity: Given that the green trees have been planted surrounding the university with an average of 2-5 trees/m^2. The number of trees potentially cut down or removed may increase compared with that potentially affected by the proposed subproject in case the other projects have also required clearing the construction sites with some trees are growing on that. Under the environmental perspectives, the lost trees may cause unbalancing the ecosystem event through they are not valuable to be protected. However, most of the affected trees could be

[14] Detailed planning scale 1/500 is in progress or FS approval awaited.

removed and replanted in the other vacant land within the university to maintain the ecosystem formed by the green trees. In addition, more trees will be planted on the vacant land of university, especially surrounding the WWTPs and both sides of the upgraded and constructed internal roads to replace the lost trees during the construction phase. The cumulative impact on the biodiversity is therefore considered moderate and can be mitigated.

Air quality: the air pollution in the subproject area would be expected to be cumulatively impacted as several projects within the geographical scope of the proposed subproject area have been constructing or planned to be constructed in next years. Regardless of their specific locations within the subproject area, dust and exhaust gases generated from the activities of soil excavation, machine operation and vehicles' movements from the other projects will contribute to increasing an extent content of dust and toxic gases in the subproject area if mitigation measures for controlling generated dust and gases emission within the standard are not effectively applied.

However, the baseline data of air quality in the subproject area showed that the existing air quality in the subproject area is quite good and parameters to be monitored in the air are far below the allowable standard. The impact is considered low and could be managed by the University by application of the mitigation measures in the ESMP to suppress dust and control exhaust gases for the proposed subproject construction.

Traffic congestion and accident: The traffic congestion and risk of traffic accident especially on the Hoa Lac highway has been given in Chapter 3. This road will be mainly used for transporting materials to the subproject construction sites and wastes from the sites to disposal sites. An additional vehicle travel due to the subproject may result in exposing the communities living near the traffic routes to higher risks of traffic congestion and accidents due to construction activities. Besides, within the geographical scope of subproject area, some other projects under the university's management are being constructed or planned to be constructed in the next years. The cumulative impact on the traffic congestion and accident not only on Hoa Lac highway but also on internal roadways especially from the Hoa Lac highway to the construction sites would be particularly occurred. The impact is considered moderate and could be managed by the University through application of the traffic management plan proposed in the ESMP to address the traffic congestion and traffic accidents on Hoa Lac highway and internal roadways of the proposed subproject construction.

CHAPTER 4. COMPARISON AND ANALYSIS OF PROPOSED OPTIONS

4.1. COMPARISON BETWEEN "WITH" AND "WITHOUT" PROJECT

Challenges existing in the project area are (i) the insufficient traffic system; (ii) pollution risk due to uncollected and untreated wastewater before being discharged into the environment. Therefore, if the project is not implemented, negative social and environmental issues will exist under the current conditions:

- The construction of the planned infrastructure facilities for education has the potential to cause environmental pollution, especially waste and wastewater. When the constructions are built and put into operation, the increase in number of people will lead to the increasing demand for domestic water every year, so the amount of wastewater will also increase and put more pressure on the environment. In addition, generation of solid waste from daily activities and hazardous waste from laboratories will also be an arising issue.
- At the present, the project area has an entrance road crossing with Thang Long highway in the direction of Hanoi - Hoa Binh, where there is a high population density who are doing business and trading on both sides of the road. If the project is implemented, traffic density and traffic safety risks will increase due to the increasing traffic volume.

Comparisons between environmental and social issues related to the choice of "with" or "without" project are described in Table 4.1 below.

Table 4.1. Comparing Cases of "With" and "Without" Project

No.	Social and environmental issue	With project	Without project
1	Education environment	When being put into operation, the project will provide a good educational and scientific environment to attract children from local area and other areas to study and work or live and settle around Thach Hoa commune and Thach That district. As a result, quality of local human resources will be improved.	Currently, the project area does not have any educational and scientific research facilities so it cannot develop strongly both human and material resources for this field
2	Environmental sanitation	Urban environmental sanitation will be improved, pollution and disease risks related to wastewater and environmental sanitation will be reduced and qualify of life of people living in the project area will be improved. Urban services will also be improved, ensuring aesthetic and sustainable development for VNU-HN.	Environmental sanitation and quality of life are not guaranteed due to the lack of a wastewater treatment system.
3	Socio-economic issues	- No adverse impacts associated with land acquisition happen due to the subproject implementation.	- Waste of the land fund of the university that has been planned

No.	Social and environmental issue	With project	Without project
		- The subproject will bring local people new job opportunities and increased incomes. - However, there will be several short-term negative impacts anticipated that can be mitigated as follows: + The increase in Influx of workers, their followers in the localities will cause negative impacts on localities such as conflicts, competition of physical and social services, social evils and pressure on domestic waste management. + Local traffic will be disturbed by the temporary increase of vehicles on the roads due to the subproject construction and increased number of students and staff to come to the subproject area during operation.	for the construction for years. - Employment opportunities for local communities would be lost. - Value of assets of local people may be insignificant increased following the markets. - Notably, the unqualified labor forces will be an impeded force of the sustainability of socioeconomic development for locality in particular and for the nation in general.

Conclusion: The investment for VNU-HN development is necessary because the subproject will contribute significantly to national and local socio-economic development and the strategy of global integration of the country. It is concluded that the option of "with subproject" is selected.

4.2. Analysis of Alternatives of "with subproject"

4.2.1. Alternative Analysis of Subproject Locations and Scales

The project proposal must be suitable with the natural conditions of Hanoi city, the national, regional development plan and the programs as well as the orientation for the development of hanoi city and the development strategy of VNU-HN.

Furthermore, the project locations and construction scales have been carefully considered based on the approved master plans of VNU-HN and the detailed plan of the University members. The locations of the all works to be constructed are of the planned land. So, there are no adverse impacts caused by land acquisition and resettlement.

Therefore, the selected locations and construction scales of the project will maximize the benefit and minimize the adverse environmental and social impacts..

4.2.2. Alternative Analysis between Traditional Design and Application of Sustainable Design for the project Buildings

Normally in Vietnam, the educational facilities have been traditionally designed following the local standards that might be set for the country in the past. Currently, the higher education system of the country has been required to be innovated to keep up with the globally advanced educational system. The requirements have been recently institutionalized through Law on Education, 2012 and the related legislation under Law. The alternatives in the sustainable design of the educational facilities shall be considered against the traditional ones to select the most suitable design model toward the global modernity meeting the international and regional standards. Two options in the design of the educational buildings are proposed to

be analyzed including (i) application of the sustainable design and (ii) following the traditional design. The results of alternative analysis are presented in Table 4.2.

Table 4.2. Analysis of Design Alternatives

Considerable issues	Sustainable design	Traditional design
Energy and material	- Optimizing energy use will contribute to effective use and saving of water and energy, reduction of Greenhouse Gases (GHG) emission, and adaptation to climate change. - Optimize Building Space and Material Use will reduce the natural resource exploration, contributing to protecting natural ecosystem. - Purchase cleaning products and supplies that are resource-efficient, bio-degradable and reduce waste through source reduction and recycling to eliminate off-site disposal.	- The buildings will use national electricity network as the energy sources for lighting, heating, cooling system during operation. This can create a burden on the national energy consumption. In addition, currently the national energy sources have been produced mainly from the hydro power plants and thermal power plants using coal as fossil fuels. Both types of power generation plants have been considered contributing to damage to the natural ecosystem and increasing GHG. - Furthermore, traditional design does not pay attention to use cleaning products and suppliers or bio-degradable materials because their costs are high. This has resulted in increasing the off - site waste disposal causing harmful to natural ecosystem.
Life span of works	- Longer because the sustainable design helps the facilities be tolerant to impacts due to climate change through designing and choosing the construction materials adaptive to climate change and other extreme weathers. - Sustainable design will minimize the system failure through training building occupants, facilities managers, and maintenance staff in sustainable design principles and methods.	- Shorter because the traditional-design does not pay attention much to the potential negative impact on facility lifespan due to climate change and other extreme weathers. - In addition, the quality of buildings applied the traditional design could be quickly deteriorated because the moisture content indoors is not properly controlled leading to a development of molds, fungi able to destroy the wall surface. Furthermore, the O&M activities are not properly managed through its life cycle.
Aesthetics	- Better as sustainable design will pay attention to value aesthetics inside and outside the facilities such as the importance of views and the integration of natural and man-made elements.	- Normally traditional design does not thoroughly analyses the landscape of a proposed building in terms of the structure and shape to be harmonizing between the features of surrounding nature and man-made elements.

Considerable issues	Sustainable design	Traditional design
Health and safety of students and staff	- Health and safety of students and staff studying and working in the facilities especially in laboratories will not be affected because of sustainable design as follows: + With building envelope design that properly manages moisture sources through heating, ventilating, air-conditioning (HVAC). Such designs will prevent airborne bacteria, mold, and other fungi, as well as radon developed inside and outside the buildings. + Quality of the environmental components in doors the facilities will be monitored automatically through test sensor control points to control the effective use of energy, water, waste, temperature, moisture, and ventilation. + System of fire and explosion prevention and fighting as well as evacuation lines for people including people with disabilities working inside the facilities will be well designed. + Noise and vibration levels inside the facilities will be controlled through the use of sound absorbing material and equipment isolation.	- Traditional design does not focus much on enhancing the environment indoor quality of a building during the operation. Concretely, it is rare to see a sensor installed indoor to monitor automatically the environmental components and control the pollutants, toxic substances, heating, air-conditioning to protect health and safety of people working inside. - The issues of prevention, fighting and evacuating due to fire and explosion may not be synchronized through the facility design to the application of mitigation measures during operation, - Noise and vibration effects from inside and outside activities may not be carefully considered during design to prevent any occupational diseases for students and staff.
Gender and social equality	- Sustainable design will contribute to improving gender equality; reducing gender based violence (GBV) and creating advantageous conditions for people with disabilities through designing the educational facilities with separate restrooms, prioritized paths to elevators, car parks for people with disabilities and pregnant women.	- Traditional design may not pay much attention to the condition for improving gender issues, GBV and being convenient for people with disabilities. - If the educational facilities are designed with no separate restrooms, pathways prioritized for people with disabilities and pregnant women and no car parks prioritized for them, the opportunities of going to the university for learning and working for them will be limited.

Considerable issues	Sustainable design	Traditional design
Construction cost, O&M cost	- Although, the construction cost must be higher, the O &M cost must be significantly reduced because (i) the work lifespan is longer, and (iii) the energies used are taken from the renewable sources.	- In contrast, the construction cost may be lower, but the O&M cost will be higher because (i) work life cycle is shorter, and (ii) the energy used is taken from national grid with a higher price.
Socio-economic efficiency	- More effective because of the following reasons: + The number of students especially female students and students with disabilities may increase. + The subproject operation will influence on the operational mechanism of the university members toward a high autonomy model that is a basis for them to improve the quality of training, scientific research and community services in the southern key economic region, the Mekong River Delta provinces, the southern central region and the central highlands. + The subproject successful model in higher education will be made into the lessons learned to be shared to the whole higher education sectors in Vietnam. + The subproject will contribute to the social sustainability through the promotion of national economic development as well as the enhancement of the democracy, equality and progress in the society.	- Less affective because of the following reasons: + The traditional design may not change the quality of learning space and facilities toward the international and regional standards as well as meeting the advanced demand of students and social and gender equality and democracy within the university. This will not become a good model for sharing with other universities. + This results in not increasing in the number of domestic and abroad students to enroll for learning and researching, which will be difficult to balance the revenue and expenditure toward the autonomy of finance following the governmental policy.

Conclusion: Based on the above analysis, the option of applying the sustainable designing for the university is selected because of its advantages meeting the demand of learners, researchers and staff and suitability with national development condition and legislation.

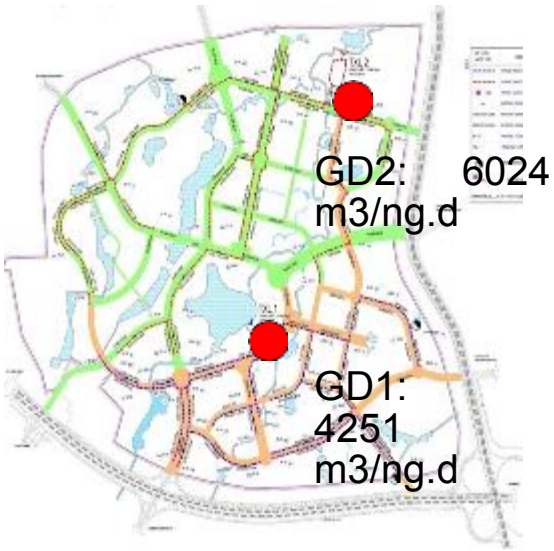
4.2.3. Alternative Analysis on WWTPs

Anayzing and Selecting Solution for the Wastewater Collection and Treatment System

Location of the WWTP is determined based on the master plan scaled 1:2000 of the project area.

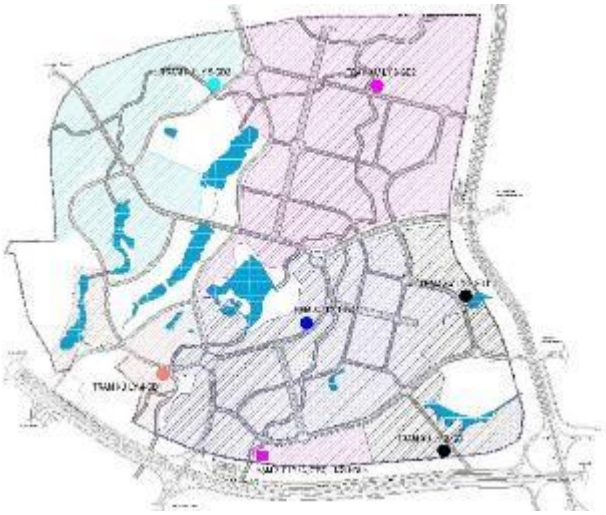
- Option 1: Construction of one centralized WWTP with maximum capacity of 10,275 m^3/day in the north of the project area.
- Option 2: Construction of two WWTPs in investment phases of the project.
  - The first WWTP: maximum capacity 4,251 m^3/day, expected to locate at the greenland in the central park area.
  - The second WWPT: maximum capacity 6,024 m^3/day, located in the north of the project area
- Option 3: Construction of one WWTP for each subproject with capacity depending on construction scale of each university. Location of the WWTP is determined specifically in each component project with capacity varying from 18 m^3 ÷1,728 m^3/day;
- Option 4: Wastewater drainage and partially treatment in each area
  - First phase: the first WWTP with capcity of 1,475 m^3/day; the second WWTP with capacity of 600 m^3/day; the third WWTP with capacity of 1,757 m^3/day; the fourth WWTP with capacity of 416 m^3/day.
  - Second phase: The fifth WWTP with capacity of 1,542 m^3/day; the sixth WWTP with capacity of 3,482 m^3/day and the seventh WWTP for partial treatment with capacity of 1,000 m^3/day located at the area of the dormitory No.3. The WWTP for partial treatment will be invested in the component project.

Option 1



Option2

Option 3



Option 4

a) Comparison of technical and economic criteria of the options

Economic criteria:

Economic criteria	**Option 1 Centralized treatment**	**Option 2 Phasing treatment**	**Option 3 Distributed treatment**	**Option 4 Partial treatment**
Initial investment cost for the WWTP	13 mil/1 m^3 wastewater	14 mil/1 m^3 wastewater	15-22 mil/1 m^3 wastewater	15 mil/1 m^3 wastewater
Construction cost of the WWTP	**128 billion VND**	**137 billion VND**	**159 billion VND**	**151 billion VND**
Operation cost	~ 3000 VND/m^3 wastewater	~3000 VND/m^3 wastewater	3000~5000 VND/m^3 wastewater	3000~5000 VND/m^3 wastewater
Capacity of partial pumping station	-PS1: 1,162 m^3/day -PS2: 512 m^3/day -PS3: 1,488 m^3/day	- PS1: 1,162 m^3/day - PS2: 512 m^3/day - PS3: 1,488 m^3/day	Not available	Not available
Capacity of WWTP	10,275 m^3/day	-WWTP 1: 4,251 m^3/day -WWTP 2: 6,024 m^3/day	about 19 treatment stations with capacity of 22 m^3/day to 1,730 m^3/day	WWTP 1: 1478 m^3/day WWTP 2: 600 m^3/day WWTP 3: 1,757 m^3/day WWTP 4: 416 m^3/day WWTP 5: 1,542 m^3/day WWTP 6: 3,482 m^3/day WWTP 7: 1,000 m^3/day
Bill of quantity of the WWTP	Refer to the attached BOQ	Refer to the attached BOQ	No drainage pipeline of the framework infrastructure	Refer to the attached BOQ
Volume of water added to the system	No addition of water to the system because the WWTP is located at the end of the drainage	~ 2,000 m^3/day (80% capacity of WWTP in phase 1)	~ 7,000 m^3/day (provisionally equal tog 80% of volume of treated water)	~ 4,000 m^3/day (provisionally equal tog 80% of volume of treated water))

Economic criteria	**Option 1 Centralized treatment**	**Option 2 Phasing treatment**	**Option 3 Distributed treatment**	**Option 4 Partial treatment**
Reuse of treated water for watering purpose	Reusable; 100% of wastewater after treatment. Far distance for reuse purpose	Reusable; 100% of wastewater after treatment. Shorter distance than option 1	Reusable; 100% of wastewater after treatment. Short distance because the WWTPs are distributed all over the project area.	Reusable; 100% of wastewater after treatment. Moderate distance because the WWTPs are distributed all over the project area.
Volume of treated water to be used for watering purpose	~ 3,000 m^3/day	~ 3,000 m^3/day	~ 3,000 m^3/day	~ 3,000 m^3/day
Total initial cost	**230 billion**	**262 billion**	**159 billion**	**200 billion**

Comment: these are comparison of economic criteria for 4 options. Accordingly, we have:

- Construction cost of the WWTP: Option 3 requires the highest cost while the option 1 is the lowest
- Total construction cost (including network): Option 2 needs the highest cost while the Option 3 needs the lowest cost

Technical and technological criteria

Technical and technological criteria	**Option 1 Centralized treatment**	**Option 2 Phasing treatment**	**Option 3 Distributed treatment**	**Option 4 Partial treatment**
Land use demand	2.0 ha	0.5 ha Phase 1 01 ha Phase 2	0.2 ha//per WWTP 1,000 m^3 Total land area in Phase 3: ~ 3.5 ha	Total land area 3.0 ~ 3.5 ha
Type of arrangement	On-land or semi-onland	On-land or underground	On-land or underground	On-land or underground
Construction time	18 months	12 months	~ 04 to 06 months (depending on WWTP capacity)	~ 04 to 12 months (depending on WWTP capacity)
Mobility and flexibility when the WWTP upgrade, expansion or relocation is required	Upgradable and expandable	Difficult for upgrade or expansion if underground	Upgradable, expandable and relocable	Difficult for upgrade or expansion if underground
Number of operators	12 trained staffs	12 trained staffs	1-2 people for each WWTP	2-3 people for each WWTP
Discharge point/Outlet	As in the planning	As in the planning (phase 2) added to the lake (phase 1)	distributed all over the project area, depending on the rainwater drainage system	distributed all over the project area, depending on the rainwater drainage system
Pipeline network	Distributed as in the planning and for phasing investment	Distributed as in the planning and for phasing investment	No need of pipeline network for drainage of grey water	option 1 and 2 need investment from the start

Technical and technological criteria	**Option 1 Centralized treatment**	**Option 2 Phasing treatment**	**Option 3 Distributed treatment**	**Option 4 Partial treatment**
Network control	Difficult for control due to huge volume and annual maintainance is required for the pipeline as well as the booster PS for wastewater	Difficult for control due to huge volume and annual maintainance is required for the pipeline as well as the booster PS for wastewater	Not available	annual maintainance is required for the pipeline a
Effluent quality control	easy and consistent	easy and consistent	Difficult because outlets are distributed all over project area	Normal
Ordor control	Good	Good	Good	Good
Technology for WWTP	aerotank and activated sludge for reduction of nitrogen	aerotank and activated sludge for reduction of nitrogen activated sludge technology (tank, continuous SBR...)	Johkasou WWTP with synthetic composite resin AFSB-F or AFSB-C reinforced concrete	aerotank and activated sludge for reduction of nitrogen activated sludge technology (tank, continuous SBR...)
Operation and management	Need an unit for operation and management of all discharges. Management of large capacity WWTP is also quite complicated with high risk of incident.	Need an unit for operation, management and collection of fee for the discharge of wastewater into the system.. Management of large capacity WWTP is also quite complicated with high risk of incident.	The unit for supervision and management, operation of the WWTP is under authority of each university.	Need an unit for operation, management and collection of fee for the discharge of wastewater into the system..
Popularity in Vietnam	Technology is popular, not exclusive. has been widely used in many similar works in Vietnam	Technology is popular, not exclusive. has been widely used in many similar works in Vietnam	The treatment process depends on technology and computer control. Technology may be dependent.	Technology is popular, not exclusive. has been widely used in many similar works in Vietnam

Comparison of the above options shows that Option 4 is the optimal plan over the remaining three options. Consultant proposes to choose option 4 as the design plan for this item.

CHAPTER 5. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Based on the potential and negative environmental impact assessment identified in chapter 3, the Environmental and Social Management Plan (ESMP) has been prepared and presented in this chapter. The measures for addressing the identified social and environmental impacts, thprocedures for implementation, monitoring and supervision, and reporting arrangement are included in this ESMP along with the capacity building program and cost estimation. This ESMP includes the following main contents:

- The measures to address the potential environmental and social impacts and risks, the environmental solutions proposed to be considered during Feasibility Study and the Detailed Design or for incorporation into construction/shopping bidding documents and contracts including the implementation responsibility;
- Environmental monitoring program;
- Environmental Compliance Frameworkincludingpolicies applicable to non-compliance;
- Capacity building plan;
- Cost estimate
- Grievance redress mechanism.

5.1. PROPOSED MITIGATION MEASURES AND ENVIRONMENTAL FRIENDLY SOLUTIONS

5.1.1. The Measures proposed for Feasibility Study and Engineering Design

The following solutions and measures are proposed to be applied during feasibility and engineering design to the extend possible.

In principle, the Feasibility Study and Detail Design will aim at achieving environmentally sound, climate-resilience, safety and comfort for the users, energy savings and efficient usage of resources during construction or operation of the facilities provided by the Hanoi subproject. The Feasibility Study and Detail Design Consultants will consider and apply to the exent possible, but not limited to, the specific requirements, measures and solutions listed below:

LAYOUT DESIGN:

- Create green space and save energy.
- Layout design based on natural landscapes, with landscape protection and conservation incorporated into the layout;
- respond to climate change, resistance to natural disasters;
- Allow reservation, conservation of greenspaces that has landscape/biological values, specifically the areas that were recommended in the ESIA. Create greenspace surrounding the buildings for micro-climate regulation and user-friendly landscaping.
- Apply green infrastructure design approach, maintaining or creation of infiltrable surfaces, minimise conversion of existing groundsurface into impermeable ones.
- Avoid, minimise filling up existing water bodies, retain rainwater recharge to existing streams, lakes within the areas disturbed by the subproject.
- Include solutions for Rainwater harvesting and benefical use such as for tree watering and/or reserve for fire fighting)

- Avoid discharge of treated wastewater into relative still water bodies such as lakes, direct the treated wastewater to running waters such as streams and rivers that have adequate carrying capacity for dilution/further natural treatment.

EXTERNAL AND INTERNAL CONNECTIVITY:

- Internal roads will be connected to National Highway 21, Lang Hoa Lac road and urban transport system. Roads will be suitable to pedagogical environment, not affected by heavy traffic, traffic emmisions and noise.
- Parking lots, traffic and transportation systems should be in ways that minimize the negative impacts of vehicles on pedestrians. Establish a pedestrian-only area where all traffic means are prohibited. The indoor and outdoor limited parking lots will be designed in a safe, friendly and attractive structure. Outdoor parking spaces will be pedestrian-friendly with beautiful, light and translucent design sheds, or climbing rigs or some other method of shading pedestrian walkways.

BUILDING DESIGN

Apply the approach of "green building" to achieve high efficiency in using energy and materials, minimizing negative environmental and health impacts through:

- Choose environmentally friendly materials, minimizing negative effects such as greenhouse effect, concretization effect, etc.
- Choose environmentally friendly materials where applicable;
- ensure that interior materials do not emit toxic gases and adversely affect physical and mental health of the users;
- Ensure the in-door noise level is lower than the allowable limits;
- Minimize energy use, manage and control lighting and save energy;
- Architecture design suits the functions of the facilities and with cultural values incorporated
- Building Management System (BMS) including Electricity distribution stations, backup generator, lighting system, air conditioning and ventilation system, fire alarm and fire fighting system, elevators, public sound system, access card system and security system
- Take advantages of building site and climate attributes to reduce heating, cooling and lighting loads, integrating landscape design for shading and windbreaks, incorporating renewable energy where possible.
- Ensure adequate ventilation to maintain in-door air quality and reduce energy consumption on air-conditions
- Maximise the use of natural lights, provide nice view of the surrounding environment
- Choose electricity-saving auto-electrical equipments
- Water storage tanks and pipelines have spill control and leakage control system
- Choose auto-taps, and other water-saving equipment in lavatories andtoilets

Universal access

- Buildings have ramps that enable access of disabled people. The slope and width of the slope shall comply applicable design standards and ensure that the disabled and aged people can access safely and conveniently.
- The width of elevators, doors, corridors, toilets, etc. ensure access of wheelchair and ensure safe access of the aged people and people with disabilities.
- Technical infrastructure outside the buildings will consider the movement of the aged people and disabled people.

- Footpath: the sidewalk section will be levelled and paved with brick with few joints and few grooves in the surface. The size between grooves and expansion joints between concrete slabs shall be less than 15mm, should be 5 mm to ensure safe movement of wheelchairs, aged people and the children.
- Use trees or different colors or lines as separators for bicycles and pedestrians

General Facility Design

Integrity of Workplace Structures

- Permanent and recurrent places of work should be designed and equipped to protect Occupational Health and Safety (OHS):
- Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds. Avoid the use of materials and chemicals that generate harmful gases.
- Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.
- Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.
- Floors should be level, even, and non-skid.
- Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.

Workspace and Exit

Exits are clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.

- Facilities will be designed and built to ensure access for disabled persons.

Fire Precautions

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment.
- Fire and emergency alarm systems that are both audible and visible

Water Supply

- Adequate supplies of potable drinking water will be provided

Lavatories and Showers

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility For laboratories where staff may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.

Lighting

- Maximise the use of natural light. Supplement sufficient artificial illumination to promote safety and health, and enable safe equipment operation. Use solar energy and other forms of electricity towards a green and friendly environment if possible. Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

- *Backup power in case of emergency:* Emergency power supply/standby power supply is required for buildings as required for professional operations. The generatorshould be placed in a well ventilated location to ensure maximum efficiency. The highest noise level, vibration and pipe and pipe dimensions will be combined in harmony with the layout of the building during the detailed design phase.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

Openings should be sealed by gates or removable chains

- Covers should, if feasible, be installed to protect against falling items
- Measures to prevent unauthorized access to dangerous areas should be in place

Fire Suppression and Control:

Fire suppression and control includes all automatic and manual fire protection installations, such as automatic sprinkler systems, manual portable extinguishers and fire hose reels

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and processrelated emissions. Air distribution systems should be designed so as not to expose workers to draughts

Labeling of Equipment

- All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, should be labeled as to the contents and hazard, or appropriately color coded.
- Piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

WASTEWATER TREATMENT PLANTS

- Final siting of the WWTPs will ensure that it is not exposed to the common/public areas, at end of wind direction;
- Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines.
- Ensure that receptors's carrying capacity is adequate to receive the treated wastewater
- Install railing around all process tanks and pits.
- Install safety showers and eye wash stations near the chlorine equipment and other areas where hazardous chemicals such as chlorine and soda (NaOH)are stored or used.
- Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;

LABORATORIES

- FS and Detail design team will work with qualified and experience university laboratory staff and managers to prepare necessary documents and procedures to ensure that only legtimate and reliable suppliers will be contracted by the project to supply equipment and setting up the new laboratories or relocation and reinstallation of existing laboratories. The documents to be prepared will include adequate , detail Specifications with regards to Environmental, Health and Safety (EHS) The Supplies / service providers will be required to comply with such specifications to ensure safe safe handling, transportation, installation, commissioning/test runs of the laboratories. and commissioning of new laboratories. The Manufactures and Suppliers are also required to provide detail technical and EHS instructions, laboratory operational procedures and regulations and adequate trainings for laboratory the operators.
- The laboratories will be separated from the main training/academic area. Separate lines for laboratories wastewater collection and treatment, and ventilation. The chemical laboratories will be designed to ensure that they do not affect, or at the minimum allowable level for the general environment.
- VNU-HN will contract authorized/licensed service provider carry out relocation of laboratory equipment and machines from the existing campus to the newly built laboratory rooms. The Detail design consultant will engage competent experts and coordinate with VNU-HN member benefited institutions to develop TORs for relocation will include ESHS requirements. VNU-HN will be responsible for coordinating with the consultants to carry out characterization of the equipment and machines, develop special ESHG during dismantling, handling, transporation, reinstallation, recommissioning and testing. Auditing on laboratory safety and updating laboratory regulations will also be carried out by relevant VNU-HN member institutions before commencement of laboratory operations in the new campus

5.1.2. The Measures proposed for Incorporation into Construction phase documents

5.1.2.1. Mitigation Measures for Common Construction Impacts

The mitigation measures for common construction environmental and social impacts and risks during the construction phase are presented in **Table 5.1** in the form of Environmental Codes of Practices (ECOP).

ECOP and relevant type-specific and site-specific mitigation measures will be included in all bidding documents and construction contracts of all bid packages to request the contractors to implement or comply with. After contract signing, each contractor will be required to prepare Contractor's Environmental and Social Management Plan (C-ESMP) to cover all measures that the contractor will carry out to address potential impacts and risks associated with the works that they are contracted to implement. Contractor's environmental compliance will be monitored and supervised by the Construction Supervision Consultant (CSC) in coordination with PMU. The Independent Environmental Monitoring Consultant (IEMC) to be contracted by PMU will carry out periodical random monitoring to verify compliance or recommend the corrective measures as appropriate.

ECOP, detailed in **Table 5.1**, includes the measures to address the common construction environmental impacts and risks identified and assessed in the ESIA: Impacts on air quality because of dust, exhaust, noise, and vibration; Wastewater and Solid waste; Localised flooding risks; water pollution; Erosion and Sedimentation; Traffic Disturbance and Safety Risks; Impacts on organism, aquatic system; Impacts on landscapes; Chance Finds; Social Impacts; Health and Safety of Communities and the Workers; Hazard Risk.

Table 5.1. Environmental Code of Practices (ECOP)

Environmental-social issues	Mitigation measures	Vietnamese regulation
1) Generated Dust, Emission, Noise, Vibration	• Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality. • Vehicles for transportation must undergo a regular emissions check and obtain certification: "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QD-BGTVT • Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. • Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. • Dust masks should be used by workers where dust levels are excessive • There should be no burning of waste or construction materials on site. • Cement processing plants should be far from residential areas. • Only use transportation vehicles with valid registry. • Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift. • Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes. • Put temporarily gathered materials and waste heaps with a volume of about 20m3within barriers or covered so as to avoid dust dispersion. • Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time. • Do not put vehicles and machines to run idle in more than 5 minutes. • Avoid preparations of construction materials such as mixing concrete near offices. • Locate vehicle washing stations at the exit/entrance of big construction sites. • Periodically wash the trucks used for transporting materials and construction wastes. • Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to	• QCVN 05: 2013/MONRE: National technical regulation on ambient air quality • QCVN 26:2010/BTNMT: National technical regulation on noise • QCVN 27:2010/BTNMT: National technical regulation on vibration • TCVN 6438-2005: Road vehicles. Maximum permitted emission limits of exhaust gas • Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection;

Environmental-social issues	Mitigation measures	Vietnamese regulation
	the community at least 2 days in advance. • Observe and secure construction progress correctly. • When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas	
2) Wastewater Management	• The Contractor must be responsible for compliance with Vietnamese legislation relevant to wastewater discharges into watercourses. • Employ local workers to limit the amount of generated domestic wastes and wastewater. • Provide septic tanks for toilets for treating wastewater before it can be discharged into the environment. On-site mobile toilets with 3-compartment septic tanks can be used in areas for major work items as traffic roads. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any waterbody • Wastewater containing pollutants over standards set by relevant Vietnamese technical standards/regulations must be collected in a conservancy tank and removed from site by licensed waste collectors. • Do not wash vehicles or machines at the stream or lake • Clear ditches around the workers' camps every week. • Build sedimentation ponds and ditches to receive stormwater runoff at the construction sites such as areas of buildings and the WWTP. • Before construction, all necessary wastewater disposal permits/licenses and/or wastewater disposal contracts have been obtained. • At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed or effectively sealed off	• QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; • QCVN 40: 2011/ BTNMT: National technical regulation on industrial wastewater
3) Solid Waste Management	• Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by the Contractors and it must be carefully followed during construction activities. • Before construction, all necessary waste disposal permits, or licenses must be obtained. • Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal through a licensed waste collector. • Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof.	• Decision No, 59/2007/NĐ-CP on garbage management; • Decision No, 38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management

Environmental-social issues	Mitigation measures	Vietnamese regulation
	• No burning, on-site burying or dumping of solid waste shall occur. • Clean up the work area and collect rubbish at the end of each day - use the dustbins and make sure that trash is not blown away by the wind. • Smoking is only allowed at designated areas and carefully dispose of used cigarettes and matches (littering is an offense) • Do not litter or dump food at the site • Do not throw garbage indiscriminately • If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses. • Limit waste pollution from litter and drop of materials. Place dustbins at the workers' camps. • Temporarily collect and separate domestic wastes. Provide watertight dustbins for domestic waste and tightly cover them to avoid giving rise to bad odors and leachate leakage, attracting flies, mice and other pathogenic species. Periodically collect and transport the waste to the dispose. • Perform concrete mixing on impermeable ground. Collect waste and wastewater containing cement through drainage ditches with sedimentation pits in construction sites before being discharged into receiving waters. • Separate the components and parts which can be reused or recycled in the construction wastes before transporting the waste to the site in accordance with design documents acceptable to the supervision engineer. • Wood scraps may be used for cooking. Corrugated iron, iron, steel, packing materials and other materials which can be recycled can be delivered and sold to scrap traders. • Collect waste and tidy up construction sites at the end of a working day/shift and the transport waste out of the construction sites in the soonest possible time. • The Contractor will sign a contract with local environmental authority to collect solid waste, conforming to Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management and Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials.	
4) Hazardous Waste Management	• Fuels and chemicals must be safely stored in areas with impermeable ground with roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds;	• Circular No. 36/2015/TT-BTNMT on hazardous waste management; • Decision No. 38/2015/NĐ-CP

Environmental-social issues	Mitigation measures	Vietnamese regulation
	• Collect, store, and transported for treatment all hazardous wastes (road asphalt, waste oil and grease, organic solvents, chemicals, oil paints, etc.) in accordance with Circular No. 36/2015/TT-BTNMT on management of hazardous waste. • Collect and temporarily store used oil and grease separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources. Sign contracts with for oil and grease to be delivered to suppliers/ manufacturers • Do not use unapproved toxic materials, including paint containing lead, asbestos, etc .; • The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. • Used oil and grease shall be removed from site and sold to an approved used oil recycling company. • Do not perform any maintenance (change of oil and filter) of cars and equipment outside the designated area. • Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by n approved specialized oil recycling company for disposal. • Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. • Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. • Relevant agencies shall be promptly informed of any accidental spill or incident • Store chemicals appropriately and with appropriate labelling • Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards • Report all incidences of oil spills immediately and prevent any risks of oil spills • Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions. • In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s): o The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU;	dated 24/04/2015 on waste and scrap management

Environmental-social issues	Mitigation measures	Vietnamese regulation
	○ The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked; ○ Should the accidents/ incidents generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage into the nearby water bodies, the Contractor shall immediate inform PMU; ○ In such cases, the Contractor(s) shall take immediate action to stop the spillage / leakage and divert the spilled / leaked liquid to nearby non-sensitive areas; ○ The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground); and ○ Depending on the nature and extent of the chemical spill, evacuation of the activity site may be necessary; ○ Spilled chemicals must not be flushed to local surface drainage systems. Instead, sawdust or sandbags used for clean-up and removed contaminated soil shall be disposed of by following the procedures for chemical waste handling and disposal already described; ○ The Contractor(s) shall prepare a report on the incident detailing the accident, clean up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future. The incident report shall then be submitted to the Supervision Engineer and PMU for review and keep in the records. The incident report shall also be submitted to DONRE, if required;	
5) Water Pollution	• The Contractor is responsible for controlling the surface water quality when discharging it out of the construction site, in accordance with QCVN 08-MT:2015/BTNMT – National Technical Regulation on surface water quality and QCVN 14:2008/BTNMT – National Technical Regulation on domestic wastewater quality. • Store used and unused oil and petrol on impermeable ground covered with roofs, with warning (flammable and danger) signs, and contained within surrounding fences for easy control and collection in case of leakage. Locate oil and petrol storages areas at least 25m	• QCVN 09:2008/BTNMT: National technical regulation on underground water; • QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; • QCVN 40: 2011/ BTNMT: National technical regulation

Environmental-social issues	Mitigation measures	Vietnamese regulation
	from any ponds, lakes, rivers, and streams. Restrict accessibility to this temporary storage, only to authorised persons can access; • Provide preliminary sedimentation ponds and ditches of stormwater runoff at the construction sites especially at area of the WWTP and Zone 4 near Da Lat lake. • Provide construction workers on site with mobile toilets. • Use hygienic sanitary facilities • Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors; • Collect and keep used/waste oil and materials polluted with oil/chemicals in containers, store in safe place (on impermeable ground, roofed, fenced and with warning signs) for regular collection by licensed dealers; • Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors; • Provide sedimentation pits and ditches at the construction sites; • Provide appropriate toilets for the workers to use; • Temporary loading of construction materials or concrete mixing are allowed only at places which are at least 50m from any ponds, lakes, rivers, streams, or other water sources, or at maximum possible distances between the temporary loading locations and the canals; Do not discharge waste, garbage, oil or foreign materials into water. Do not wash in rivers, lakes • Avoid excavation and backfilling in rainy weathers. • Gather materials and wastes generated during excavation and backfilling, collect and transport them out of the construction site to the approved disposal sites within the soonest possible. • Do not allow temporary gathering of bulk materials and mixing of concrete within 50m from ponds, lakes, rivers, streams, or other water sources. • Store used and unused oil and petrol in closed containers on impermeable ground covered with roofs and contained within surrounding banks for easy control and collection in case of leakage. Do not locate oil and petrol storages within 25m from ponds, lakes, rivers, and streams. • Collect and transport excavated soils from the construction of sewers and ditches out of the construction site within 24 hours. • Only perform maintenance work of motored vehicles and equipment, including oil replacement or lubrication in designated areas, without allowing chemicals, petrol, oil, or grease to leak onto soil or	on industrial wastewater; • TCVN 7222: 2002: General requirements for concentrated wastewater treatment plants

Environmental-social issues	Mitigation measures	Vietnamese regulation
	into the drainage system or water sources. Trays are to be used to hold rags and materials used in maintenance. Collect and dispose of the wastes in accordance with hazardous waste management regulation.	
6) Impacts on Plants and Aquatic Species	• The Contractor shall prepare a Clearance, Re-vegetation and Restoration Management Plan. • Avoid disturbances and damage to the existing vegetation and green trees. • Do not load materials and wastes at places having vegetation cover. Load them on barren land instead; • If trees can be replanted somewhere, move them instead of cutting the trees down; • If any invasive species are found during construction phase, burn them before disposed of to prevent them from regrowing at disposal site; • Chemicals must not be used to clear vegetation; • Maintain flow where possible to retain aquatic lives (More details are described in specific mitigation measures). • Minimise the areas disturbed, especially in locations having trees or vegetation; Determine areas to be undisturbed for protection during construction. • Do not remove or damage the vegetation without direct instructions. • Do not hurt, trap, feed or harm any animal - including birds, frogs, snakes, etc. • Do not cut trees outside the approved construction area for any reason • Do not buy any wildlife for food; • Birds and animals must not be kept in cages in camps • No collection of firewood. • Do not fish with fishing rod or dynamite • Do not burn litter that damages vegetation. • Limit disturbances to areas with construction operations, especially in locations covered with green trees or vegetation. Do not use chemicals to clear vegetation. • Do not gather materials and wastes at places covered with vegetation or with green trees, but on vacant land instead. • If possible, green trees should be moved and replanted in other places if the trees are in the way of the pipelines to be constructed. • The contractor shall remove topsoil from all areas where topsoil will be impacted by construction activities, including temporary activities such as storage and stockpiling, etc; the stripped topsoil	• Law on environmental protection No. 55/2014/QH13

Environmental-social issues	Mitigation measures	Vietnamese regulation
	shall be stockpiled in areas agreed to by the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. • Trees cannot be cut down unless explicitly authorized in the vegetation clearing plan. • When needed, temporary protective fencing will be erected to efficiently protect the preserved trees before commencement of any works within the site. • No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CSC, who should consult with PMU, IEMC and the relevant local authorities. This could include areas of breeding or feeding for birds or animals, fish spawning areas, or any area that is protected as a green space. • The Contractor shall ensure that no hunting, trapping, shooting, poisoning of fauna takes place.	
7) Sedimentation, Erosion, Flooding, Subsidence and Slides	**Management of Flooding Risks** • Periodically and thoroughly remove soils, stones and wastes from drainage sewers and ditches inside and around the construction site. • Neatly gather materials and wastes so as to limit them being swept away by stormwater. • Carry out ground levelling and rolling after discarding materials at disposal sites. • Install supports to protect the walls where excavation is deeper than 2 m. • Check the existing drains within and surrounding the construction sites, improve before levelling to ensure rainwater can be drained properly; • Load construction material and wastes at least 10 m from any existing drainage ditches or water sources to minimise materials from entering the channels which may lead to sedimentation and blockage; • Clean up the existing drains regularly. **Erosion and Sedimentation Control** • Transport the waste out of the site within the shortest time possible but this operation should not last more than 2 days; • Install and maintain sedimentation traps within and/or surrounding centralised construction sites. Remove the soil, stone and waste periodically from the traps to maintain their functions; • Gather the materials and waste neatly to limit the amount of materials being swept away by stormwater; • Carry out levelling and rolling after waste disposal at the disposal sites in order to minimise	• TCVN 4447:1987: Construction regulation • Circular 22/2010/TT-BXD: Regulation on construction safety • QCVN 08:2008/BTNMT – National technical regulation on surface water quality

Environmental-social issues	Mitigation measures	Vietnamese regulation
	erosion; • Use Larsen sheet piles for protecting the walls/slopes when excavation is deeper than 2.5m. Reinforcing piles must be checked and maintained to ensure stability of excavated trenches and holes; • Levelling the disturbed areas to prevent erosion; • Strictly avoid disturbance or damages to the existing vegetation and trees. **Measures to Control Landslides and Subsidence** • Limit disturbances to construction areas, especially in locations currently with green trees or vegetation; • Use Larsen sheet piles for building prop walls when excavation is performed to a depth of 2.5m and more; • Reinforce weak slopes and protect them with sandbags when there are high risks of erosion and landslides or in case of visible gully erosion;	
8) Traffic Management	• Install and maintain sign boards, fences, signal lights to direct traffic to ensure traffic safety. Ensure adequate lighting at night time; • Only use vehicles with valid registration. Trucks must be covered to prevent materials from dropping along the routes to cause dusts and accidents;Arrange and provide separate passageway with safe and easy access for pedestrian and for people with disability and mobility issues especially the areas in proximity of schools, including easy wheel chair access and hand rail. Make staff available any time for helping people with disability if needed. • Set up traffic and maintain instruction signs and warnings to secure safety for people and means of transport during construction. • Put speed limit signs at a distance of 200m from the construction site. • Carefully cover materials on trucks. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. Collect spilt soils and materials at the construction site each day to avoid slippery incidents for vehicles. • Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements. • Water the roads to prevent dust, limit the speed of traveling trucks, do not allow flared horns, and do not dispose the waste and wastewater onto areas near office areas of the VNU-HN	• Law on communication and transport No. 23/2008/QH12; • Law on construction No. 50/2014/QH13; • Law No. 38/2009/QH12 dated 19/6/2009 amending and supplementing some articles of the Law relating to capital construction investment • Circular No. 22/2010/TT-BXD on regulation on construction safety

Environmental-social issues	Mitigation measures	Vietnamese regulation
	• Install night lighting of all construction sites. • Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. • Installation of lighting at night must be done, if necessary, to ensure safe traffic diversion. • Avoid material transportation for construction during rush hours. •	
9) Influence to Existing Infrastructure and Services	• The Contractor must only use vehicles of sizes and loads within permissible limits for the roads along such vehicles' route. • Arrange workers to direct crane operators; • Stop construction when existing works are damaged. Identify causes of related incidents and work out solutions. In case the damages are due to the Contractors' faults, the Contractors have to repair, recover, and compensate for all damages at their own expenses. The results of handling such damages must be approved by the Supervisor Engineer. • Reinstate all road surface, sidewalks and other exiting infrastructure disturbed or damaged at construction sites after the construction has been completed. • Any damages to existing cable utility systems shall be reported to the PMU and repaired by the contractor as soon as possible.	• Decree No. 73/2010/ND-CP on administrative penalization of violations related to security and social affairs
10) Social Mitigation Measures Through Worker Management	• Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction; • The contractor register the list of workers with the local authorities for temporary residence; • The contractor inform the community about construction plan at least 2 weeks before commencement of the construction; • Employ local laborers for simple tasks. Instruct workers on environmental issues, safety and health before construction tasks are assigned. It is advisable to communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people. Communication should cover, but not limited to the followings: (i) Use adequate safety gear provided; (ii) Do not litter construction sites; (iii) Storing or use of weapons and toxic substances is prohibited; (iv) Do not cut trees outside construction sites or set fire to waste on-site(except invasive plants); (v) + Drinking of alcohol during working hours is prohibited; (vi) Do not operate construction plant if not authorised to do so; (vii) Do not engage in quarrelling, fighting,	• Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs

Environmental-social issues	Mitigation measures	Vietnamese regulation
	gambling or social evils such as drug use, prostitution; and (viii) Do not litter the sites and the surrounding areas • The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. • The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. Conduct sensitization campaigns with both workers and communities on these issues, liaison with local organizations to ensure monitoring, and a grievance redress system to which the community can refer to. • The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. • Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence. • Provide training on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/ AIDS and infectious diseases for the workers within 2 weeks since mobilization of the workers in each construction contracts which last at least 6 months. This training is mandatory. • The workers are required to comply with Code Conduct specify in construction contract • Do not hire people under 18 years of age to carry heavy objects (from 15 kg), to carry out demolition, work in construction sites, or work underwater. • Avoid construction operations that generate loud noise such as piling before 6am and after 10 pm. Where construction at nighttime is inevitable the community must be informed at least 2 days in advance ; • Rolling/stagged construction methods shall be applied to pipeline installation packages. Construction should be performed within the shortest possible time, particularly at sections passing populated residential or business areas; • Construction sites shall be kept tidy and safe; • Provide training to workers on the Codes of conducts and modes of communication with local communities • Medical checkups for workers are to be periodically performed. People with highly infectious diseases shall not be employed.	

Environmental-social issues	Mitigation measures	Vietnamese regulation
11) Control of Impacts on Physical Cultural Resources	• No damages or violation permitted to any cultural, historical, and religious works. • In case of archaeological objects being unearthed during the implementation of earthwork, all parties will conform to the following procedures: + Suspend construction operations at the place of discovery; + Preliminarily describe the area where the archaeological objects are to be unearthed; + Strictly protect the area of the discovery so as not to damage or lose moveable objects. In case the unearthed objects are moveable or sensitive ruins, provide night protection until the local authorities, the Department of Culture, Sports and Tourism or the Institute of Archaeology takes over these unearthed objects; + Inform the Supervision Engineer of the event and who in turn will immediately inform the subproject owner, the local authorities in charge of the case and the Institute of Archaeology (within 24 hours or less); + Local relevant agencies and the Vietnam National Administration of Tourism will be responsible for protecting and preserving such archaeological relics before making decisions on the next suitable formalities. The Institute of Archaeology may be needed in the preliminarily assessment of the unearthed objects. The significance and importance of such discovered objects will be assessed by different criteria related to the nature of cultural heritages; such criteria would include aesthetic, historical, scientific, social or economic values; + Decisions on handling such discovered objects will be made by competent levels. Such decisions can result in changes in site arrangements (e.g. when the discovered item is a cultural relic which cannot be displaced or is archaeologically important, it is necessary to preserve, recover and excavate it); + The implementation of such decision by competent agencies related to the management of discovered objects will be communicated in writing by local competent agencies; and + Only resume construction activities at the site after being permitted by the local competent agencies and the PMU in relation to safeguarding such relics	• Law on cultural heritage No. 28/2001/QH10; • Amended and supplemented Law on cultural heritage No. 32/2009/QH12; • Amended and supplemented Decree No. 98/2010/ND-CP
12) Community's Safety and Health	• The Contractor will have to conform to regulations in Circular No. 04/2017/TT-BXD by the Ministry of Construction on safety in construction. • The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. • The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. • Do not disturb or cause trouble to community	• Circular 04/2017/TT-BXD regulates construction safety - TCVN 5308-91: National standard on construction safety - Decision. 96/2008/QD-TTg on clearance of unexploded ordnance

Environmental-social issues	Mitigation measures	Vietnamese regulation
	• Fence of excavation pits and open channels and make off with luminous cordon and warning signs. Provide sufficient lighting when carry out construction at night. • Limit the speed of transport means to 20km/h within 200m from the construction site so as to minimize dust and noise. • Keep noise-generating machines and vehicles at such suitable distances that noise transmitted to residential areas will not be higher than 70dBA. • Use static compacting when the road base is constructed near areas with many households and weak temporary works to restrict vibration. • The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers.	
13) Workers' Health Safety	• Electrical lines will be arranged in a safe manner, no wires will be place on the ground or without proper plug. Electrical panel placed outside must be protected from weather and for safety; • Oil, fuel and chemicals will be stored at least 10 m from workers' accommodation and Contractor's Site office. These hazardous must be stored on water-proofed floor, bound and roofed. Warning signs must be placed at that storage area; • • Provide training for the workers on issues related to environment, safety and health including awareness raising on HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. • Provide workers with and request them to use adequate safety gear such as masks, gloves, belts, helmets, shoes/boots, goggles, etc. depending on job characteristics. • • Safely install and maintain power lines, switches etc. at site-offices and in construction sites and do not lay connectors on the ground or water surface. Electric wires must be with plugs. Place outdoor electric panels in protection cabinets.. • Limit the speeds of vehicles traveling inside construction sites to be 5km/hour. • Do not set fires, including small fires. • .	• Decree No. 04/2017/TT-BXD on regulation of construction safety; • TCVN 5308-91: Technical regulation on safety in construction; • Decision No. 96/2008/QD-TTg on clearance of UXOs.

Environmental-social issues	Mitigation measures	Vietnamese regulation
	• Provide fire-extinguishers, first-aid kits, and medical cabinets with sufficient medicines for treating common diseases in the locality must be provided at site office and the camp. • In case occurring the accident, the contractor should immediately cease the execution, take the first aid to the victim then to move to the nearest medical firm, to report the supervisor and investor. • Safely store fuels and chemicals in areas with impermeable ground with roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds. • Immediately report on any case of worker or animal injuries. • In case of chemical and fuel leakage, the following steps will have to be taken: • Immediate check must be carried out to detect any possible case of injury. In case of injury, first-aid must be given and the injured person must be rushed to the nearest medical station for healthcare, and at the same time the case must be informed to the Supervision Engineer and the PMU; • Carry assessment to determine the kind of leaking/overflowing fuel/chemical; • Do not flush overflowing chemicals into drainage systems. Send staff with suitable safety gear to the site to handle the leakage by scattering sawdust (in case of small volumes of leaks/overflow) or sand (for high volumes of leaks/overflow). Use shovels to remove the surface soil layer if the leakage/overflow takes place on vacant land; and • Subsequent to the occurrence of such incident or accident, the Contractor will have to prepare a detailed report describing the incident and performed activities and submit the same to the Supervision Engineer and the PMU for consideration and filing. Such report will also be presented to the Department of Natural Resources and Environment or functional agencies at their request • Set up the camps with sufficient supplies of clean water, power, and sanitation facilities. There must be at least one toilet compartment for every 25 workers, with separate toilets for males and females. Workers' beds must be provided with mosquito nets so as to prevent dengue fever. Temporary tents will be unacceptable. • Clean camps, kitchens, baths, and toilets and sanitize regularly, and keep in good sanitation conditions. Provide dustbins and collect wastes daily from the camps. Clear drainage ditches around the camps periodically. • Stop all construction activities during rains and storms, or upon accidents or serious incidents. • The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers.	

Environmental-social issues	Mitigation measures	Vietnamese regulation
14) Management of Warehouses and Borrow Pits	• All borrow pit locations to be used must be previously identified in conformity with approved construction technical specifications. Sensitive sites such as scenic spots, areas of natural habitat, areas near sensitive receiving waters, or areas near water sources should be avoided. An open ditch shall be built around the stockpile site to intercept wastewater. • Retaining walls are to set up around disposal areas if necessary. • The use of new sites for stockpiling, gathering or exploiting materials necessary for construction operations must obtain prior approval from the Construction Engineer. • PMU's Environment Officer should conduct due diligence to make sure that borrow pits and quarries are legally operating by undertaking a rapid review of quarry sites to assess if operations are in compliance with Vietnamese laws and Bank requirements prior to construction. • Include the requirement that the contractors shall be required to buy materials from licensed borrow pit and quarry operators into the civil work contractual documents.	•
15) Communication to Local Community	• The contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labor safety in construction operations; • Copies of Vietnamese versions of these ECOPs and of other relevant environmental protection documents shall be made available to local communities and to workers at the site. • Subproject information will be disseminated to affected parties (e.g. local authorities, enterprises and affected households, etc.) through community meetings before construction commencement. • A contact address will be provided to the community. • The community will be provided with all information, especially technical findings, in a language that is understandable to the general public and in a form convenient to interested citizens and elected officials through the preparation of fact sheets and news releases, when major findings become available during subproject phase. • Community concerns and requested information are to be monitored as the subproject progresses. • Inquiries must be responded by telephone and written correspondence in a timely and accurate manner. • Local residents must be informed about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition operations, as appropriate. • Notification boards shall be erected at all construction sites providing information about the subproject, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that affected people could have a	• Decree No. 167/2013/ND-CP stipulating the sanctioning of administrative violations in the field of security, social order and safety, prevention of social evils, fire prevention and fighting, domestic violence prevention

Environmental-social issues	Mitigation measures	Vietnamese regulation
	channel to voice their concerns and suggestions. • In case of epidemic outbursts, the Project shall cooperate closely with the local government to carry out the required mitigation and control measures; • Fence centralized construction sites with solid materials of at least 2m high; • Place warning signs and fence the open pits, channels to prevent accident; • Sufficient lighting will be provided when construction is carried out at night; • Apply speed limits at 10km/h within 200m from the construction; • Where possible, place machines generating high level of noise as far as possible from residential houses and public areas so as noise level and be kept below 70dBA;	

Workers and Workforce Management

A concern during construction phase of the project is the potentially negative impacts of the workforce interactions with the local communities. For that reason, a Code of Conduct shall be established to outline the importance of appropriate behavior, alcohol abuse, and compliance with relevant laws and regulations. Each employee shall be informed of the Code of Conduct and bound by it while in the employment of the Client or its Contractors..

The Contractor is responsible for providing appropriate training to all staff according to their level of responsibility for environmental, health and safety matters.

The Code of Conduct should contain at least the following (but not limited to them):

- Compliance with applicable laws, rules, and regulations of the jurisdiction;
- Compliance with applicable health and safety requirements (including wearing prescribed personal protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment);
- Priorities the use of local labours;
- The use of illegal substances, weapons and firearms and gambling are prohibited;
- Non-Discrimination (for example on the basis of family status, ethnicity, race, gender, religion, language, marital status, birth, age, disability, or political conviction);
- Interactions with community members with attitude of respect and non-discrimination);
- Creating nuisances and disturbances in or near communities shall be prohibited;
- Disrespecting local customs and traditions shall be prohibited;
- Smoking shall only be allowed in designated areas;
- Sexual harassment (for example to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate) is prohibited;
- Violence or exploitation (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior) is prohibited;
- Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behavior with children, limiting interactions with children, and ensuring their safety in project areas);
- The workers have access to drinking water supply and appropriate sanitary facilities provided by their employer and not open areas);
- Avoidance of conflicts of interest (such that benefits, contracts, or employment, or any sort of preferential treatment or favors, are not provided to any person with whom there is a financial, family, or personal connection);
- Respecting reasonable work instructions (including regarding environmental and social norms);
- Protection and proper use of property (for example, to prohibit theft, carelessness or waste);
- Duty to report violations of this Code;
- Non-retaliation against workers who report violations of the Code, if that report is made in good faith; and
- Residing camp workforce visiting the local communities shall behave in a manner consistent with the Code of Conduct.

The Code of Conduct should be written in plain language and signed by each worker to indicate that they have:

- Received a copy of the code;
- Had the code explained to them;

- Acknowledged that adherence to this Code of Conduct is a condition of employment; and
- Understood that violations of the Code can result in serious consequences, up to and including dismissal, or referral to legal authorities.

Prohibitions. The following activities are prohibited on or near the project site:

- Cutting of trees for any reason outside the approved construction area;
- Hunting, fishing, wildlife capture, or plant collection;
- Buying of wild animals for food;
- Use of unapproved toxic materials, including lead-based paints, asbestos, etc.;
- Disturbance to anything with architectural or historical value;
- Building of fires;
- Use of firearms (except authorized security guards);
- Use of alcohol by workers during working hours;
- Gambling should be strictly forbidden.
- Washing cars or machinery in streams or creeks;
- Doing maintenance (change of oils and filters) of cars and equipment outside authorized areas:
- Disposing trash in unauthorized places;
- Driving in an unsafe manner in local roads;
- Having caged wild animals (especially birds) in camps;
- Working without safety equipment (including boots and helmets);
- Creating nuisances and disturbances in or near communities;
- The use of rivers and streams for washing clothes;
- Indiscriminate disposal of rubbish or construction wastes or rubble;
- Littering the site;
- Spillage of potential pollutants, such as petroleum products;
- Collection of firewood;
- Poaching of any description;
- Explosive and chemical fishing;
- Latrine outside the designated facilities; and
- Burning of wastes and/or cleared vegetation.

Security. Some security measures shall be put into place to ensure the safe and secure running of the camp and its residents. Some of these security measures include:

- The list of workers must be registered to local authorities in accordance with existing Vietnamese regulations
- Children under 14 years of age will hot hired under the Project
- Adequate, day-time night-time lighting shall be provided;
- Control of camp access. Access to the camp shall be limited to the residing workforce, construction camp employees, and those visiting personnel on business purposes;
- Prior approval from the construction camp manager for visitor's access to the construction camp;
- A perimeter security fence at least 3m in height constructed from appropriate materials;
- Provision and installation in all buildings of firefighting equipment and portable fires extinguishers.

Any construction worker, office staff, Contractor's employees or any other person related to the project found violating theses prohibitions will be subject to disciplinary actions that can range from a simple reprimand to termination of his/her employment depending on the seriousness of the violation.

Workers Camps

Workers' Camp and Site Installation Requirement. Potential sites of workers'camps were discussed with and proposed by local communities and authorities during consultations. Construction camp sites will have to be approved by local authorities and agreed with local communities prior to their establishment. If additional camps and ancillary construction sites are selected, for following criteria must be used:

- Construction sites, including asphalt stations as well as construction camps will minimize the land occupation by setting them at the interchange areas where relatively large areas of land will be needed eventually.
- Site offices shall be located at least 200 meters from any existing residential settlements. Camp facilities should not be located in steep slopes;
- Site offices, camps be located at least 100 meters from any watercourses and be operated so that no pollutants enter watercourses. Camp areas shall be located to allow effective natural drainage;
- All construction camps shall be zoned according to their use. For example, workers' camp zone, sanitary facilities, offices, etc.
- The workers' camp must be provided with clean water, electricity and mobile toilets. Workers' beds must be protected with mosquito nets;
- The camp, kitchen, bathing place and toilets should be cleaned up and tidied up regularly and kept in good hygienic conditions. The flow of drainage ditches around the camp should be periodically cleared;
- The workforce shall be provided with safe, suitable and comfortable accommodations. They have to be maintained in clean and sanitary conditions;
- In every site adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein;
- Potable water for human consumption shall be provided for at camps, site offices, medical facilities, and other areas. Potable water shall follow the National Standards for Drinking Water Quality, and the other municipal water will be in accordance with class A1 of QCVN 08-2008/BTNMT - National technical regulation on surface water quality.
- The camp can be characterized as a housing estate, and the water quota could refer to class A1 QCVN 08-2008/BTNMT - National technical regulation on surface water quality.
- Drainage, wastewater treatment and solid waste disposal of the construction site shall follow national regulations and the mitigation measures presented in the Contractor's Waste Management Plan.

Sanitary Facilities. In every camp site separate and adequate lavatory facilities (toilets and washing areas) shall be provided for the use of male and female workers. Toilet facilities should also be provided with adequate supplies running water, soap, and toilet paper. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions;

- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be;
- Sanitary arrangements, latrines and urinals shall be provided in every work place on the following scale: Where female workers are employed, there shall be at least one latrine for every 25 females or part thereof; Where males are employed, there shall be at least one latrine for every 25 males or part thereof;
- At every construction camp, there must be at least one septic tank. The wastewater from the tank shall not be discharged into any watercourses. The wastewater shall be periodically transported away by a water tank to the nearest treatment plant;

- Sewage tanks shall be designed and installed by the Contractor(s) in accordance with the National Design Code for construction of camps.

Medical Facilities. A medical and first aid kit shall be provided at each camp area. All consumables in the first aid kit should be checked and recharged regularly.

5.1.2.2. Environmental Mitigation Measures for specific civil works construction activities

Depending on the scope of work in each bid package, the Contractors will be required to comply with the specific requirements described below. The CSC and PMU shall monitor the Contractor's compliance.

Demolition of Existing Infrastructures

The following measures shall be implemented in order to protect workers and the public from falling debris and flying objects:

- Set aside a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels;
- Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable;
- Maintain clear traffic ways to avoid driving of heavy equipment over loose scrap;
- Provide all workers with safety glasses with side shields, face shields, hard hats, and safety shoes.

Earthworks, Cuts and Fill Slopes Management:

Earthworks, cuts and fill slopes shall be carefully managed to minimize negative impacts on the environment

- All earthworks shall be properly controlled, especially during the rainy season.
- The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation to avoid partially completed earthworks, especially during the rainy season.
- The Contractor shall use the excavated material from for filling unless the CSC consider the material unsuitable for filling;
- Any excavated cut or unsuitable material shall be disposed of in designated disposal areas as agreed to by the CSC;

Work in Heights

Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites. Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention will include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area
- Provide appropriate training in use, serviceability, and integrity of the necessary PPE for the workers
- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support 5000 pounds (also described in this section in

Working at Heights above), as well as fall rescue procedures to deal with workers whose fall has been successfully arrested. The tie in point of the fall arresting system should also be able to support 5000 pounds

- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces
- Proper use of ladders and scaffolds by trained employees
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or selfretracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall

Struck By Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable
- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged
- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle
- Ensuring moving equipment is outfitted with audible back-up alarms
- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Confined Spaces and Excavations

Examples of confined spaces that may be present in construction or demolition sites include: silos, vats, hoppers, utility vaults, tanks, sewers, pipes, and access shafts. Ditches and trenches may also be considered a confined space when access or egress is limited. The occupational hazards associated with confined spaces and excavations in construction and decommissioning sites should be prevented according to the following recommendations:

- Controlling site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning
- Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders
- Avoiding the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated

Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of projectspecific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition
- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including Additional information on the management and removal of asbestos containing building materials can be found in ASTM Standard E2356 and E1368 respirators, clothing/protective suits, gloves and eye protection

Welding/Hot Work:

Welding creates an extremely bright and intense light that may seriously injur a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. The Contractors are be required to comply with the folowings:

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.

Illumination

Work area light intensity should be adequate for the general purpose of the location and type of activity, and should be supplemented with dedicated work station illumination, as needed. Controls should include:

- Use of energy efficient light sources with minimum heat emission
- Undertaking measures to eliminate glare / reflections and flickering of lights
- Taking precautions to minimize and control optical radiation including direct sunlight. Exposure to high intensity UV and IR radiation and high intensity visible light should also be controlled
- Controlling laser hazards in accordance with equipment specifications, certifications, and recognized safety standards. The lowest feasible class Laser should be applied to minimize risks.

5.1.2.3. Site-specific Mitigation Measures

a. Specific Mitigation Measures in Zone 1

Table 5.2. Specific Mitigation Measures in Zone 1

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
Northeast of Zone 1 Adjacent to the roundabout of Road No. 4 and Road No. 1		At present, the Zone 1 is accessible by internal road No. 1 and road No. 4. On the two sides of the road, there are sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.) There is no households and no structures on the land. The typical ecosystem in this area is grassland, shrubs, scattered timber trees. The animals in Zone 1 are mainly reptiles and frogs Construction work items: - Administration and operation building (8-floor building); - Academy block (8-floor building); - Lecture hall building (8-floor building); - Specialized library buildings (5 5-floor buildings); - Building for practical activities and laboratory	- Increase raffic density and traffic safety risk, increase dust along this road -	- Install signboards such as "Work in progress", ahead, speed limit 5km/h, "danger" warning signs on Road No1 and 4 - Clean up the dirts along roads 1 and 4, 200 m long each, on days that trucks carrying out excavated materials out of the site
Northwest of Zone 1 Adjacent to road No. 1			- Damage to existing infrastructure such as water supply and drainage pipes, electrical and , telecommunication poles and cables. -	- Clearly set up the boundary of construction site, create safe entrance and movement corridors for construction plants to avoid existing infrastructure if possible. - Insltall signboard informing clearance height of existing wires swithin and surrounding construction site and arrange instructors when construction plants working nearby the poles and cables. - Reinstate/rebuild the damaged infrastructure
Southeast of Zone 1				

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
		(3-floor building); - International Conference Center and Hall (2-floor building); - Multi-function sport building 1,000 seats (5-floor building); - Service area (2-floor building); - Academic-business cooperation area (5-floor building); - Agricultural practice area (area of 1 ha); - Outdoor experimental area (area of 1 ha); - Technical infrastructure system and internal facilities		before commissioning - - .
			- Accidents to workers from being attacked by harmful insects such as ants, bees, spiders, and snake during site clearance or when working or living in camps near the bushes. -	- Warn the workers about harmful insects before site clearance, provide adequate PPE such as mask, gloves and boots for them to use - Ensure the camps are closed/tight to prevent invasion of harmful insects to the camp. Keep the areas within 10 m from the camp vegetation-free. Plant lemon grass to keep them away. - Evacuate the workers to the nearest healthcare facility if they are affected seriously by harmful insects
			- Biological impacts: trees, vegetation cover, some animals will be affected by construction activities or workers's behaviours	- Instruct the workers not to kill the insects/reptiles if found during site clearance, let them go or lead them to nearby not disturbed habitat

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
Southwest of Zone 1			-	-

b. Mitigation Measures for Specific Impacts in Zone 3

Table 5.3. Mitigation Measures for Specific Impacts in Zone 3

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
East of Zone 3 Adjacent to road 1 and the VNU-HN guest house area	 	The east side of Zone 3 is on the road No.1 entering VNU-HN village. The road has cross section of 32m. Facing to the area of VNU-HN guest house which is used as the office building for VNU-HN, welcoming guests and organizing of conferences.	- increased traffic, increasing the traffic safety risks	- Install signboards such as "Work in progress", speed limit 5km/h, "danger" warning signs on Road No1 and 4 - Clean up the dirts spilled on the 200 m section of roads 1 and 4 on days that trucks carrying out excavated materials out of the site
			- Damage to existing infrastructure , electrical and telecommunication cables and poles. - Impact of dust, noise and	- Clearly set up the boundary of construction site, create safe entrance and movement corridors for construction plants to avoid existing infrastructure if possible. - Insltall signboard informing clearance height of existing wires swithin and surrounding

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				construction site and arrange instructors when construction plants working nearby the poles and cables. - Reinstate/rebuild the damaged infrastructure before commissioning - .
			- Dust and noise affect the operation of VNU-HN guest house. Impacts on landscape	- All facilities are maintained in a neat and tidy condition and the site shall be kept free of litter; - Fence the construction site with solid materials if the construction site is exposed to sensitive sites; - Do not load construction materials or waste within 10 m from any existing buildings etc.;

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				- Clean up the construction site daily in construction areas within 200 m from any existing buildings; - Install solid fence along the side of the construction site that face the guest house to fully block the view from the guest house to the construction site. - The contractor clean up the road No1. weekly
West of Zone 3		The west of Zone 3 has a some areas for plantation of tea, short-term crops that local people cultivate while construction not started. There is a soil road in the middle of Zone 3 mainly being used by the farmers and trucks accessing atemporary material yardsit is expected that the material yard will be closed thus there will be no transportation activities on this road by 2020.	- Safety risks if the farmers keep accessing the site during construction phase	- Inform the farmers at least two weeks in advance (first announcement made by PMU 6 months in advance) the date that the site will be closed for construction before construction commencement - Place “restrict access” signboard, install fences and barriers,

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				arrange guards to prohibit unauthorized people from entering construction site -
South of Zone 3	 	South of Zone 3 is about 300m from a to residential cluster along Hoa Lac - Hoa Binh road. Currently the site is significantly covered with bush	Dust, noise and vibration impacts on residential cluster	- Inform community about construction schedule at least 2 weeks in advance - Install solid fences for noise and dust control . - Do not carry out activities that generate loude noise such as pile driving before 6 am or after 10 pm -
			- Accidents to workers from being attacked by harmful insects such as ants, bees, spiders, and snake during site clearance or when working or living in camps near the bushes.	- Warn the workers about harmful insects before site clearance, provide adequate PPE such as mask, gloves and boots for them to use - Ensure the camps are closed/tight to prevent invasion of harmful

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				insects to the camp. Keep the areas within 10 m from the camp vegetation-free. Plant lemon grass to keep them away. - Evacuate the workers to the nearest healthcare facility if they are affected seriously by harmful insects
			- Biological impacts: trees, vegetation cover, some animals will be affected by construction activities or workers's behaviours	- Instruct the workers not to kill the insects/reptiles if found during site clearance, let them go or lead them to nearby not disturbed habitat -
North of Zone 3		The North side is adjacent to Road No. 4 which is 32m wide. The area is currently well-covered with vegetation. Construction work items: - The building of an interdisciplinary laboratory system (5-floor building); - Building for key laboratory system (5-floor building); - Blocks of institutes and	- Increase raffic density and traffic safety risk, increase dust along this road -	- Install signboards such as "Work in progress", ahead, speed limit 5km/h, "danger" warning signs on Road No1 and 4 - Clean up the dirts along roads 1 and 4, 200 m long each, on days that trucks

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
		research cente (4 buildings of 5 floors); - Lecture hall building for post-graduate educationl (5-floor building); - Workshop (2-floor building); - Building for services, conference, sports, and auxiliary items (2 blocks; on 2-floor building); - Internal infrastructure (construction area of 20 ha). - WWTP with capacity of 600m3 /day -		carrying out excavated materials out of the site
			- Damage to existing infrastructure such as water supply and drainage pipes, electrical and , telecommunication poles and cables.	- Clearly set up the boundary of construction site, create safe entrance and movement corridors for construction plants to avoid existing infrastructure if possible. - Insltall signboard informing clearance height of existing wires swithin and surrounding construction site and arrange instructors when construction plants working nearby the poles and cables. - Reinstate/rebuild the damaged infrastructure before commissioning - .
			- Risks to workers during the process of clearing	-

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
			trees, possible getting attacked/biten by snakes and insects. -	
Transportation route	  	Concrete road, width of 6-8m. The two sides have trees. Low traffic density	- Conflict or disruption of traffic, increasing the risk of unsafe traffic.	- Arranging warning signs and staff for traffic navigation at the time of transportation - Navigating transportation means to avoid peak hour

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				

c. Mitigation Measures for Specific Impacts in Zone 4

Table 5.4. Mitigation Measures for Specific Impacts in Zone 4

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
East and South of Zone 4. Adjacent to Road No. 6		The road already has sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.)	- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working - Damage to existing equipment such as water supply and drainage pipes, electric cables, telecommunication cables. - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when working near dense areas, bushes..	- Arranging warning signs and staff for traffic navigation at the time of transportation - Navigating transportation means to avoid damages on the existing technical tunnels or sewer system - Provision of labor protection equipment for workers. Have first aid assistance avaiable for emergency cases.
In the west of Zone 4		There is a soil road in the middle of Zone 4. This is an old trail of local people and is being used by the VNU-HN PMU for tracking purpose in the area. In this area, there are old houses that local people left behind after they relocatedd in resettlement site.	- Risk of labor accident in the process of dismantling old and damaged buildings - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when working near dense areas, bushes..	- Provision of protective equipment and support for demolision of works - Provision of labor protection equipment for workers. Have first aid assistance avaiable for emergency cases.

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				
North of Zone 4		About 300m from Da Lat lake.	- The main risk in the construction phase is construction materials and waste flowing into the lake - Risk of accident for workers - falling and drowning when going to the lake	- Establishing shields to prevent construction materials and wastes from spilling into streams, lakes - Setting warning signs to prevent workers from swimming/bathing in the lake/stream
			-	- Avoid disturbances and damage to the existing vegetation and green trees. - Keep the disturbed areas to be minimal; re-establish vegetation cover as soon as construction is completed; - Dismantle the camps as well as other temporary works set up during construction and restore the site before the completed

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
				work could be handed over to the subproject owner. Back fill and tightly seal toilet pits, septic tanks, and temporary sewerage ditches;
		Construction items: - The operator of VNU center (12-floor building); - Library center building (1 5-floor building); - Internal infrastructure (construction area 6.16 ha). -	- Risks to workers during the process of clearing trees, possible getting attacked/biten by snakes and insects. - Risks for construction workers on high-rise buildings regarding occupational accidents such as falling from high platform, falling into openings on working floors ... - Risk of fire and explosion when not complying with regulations on fire safety - Health risks of workers when not fully equipped with labor protection - Risk in construction process of electric systems, transformer stations, electrical connections is likely to occur in terms of electric shock, fire. - The risk of construction materials falling from the top of the building due to the	- Provision of labor protection equipment for workers. Have first aid assistance avaiable for emergency cases. - Installation of warning signs and handrails at dangerous areas - Have plan for training and provision of fire fighting equipment - Provision of all protective equipment for workers - Arrange warning signs on electricity hazards at the area involving with use of electricity. - Covering to shield spilled materials. Workers are prohibited from dropping/throwing materials from height. Full and periodical maintenance for machinery and

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measures
			carelessness of workers, due to old and insufficiently maintained machinery. - Impacts on health of workers operating tower cranes and hoists due to long-term working duration at height	equipment as stipulated by manufacturer - Working hour and rest in accordance with regulation for workers who operate tower cranes and hoists

d. Mitigation Measures for Specific Impacts at WWTP area

Table 5.5. Mitigation Measures for Specific Impacts at WWTP Area

Location	Photo taken at the site	Main features	Specific impacts and risks	Mitigation measure
South of WWTP. Adjacent to Road No. 6		The road already has sidewalks and technical infrastructure (lighting, electricity, water supply, fire hydrants, technical trenches, etc.). Distance to the nearest private house is 1km. The stream is about 10m wide. The flow is directed towards Da Lat lake. - WWTP - Scope of service: The WWTP will collect and treat wastewater for industrial parks, central area, WWTP No. 1 and	- Safety risks to workers during siteg clearance if attacked/bitten by snakes or harmful insects such as bees, toxic spiders or fire ants.	- Train the workers on ESHS including awareness, preventive and cure measures related to insects - Provide appropriate and adequate PPEs for workers, depending on the task they carry out. - Provide first aid kit at the site.
			- Construction materials including	- Create and maintain internal drainage system within the

North and West of WWTP		some other dormitories of VNU in Hoa Lac. - Location: the WWTP is located on road No.6, next to VNU-HN central area - WWTP's area: 5,000 m^2 - Capacity: 1,475 m^3/day, - Technology: Conventional Sequencing Batch Reactor (CSBR). - The quality of the output wastewater will meet the Vietnamese Standard QCVN 14: 2008/BTNMT (Column A) and discharge into No.1 stream.	excavated soils are washed to the nearby stream, polluting the water and cause sedimentation - -	construction site including sedimentation traps to ensure that rainwater is controlled before leaving the construction site - Avoid excavation and minimise storage of loose materials at the site in rainy weather - -
			-	-

The contractor must sign short-term or long-term labor contract witl all workers

Contractors must sign labour contracts with all workers including casual workers when according to labour law (working duration from 3 month)

Drill wells for water supply

According to information from groundwater resource, it can be seen that the underground water reserve in the project area is large enough and of sufficient quality to be exploited and used in construction. Extraction of groundwater for construction will not significantly affect the groundwater level in the area.

In the process of exploitation and use, the following measures should be applied to minimize impacts on groundwater:

- The process of designing and constructing wells must be closely supervised;
- It is required to maintain and protect the well area during the construction process and fill it up safely before handing over the project;

f. Mitigation Measures for Specific Impacts in multiple storey Building

- Only use new equipment with calibration certificate.
  Regular maintenance of construction equipment
- Check the status of the anchor systems bracing the tower body (when the tower crane has exceeded the vertical height). The anchoring system of the tower crane is only allowed to connect to the bearing structure of the building (floor, momentum, columns, concrete walls), not allowed to connect to brick walls.
- Only licensed drivers are allowed to Operate equipment and machines .
- Workers must strictly follow safety rules for working at height. The travel and relocation of workplaces must be carried out in the right places and at the prescribed routes, not climbing to get up and down at high positions. Strictly prohibit to walk on the top of the walls, top of beams, girders, roof frames and other structural parts which are under construction. For going up and down in the high position, use a firm ladder. Do not carry heavy or bulky objects when climbing up and down the stairs.
-
- Workers should have tool-kit bags. It is prohibited to drop/throw any objects from height. Do not work on high platforms, chimney, water tower, hoist, girder, roof of 2 or higher floors at night-time, in heavy rain, thunderstorms, or strong winds of level 5 or higher.
- Every 6 months, health check will be provided to all workers. Pregnant women, people with heart disease, blood pressure, deaf ears, poor eyesight should not work on high platforms. Workers should have certificate of labor safety training issued by the director of the company.
- Quality scaffolding must be used and no types of temporary scaffolding shall be used.
- The scaffolding system for bearing the downward load should be carefully calculated, in addition, the only scaffolding system being fabricated and erected in line with its design can be put into use.
- Scaffolding stairs should be arranged reasonably and firmly to help workers easily get up and down and arrange labor in a reasonable manner to minimize the moving in construction.
- Provide workers with appropriate labor protection and safety devices such as safety belts, helmets, or protective clothing suitable for overhead working conditions.

g. Mitigation Measures for Specific Impact of Disposal Site

Table 5.6. Mitigation Measures for Specific Impact of Disposal Site

Specific impacts and risks	Mitigation measures
- Conflict or disruption of traffic, increasing the risk of unsafe traffic for officials when working. - Materials may spill into drains causing flow obstruction - Damage to existing equipment such as water supply and drainage pipes, electric cables, telecommunication cables. - - Accidents for workers from biting risks caused insects such as ants, bees, spiders, and snake when construction near dense areas, bushes..	- Arranging warning signs and staff for traffic navigation at the time of transportation - Cover the transportation vehicles to prevent material from falling on the road. - Cover to prevent wastes or waste materials from falling into the drainage system - Navigating transportation means to avoid damages on the existing technical tunnels or sewer system - Arrange bulldozer after disposal of wastes to minimize the risk of sliding and erosion from wind. - Provide adequate labor protective equipment for workers.

h. Mitigation Measures for Social Impacts

Table 5.7. Social Action Framework for the Subproject

Content	Objective	Proposed action	Implemented by	Indicator	Note
Accessibility to public works	Ensure the health of staff, lecturers and students as well as visitors; Create landscapes, workspaces; Reduce pollution from wastewater	Detailed design, Engineering drawings	PMU Consultant	The number of students increases thanks to a friendly learning environment. Favorable economic development for the subproject area	Cost estimates and detailed designs prepared by consultants
Risk of sexually transmitted infection (STI)	Reducing the risk of sexually transmitted infection due to increase in the number of workers in construction phase	Incorporate interventions to raise contractors' awareness of HIV / AIDS	PMU Construction contractors Consultant	Interventions and awareness raising on STIs are included in the bid packages	Implementation and monitoring activities will be carried out by detailed design consultants and consultants
Workers	Contracts for contractors should include provisions for occupational health and safety; no discrimination of wages between women and men, prevention of	The contract shall be reviewed to ensure that there are provisions related to occupational health and safety and gender equality Women and the poor are	PMU, Socio-political organizations (Youth Union, Women's Union, ...), Employment information center Local government Contractors	Regulations related to: i) occupational health and safety; ii) promotion of gender equality and preventing gender discrimination; and iii) Child labor prevention	Supervision activities will be carried out by supervising consultants Cost is not included as a part of supervision activities

	child labor; and comply with labor laws and the related obligations of international treaties Maximize the employment of women and the poor during construction	prioritized to get jobs that do not require much skill	Consultant	is included in the contractor's contract. Number of local employees by gender Men and women will receive equal pay for equal work;	

During operation phase, safety, solid waste and wastewater associated with the operation of the laboratories supported by the Project were identified as the key issues. Safety risk is expected to be manageable and under control through the compliance with available strict laboratory management guidelines and regulations including those provided by the manufactures/suppliers of specialized equipment and tools.

Setting up new laboratories

For setting up the new laboratories including equipment and machines, the Shopping Contracts will include the requirements that the Suppliers are responsible for safe transportation, installation, commissioning/test runs and provision of operational trainings including risk management related to laboratory operations.

Movement/Transportation of Lab Machines and Equipment:

The procedures for transportation of hazardous materials should include:

- Proper labeling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
- Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labeling of the containers. The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility Ensuring that the volume, nature, integrity and protection of packaging and containers used for transport are appropriate for the type and quantity of hazardous material and modes of transport involved
- Ensuring adequate transport vehicle specifications
- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures
- Using labeling and placarding (external signs on transport vehicles), as required
- Providing the necessary means for emergency response on call 24 hours/day

Emergency Preparedness and Response

It is important to develop procedures and practices for the handling of hazardous materials that allow for quick and efficient responses to accidents that may result in injury or environmental damage. The sponsor should prepare an Emergency Preparedness and Response Plan that should cover:

- Planning Coordination: This should include procedures for:
    - Informing the public and emergency response agencies
    - Documenting first aid and emergency medical treatment
    - Taking emergency response actions

  - Reviewing and updating the emergency response plan to reflect changes and ensuring that the employees are informed of such changes

- Emergency Equipment: The plan should include procedures for using, inspecting, testing, and maintaining emergency response equipment.

Training: Employees should be trained in any relevant Procedures

5.2. MITIGATION MEASURES IN OPERATION PHASE

5.2.1. Mitigation Measures Applicable to the Buildings

The following principles and activities will be followed during the operation of the provided buildings:

- Standard Operating Procedures (SOPs) will be developed for the case of emergency down, including an evacuation plan. Drills to practice the procedure and plan will be undertaken annually.
- Passages to emergency exits must be kept unobstructed at all times.
- Fire-fighting equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual firefighting equipment that is easily accessible and simple to use
- Toilet facilities should be provided with adequate supplies. Cleaning workers will regularly clean the saniation facilities to prevent odors. Drains and vents will be checked regularly to prevent odors. Ventilators and windows will be installed to prevent odor. Licensed company will be contracted to pump sludge in the septic tank regularly.

5.2.2. Mitigation Measures applicable for the Wastewater Treatment Plant

(1) Measures to Minimize Impact on Receiving Water

- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP;
- The quality of sample effluent from the WWTP must be analyzed once every 3 months;
- Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system;
- Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident) in order not to disrupt the operation of the plant;
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO) and applicable national requirements

(2) Odor Control

The following measures are required to prevent, minimize, and control air emissions and odors during operation:

- Domestic waste and sludge generated during the operation of the plant will be safely collected by specialized tank trucks and transported away by URENCO to serve the planting of urban green trees or to be dumped at Disposal site of the town. This will reduce bad odors generated from sludge;
- The waste (sludge and domestic solid waste) will be contained in standardized containers to minimize dispersion and gases and solid waste into the environment.
- There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.

(3) Sludge

- Land application or other beneficial re-use of the WWTP residuals should be considered but only based on an assessment of risks to human health and the environment. Quality of residuals for land application should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[15] and applicable national requirements;
- Processing, disposal and re-use of wastewater treatment plant residuals should be consistent with applicable national requirements;
- URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at Disposal site. Transportation will be carried out by specialized tank trucks to avoid odor emission and sludge spillage along the route.

(4) Hazardous Waste Management

- The subproject owner will register as the owner of hazardous waste according to Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management;
- Containers of hazardous waste are to be placed on flat floors without tilting, tumbling, and must be free from stormwater infiltration. Collected hazardous waste will be stored in containers/houses and labeled as currently stipulated. Packaging materials for chemicals will be returned to the suppliers;
- Once every 2-3 months, the WWTP will have to employ a local contractor tasked with handing hazardous waste to collect, transport and handle such waste;
- Empty chlorine containers are to be returned to manufacturers

Occupational Health and Safety Issues in Wastewater Treatment Operations

Wastewater treatment facility operators may be exposed to physical, chemical, and biological hazards depending on the design of the facilities and the types of wastewater effluents managed. Examples of these hazards include the potential for trips and falls into tanks, confined space entries for maintenance operations, and inhalation of VOCs, bioaerosols, and methane, contact with pathogens and vectors, and use of potentially hazardous chemicals, including chlorine, sodium and calcium hypochlorite, and ammonia.

Worker occupational health and safety impacts associated with the operational phase of the WWTP primarily include the following: i) Accidents and injuries; ii) Chemical exposure; ii) Hazardous Atmosphere; and iii) Exposure to pathogens and vectors.

Accidents and Injuries:

[15] WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

Work at the WWTP is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work at the WWTP may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters. Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions. The following procedures required to prevent, minimize, and control accidents and injuries at WWTP:

- Use fall protection equipment when working at heights.
- Maintain work areas to minimize slipping and tripping hazards.
- Implement fire and explosion prevention measures in accordance with the national regulation.
- Locate all underground utilities before digging.

Chemical Exposure and Hazardous Atmospheres:

- The chemical house must be equipped with leakage detectors, ventilation, warning lights, gas masks, compressed oxygen breathing apparatuses, protective clothing, and a system of emergency watering/showering/ eyewash of the chlorination house.
- Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures.
- Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance.
- Prepare escape plans from areas where there might be a chemical leakage.
- Prohibit eating, smoking, and drinking except in designated areas.
- Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.

Pathogens and Vectors:

The measures to prevent, minimize, and control exposure to pathogens and vectors include:

- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors.
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods.
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes.
- Encourage workers at wastewater facilities to wash hands frequently.
- Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations.
- Reduce aerosol formation and distribution, for example planting trees around the aeration basin to shield the area from wind and to capture the droplets andparticles, collection of droplets (e.g. by sedimentation, scrubber, electrostatic precipitator, or fabric filter), disinfection of airborne particles (e.g., by using ultraviolet lights).
- Avoid handling screenings by hand to prevent needle stick injuries.
- Maintain good house-keeping in sewage processing and storage areas.
- Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection.

Incidental discharge from the WWTP:

- Prepare an emergency plan for incidental discharge of untreated waste water and conduct emergency training for the operators.
- Inform the residents of the incident and mitigation measures.
- Standby generators must be always available.

5.2.3. Management measures applicable for the Laboratories

Relocations of Laboratories

Once the timing of the relocation is planned, the University will minimise storage of laboratory consumables, particularly the chemicals, at the existing labs in order to minimise the volume to be wasted or safety risks during the relocation process. This can be done through fitting the supply request with experiment schedules.

Professional movers with good reputation, particularly those with prior experience on moving or transportation of laboratory machines and equipment, will be contracted to carry out relocation under the monitoring and supervision of experienced direct laboratory managers.

Laboratory Relocation and Reinstallation Plan (LRRP)

After contract signing, the contracted Laboratory mover will work with laboratory managers and staff to to develop Laboratory Relocation and Reinstallation Plan for each Laboratory. The Content of the LRRP should include, but not limited to the followings:

- Schedule for Inventory of the existing laboratory equipment, machines and materials to be relocated;
- List of the items that requires specific requirements on dismantling, handling, transportation and reinstallation, and descriptions of the specific requirements. Appoint staff in charge of doing and supervising each step in the entire relocation process;
- Sequence of lab equipment dismantling, wrap up, transportation and reinstallation/set up;
- Specific Measures to ensure EHS to be applied and Emergency Response procedure;
- Inspection of new labs readiness before moving;
- Testing operations at new campus;
- Schedule for cleaning up the existing labs, separate hazardous and non-hazardous wastes and dispose of all the wastes in safe manner.
- Review and update laboratory and OHS rules and regulations.

With the operatio

Solid wastes will be separated at source and licensed service providers will be contracted for collection and safe disposal.

Management of Solid wastes – Hazardous waste from the laboratories

Although the amount of hazardous waste from laboratories is not much, they have a negative impact on the environment, so they need to be collected, transported and treated by competent authorities. Before laboratories are in operation, they should:

- Register generator and hazardous waste with Hanoi Department of Natural Resources and Environment and build temporary storage of hazardous waste according to Circular No. 36/2015/TT BTNMT dated June 30, 2016 of the Ministry of Finance Resources and Environment. Containers of hazardous waste are to be placed on flat floors without tilting, tumbling, and must be free from stormwater infiltration. Collected hazardous waste will be stored in containers/houses and labeled as currently stipulated. Packaging materials for chemicals will be returned to the suppliers.

- Sign contracts with functional units to collect and treat hazardous waste

- Fully equip all laboratories, actual laboratories of faculties and centers on hazardous waste containers. Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where:

- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs
  - Store in closed containers away from direct sunlight, wind and rain
  - Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
  - Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location
  - Provide adequate ventilation where volatile wastes are stored. Hazardous waste storage activities should also be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes:
  - Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents
  - Limiting access to hazardous waste storage areas to employees who have received proper training
  - Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan
  - Conducting periodic inspections of waste storage areas and documenting the findings
  - Preparing and implementing spill response and emergency plans to address their accidental release
  - Avoiding underground storage tanks and underground piping of hazardous waste

- Develop and disclose rules for collection and management of all hazardous wastes in general and chemical packaging bags in particular in each laboratory

- Prohibit disposal of mixed hazardous and other solid wastes

- Chemical wastes from laboratories must be kept under strict safety regulations on chemical and biological substances. These rules must be disseminated to those working in the laboratory;

- All types of hazardous waste must be labeled in line with regulations;

Transportation: On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance provided in Section 3.4 on the Transport of Hazardous Materials.

Wastewater from laboratories

Wastewater from laboratory will be collected and treated in a separate system (possible a package plant, which is readily available in the market) before being further treated by by the second WWTP capacity 600 m3/d to be provided under the Project.

Other ESH issues will be managed taken into account the followings:

Management of Air Quality in Laboratories

The laboratories will be equipped with modern equipment: exhaust fans and modern ventilation systems; fume hoods; solvent vapor with the treatment system (absorbed by activated carbon) before being discharged into the environment, minimizing emissions from laboratories.

First Aid for laboratories

- VNU-HN shall ensure that qualified first-aid is provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
- Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Dedicated and appropriately equipped first aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids

Measures to Minimize Chemical Leakage

A small amount of laboratory smoke can be leaked frequently. Therefore, top priority is given to lab ventilation. Besides, the laboratories are equipped with exhaust fans and chemical fume hoods to ensure the health of laboratory users.

Collection and treatment of smoke in the laboratory: Desks and working space in the laboratory shall be properly arranged. Experiments involving volatile chemicals will be conducted in a separate area equipped with a fume hood to ensure that all fumes and chemical fumes are completely exhausted. In laboratories where digestion and sample research are conducted, a separate ventilation cabinet system will be installed for the sample decomposition process and the smoke will be exhausted by the exhaust system.

Prevent risks when Using Chemicals and Laboratory Equipment
To reduce risks from the use of laboratory chemicals:

- Chemical storage room should be arranged separately, the storage depends on clear assignment for the staffs and types of chemicals;
- Chemicals shall beverified for their origin, expiration date and quality assurance for analysis;
- Do not import chemicals with too big amounts to avoid prolonged storage and unsafe for management;
- Teachers or instructors should closely follow the students' preparation or use of chemicals;

- Staff or students should be fully equipped or wear a lab coat before handling with special chemicals;
- Record all input data about chemicals to be stored, their expiration date, precautions, etc .;
- For used chemicals, its bottles/packages should be carefully collected and put into hazardous waste collection and treatment systems;
- Suction of chemicals by mouth is strictly forbidden;
- Train about laboratory safety for employees.

Safe Operation of Equipment and Machinery

- All operators of equipment and machinery must be trained and transferred technically before operating
- No untrained staff/student is allowed to operate the equipment
- Instruction for use should be sticked on each equipment
- Prepare a daily log to track daily operation of the equipment
- All equipment must be regularly maintained and checked for their proper and accurate operation
- The power supply for each equipment must be checked before installation and it must be installed with its own automatic system
- Though it depends on type of equipment, most equipment must be placed in a room with stable humidity. Therefore, these rooms are often equipped with air conditioning systems
- Dilusion and storage of chemical are strictly forbiden near the equipment. Use only chemicals according to the device's instructions

5.2.4. Mitigation Measures for Pollution during Operation of the WWTP

The University will update laboratory OHS rules and require all staff and student to strictly comply with these regulations, any non-compliance will not be allowed.

SAFETY IN LABORATORIES

Radiological Hazards: Radiation exposure can lead to potential discomfort, injury or serious illness to workers. Prevention and control strategies include:

- Places of work involving occupational and/or natural exposure to ionizing radiation should be established and operated in accordance with recognized international safety standards and guidelines..
- Exposure to non-ionizing radiation (including static magnetic fields; sub-radio frequency magnetic fields; static electric fields; radio frequency and microwave radiation; light and near-infrared radiation; and ultraviolet radiation) should be controlled to internationally recommended limits
- In the case of both ionizing and non-ionizing radiation, the preferred method for controlling exposure is shielding and limiting the radiation source. Personal protective equipment is supplemental only or for emergency use. Personal protective equipment for near-infrared, visible and ultraviolet range radiation can include appropriate sun block creams, with or without appropriate screening clothing.

Corrosive, oxidizing, and reactive chemicals: Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. owever, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:

- Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water

In order to ensure safety, avoid unfortunate cases that occur when working in the laboratory, each officer must belong to master the processes and regulations. Equipment and the use of workwear equipment is extremely necessary. Before the start of the operation ensure that the officers have mastered 14 general provisions when working in the laboratory

LABORATORY REGULATIONS

- Only experimental in the presence of an instructor in the laboratory.
- Carefully read the theory and think before doing experiments.
- Always get to know where to secure equipment.
- Must wear a lab gown.
- Must wear protective goggles.
- The hair is tied.
- Clean the old lab table before starting an experiment.
- Never tasted chemical experiments. Do not eat in the lab.
- Do not look down the test tube.
- If the chemical is spilled or occurred at the accident, notify the rebuke immediately.
- After work must wash face, hand and tools (soap should be used).
- If the chemical falls into the eye, it must go immediately.
- Dispose of the laboratory waste in the right place as instructed, store and preserve the chemicals carefully.
- If you are unclear about the problem, ask
- Every person working in the laboratory must be studied, examined the rules of occupational safety, master the processes, technical regulations and measures to ensure occupational safety.
- Each person shall only work in order, keep hygiene and comply with the instructions of the Department in charge of the regulations. No strangers or overtime is required, if you want to do so overtime, you need to have consent from head of the lab and protection room

- Have to read the document carefully, understand all the details of the experiment before doing and anticipate the incidents that can happen to proactively prevent.
- To conduct experiments, it is necessary to observe and record the figures to make the test report. After hours of cleaning, neat arrangement of laboratory equipment and laboratory instruments.
- Do not smoke or eat in the lab.
- Laboratories must wear blouses, long pants, neat hair, masks, gloves and goggles.
- Do not use contact lenses when working in the laboratory.
- Carefully inspect equipment, facilities, and testing equipment before use.
- Understand the Chemical Safety Data Sheet (MSDS) and follow the instructions.
- When performing a test method, be familiar with the method and understand it well before proceeding.
- Do not leave objects and chemicals on the floor, in the aisle.
- When distilled water, regularly check the water source into the device, so as not to run out of water.
- When you have finished using appliances such as furnaces, ovens, stoves, etc. in the laboratory, switch off the appliance and turn off the power.
- Dispose of chemicals in accordance with regulations.
- Clean and dry workplace after testing (handling immediately if spilled).
- In case of burns with acid or base wash immediately with cold water and apply to the wound 1% NaHCO3 (case of acid burns) or 1% CH3COOH (if base burns). If splashed in the eyes, rinse vigorously with cold water or 1% NaCl. In case of severe burn, first aid must be wounded and taken to the nearest medical center.
- Check electricity and water in the laboratory before leaving.

* Note: Where to get the chemicals, the laboratory instrument will reset the old position. Before leaving the PTN need to re-check the PTN, lock the water valves, close the electric breaker,...

In addition to the above general provisions, each laboratory depends on the professional nature of the individual rules to ensure the absolute safety for people and property in the room.

Safety rules: All experiments that use volatile poison, have an unpleasant odor, toxic gases or special acids must be carried out in the app cabinet or ventilated place. To learn about the chemicals used in the PTN for characteristics such as toxicity, fire, explosion,... To avoid occurring mistakes when conducting experiments, lead to unfortunate consequences.

Work with toxins: In chemical DEVELOPMENT There are many types of chemicals common but highly toxic such as: HCN, NaCN/IPS, Me2SO4, Hg, HgCl2, CO, Cl2, BR2, NO, NO2, H2S, NO2,... Organic synthetic substances such as: CH3OH, pyridine C5H5N, THF, benzene, toluene, Acrylonitrin, Anilin, HCHO, CH2Cl2... All substances that do not know clearly are considered poisonous substances. When working with these chemicals, it is necessary to pay attention to the quality control of the instrument and the instrument of conducting experiments. In particular strictly adhere to the conditions outlined in the curriculum, the documentation has been prepared in advance.
Do not directly take the chemicals to the nose and smell but to keep away and use hand to light them on the smell.

Working with flammable substances: flammable substances, volatile flammable substances are Et2O, Me2CO, ROH, petroleum, gasoline, CS2, benzene,... When working with them it is

necessary to pay attention only to heat or distillation them on the pot or the air in a closed electric stove.
Not to close to heat sources, power breakers,...
When conducting crystallizing from flammable solvents, it is necessary to perform in separate tools, with an erection of soldering recharge.

Working with explosive substances: when working with substances such as H2, alkalis (Metal & Solution), NaNH2/KNH2, dense acids, explosive organic substances (especially Polynitro)... As well as working under low pressure or high pressure need to wear protective goggles (made of organic glass) to cover the eyes and important parts on the face.
-Do not bow the head towards the liquid that is boiling or the solid is melting to avoid the chemical firing in the face (there are many cases do not note this problem). When heated in-vitro solutions must be used in pairs and always pay attention to the spin of the test tube towards no person, especially when heating dense acids or dense alkalis. Must know where to and use the fire extinguishing tools, extinguishers and ambulance boxes so that when the incident occurs can be quickly and efficiently handled.

WORKING WITH CHEMICALS

Experiments with toxic substances

- In the laboratory there are many toxins such as mercury (Hg), white phosphorus (P), carbon oxide (CO), hydrogen sulfide (H_2S), phenol (C_6H_5OH), formic acid (HCOOH), benzene (C_6H_6), chlorine (Cl_2), nitrogen dioxide (NO_2), etc...
- The experiments with hazardous substances should be conducted with small amounts of chemicals, work in a well ventilated area and good posture.

Note: do not taste chemical and master common chemical smelling practices.

Experiment with caustic and burning substances:

- Carefully perform experiments with concentrated alkaline, acid, alkali metals, phenols etc.to avoid contact to hands, clothing, especially the eye (use goggles).
- When diluting H_2SO_4 acid carefully pour the acid into the water slowly and stir it well but not vice versa.
- When heating a solution of these substances comply with the rules of chemical heated in vitro.

Experiment with flammable substances

- There are flammable substances such as alcohol, gasoline, Benzene, acetone ether... in the laboratory.
- Use small amount in experiment keep solutions away from the flames.... do not heat them directlyover fire, use water bath instead.
- Do not use large pot to store these substances and keep them away from fire sources (eg Bunsen burner, electric stove...)
- Use alcohol burner in compliance with the defined rules.

Experiments with explosives:

The explosives often found in laboratories are nitrate salts, chlorate salts etc.... These substances should be kept away from fire sources and carefully blended in accordance with the proper ratio of the volume. Wear protective gauges in experiment; high risk experiments are not allowed. When such gases as H_2, C_2H_2, CH_4, etc are burnt... their purity must be tested to avoid mixing with oxygen creating dangerous explosive mixture. Do not put large amount of sodium into the water as this will cause a fire and explosion accident.

How to test:

Collect H_2 gas through H_2O into the small test tubes. Use finger to cover the tube containing H_2 and put the tube mouth near an alcohol burner. When opening the tube, the mixture of H_2 gas and O_2 (in the air) will fire with pretty loud sound. Continue this process until no loud sound is heard to gain the pure H_2.

Use of glassware:

- Carefully put glass tube through the button to avoid cracking.
- Do not put hot water, boiling water into the cold or room temperature glass container.
- If finger is cut by broken glass bleed off the toxic substance for few seconds before washing with 90^o alcoholand applying bandage.
- Broken glass instruments should be collected separately from other waste.

TOXIC PREVENTION IN CHEMICAL LABORATORY

Toxic precaution

- Each chemical laboratory should be equipped with protective facilities such as gowns, rubber gloves, goggles, ventilators etc.
- Carefully read labels and understand toxicity signs when using chemicals. Keep in mind how to take and smell chemicals. In the process of experimenting with toxic escaping fumes such experiment should be conducted in a well ventilated area or in fume hood.

Explosion and fire precautions

- Each laboratory should prepare sufficient means of fire prevention and fighting: fire extinguishers, sand, water containers, sacks, buckets etc. Laboratory staffs should understand the principles of firefighting and especially master the principles of storing and using explosive chemicals, flammable and explosive fire symbols on the label on the chemical containers. When a fire or explosion occur quickly determine the causes to propose suitable remedial measures.
- In cases when accidents happen all employees must apply first aid rules for the victims before transferringto the medical facility.

First aid for chemical accidents

In case of burns:

- For burns by flammable solvents such as benzene, acetone (C_6H_6, CH_3COCH_3etc....) use wet cloths over the burnt part, then apply sand or wet burlap to extinguish the fire. Do not use water to wash the burns; instead use potassium permanganate soaked gauze ($KMnO_4$ 1%) or carefully apply picric acid H_3BO_3 2% on burn wounds.
- For concentrated alkali burns, caustic soda, caustic potat (NaOH, KOH): Use clean water to wash the wound several times, then wash with 5% acetic acid solution. If the eye contacts with alkaline it must be washed with clean water several times then boric acid solution (H_3BO_3 2%).
- For concentrated acid burns like sulfuric acid, nitric (H_2SO_4, HNO_3...): First wash with clean water several times, then use 5% of ammonia or 10%s olution of $NaHCO_3$, to remove the acid (do not use soap to wash the wound). If If the eye contacts with acid it must be quickly washed thoroughly several times with clean water and distilled water then sodium hydrogen carbonate ($NaHCO_3$) 3%.
- For burns by phosphorus (P): First wash the burn with copper sulfate solution ($CuSO_4$) 2%. Do not use ointments or vaseline. Then apply gauze soaked with copper sulfate 2% solution or aqueous potassium permanganate ($KMnO_4$) 3% on the wound. This type of burns takes longer time to recover, be aware of infection.

In case of poisoning:

- Drinking acid by mistake: First let the victim drink ice water, crushed egg shells (1/2 spoon in the cup of water) and drink slowly magnesium oxide powder (MgO) mixed with water (29 grams in 300 ml of water). Do not use purge.
- *Poisoned by absorbing alkali (ammonia, caustic soda...):* first have the victim drink diluted vinegar (2% acetic acid) or lemon juice. Do not drink purge.
- *Poisoned by digesting mercury compounds,* first have the victim vomit and drink milk with egg whites. Then have the victim drink activated charcoal.
- *Poisonedbywhite phosphorus*: first have the victim vomit, then drink copper sulfate solution ($CuSO_4$) 0.5 grams in a liter of water and iced water. Do not drink milk, egg whites, oil because these substances solute phosphorus.
- *Poisoned by lead mixture*: have the victim drink sodium sulfate (Na_2SO_4) 10% or magnesium sulfate ($MgSO_4$) 10% in warm water because these substances will form a precipitate with lead. Then drink milk with the egg whites and activated charcoal.
- *Poisoned due to inhalation of toxic gases such as chlorine, bromine..* (Cl_2, Br_2): carry the victim to open space, loosen waistband, breath in a small amount of ammonia or 90^0 alcohol mixed with ammonia.
- *Poisoned from breathing hydrogen sulfide, carbon oxides...* (H_2S, CO): lay the victim in open space and breath in pure oxygen for breathing and apply artificial respiration if necessary.
- + *Poisoned by overinhaling ammonia*: let the victim inhale hot water steam, then drink lemon juice or diluted vinegar.

Fire fighting in the laboratory

a. Water:

- Water is effective in wetting, cooling, extinguishing and preventing fire from spreading when sprayed onto the material near the fire. It is best to use a small jet of water with droplet size of 0.3-0.8mm.
- Water is effective in extinguishing fire of the conventional solids: wood, paper, coal, rubber, cloth and some water-soluble liquid (organic acid, acetone, low ranking alcohol)

Do not use water when:

- Extinguishing fire in powered equipment as this will destroy other equipment.
- There are substances reactive with water in the fire area.
- Extinguish the fire and liquid hydrocarbons dissolved in water which is lighter than water density. These substances will float on the water and the fire will spread.
- Fire by oil, high temperature liquids or melting solids. It is dangerous to use water which will cause boiling, exploding or foaming.

b. CO_2 tank: Pressurized CO_2 (often 60atm) will evaporate and cover the fire by dry snow forms when released.

Advantages:

- Easy to use, especially in the small fire, CO_2 is not harmful for machinery and equipment, including electrical equipment.
- The amountof CO_2 is determined by weighing the tank.

Do not use CO_2 tank in the following cases:

- burning clothes (because cold CO_2 will harm exposed skin)
- fire by alkali metal, magnesium, substances capable of separating oxygen (peroxide, chlorate, potassium nitrate, permanganate,...), the organometallic liquids such as

aluminum alkyl (however CO_2 can be used for the alkali metal and organometallic substances in organic solvents)

- CO_2 is less effective when extinguishing fire of decaying materials.

c. Portable chemical foam tank:

Powder extinguisher (eg, sodium carbonate and additives, ammonium phosphate and additives, or some other substance) + compressed inert gas in a small bottle mounted on the extinguisher.

Usage:

- Overturn the tank, $NaHCO_3$ reacts with sulfuric acid generating CO_2 foam that insulates air from fire and cools fired objects.
- when there are no other means of extinguishing fires, or other means areineffective.
- Most effective for extinguishing fires of alkali metals, alkaline earth, organometallic, metal hydride...
- Less toxic, little or no damage to equipment, no risk of electrocution.

Disadvantages:

- Powder cover should be thick enough for the fire not be resumed.
- Foam with acid and salt → good electrical conductivity→ only use when power is disconnected.
- Do not use in places where substances can react with water to cause explosions, fires and gas separation, corrosive gas, heat...(eg peroxide chemicals, hyrua, carbide, andrit, organometallic...)
- Do not use in places where chemicals can corrode or damage due to fire-fighting foam.
- Best for extinguishing largefires when other means are less effective.
- The usage range can vary depending on powder type loaded in the tank:For example, sodium bicarbonate is not used for alkali metal fires because when heated it decomposes into CO_2 and H_2O, the remaining material interacts with hot alkali metal and make the fire stronger.

d. Asbestos fabric:

- Only used for extinguishing small fires ($<1m^2$). Incombustible asbestos cloth, separating the oxygen with fire → extinguishing fire. Only cover asbestos cloth over the fire when the temperature is lowered to avoid fire resuming from flammable materials.
- To cool down quickly, spray CO_2 foam on asbestos cloth to extinguish burning cloth on body.
- Use wet cloth, thick woolen cloth or wet blanket to put out the fire of clothes on body.

However, usage of asbestos material is restricted as it can be toxic to humans.

e. Dried sand: Dry sand can be used to extinguish the fire containing small amounts of liquids, solids when water can not be used.

FIRST AID FOR INJURY AND POISONING IN LABORATORY:

- The general instruction is given as different specific solutions are applied by cases.
- Easy access must be secured to laboratory medicine cabinet. Medicine cabinets usually contain bandages, alcohol iodine, ointments, solutions of $KMnO_4$ 3%, $CuSO_4$, $NaHCO_3$ 2%, CH3COOH 1%, tannin solution in alcohol...

First-aid kits in chemistry lab

First-aid kits in chemical laboratories should be in the most appropriate place and managed by lab staffs. The kit cabinet includes:

- Tools: medical cotton, gauze, bandages, tweezers, scissors, syringes.
- Drugs.
- hemostatic drugs: alcohol iodine 5% solution
- antiseptic drugs: potassium permanganate solution ($KMnO_4$ 5%), alcohol 400
- burn treating drugs: sodium bicarbonate (NaHCO3) 5% ammonia solution (NH_4OH) 2%, copper sulfate solution ($CuSO_4$) 2%, solution of acetic acid (CH_3COOH) 2%.
- assisting drugs: vitamin B1, C, K, glucose or saccharose sugar...
    + When contacting with concentrated acid (H_2SO_4, HNO_3, HCl, HOAc,...) or bromine, phenol, wash with strong running water for a few minutes, then use cotton dipped with $NaHCO_3$ 2% or tannin in alcohol covering up the burn.
    + When the eye contacts with chemicals it must be washed with water several times before the victim being hospitalized immediately.
    + If poisoned by breathing too much gases such as Cl_2, Br_2, H_2S, CO,... the victim must be carried to the open space immediately. When poisoned with metals such as As, Hg,... or cyanide the victim must be transferred immediately to the hospital for emergency treatment.

The laboratory always stores a certain amount of chemicals that may be spread into the air and exposed to staffs. Also while performing experiment, chemicals interact and react with each other; reckless operations will lead to unfortunate consequences.

Biosafety in Medical lab

Laboratory Access Restrictions

- Only authorized personnel are allowed to enter and leave the work area.
- The laboratory door should always be closed.
- Do not allow children to enter work areas.
- Do not allow patients to enter the laboratory to collect samples.

Use PPE and and hygiene equipment

- Wear a lab coat, or lab uniform for the entire duration of the laboratory work.
- Wear gloves during all direct contact with blood, body fluids, other potentially infectious substances or infected animals. After use, remove gloves and wash hands properly.
- Wash your hands after handling contaminated materials and surfaces and before leaving the laboratory work area.
- Wear goggles, masks or other protective equipment to avoid exposure to infectious, chemical solutions.
- Wear a mask or a mask with a high filtration efficiency (N95, N96, ...) in case of being able to splash, shoot or create aerosol containing pathogens.
- Do not wear outside protective lab clothes such as a cafeteria, refreshment room, office, library, toilet, etc.
- Do not use shoes, open-toed sandals in the laboratory.
- Do not eat, drink, smoke, wear cosmetics or wear contact lenses in the work area of the laboratory.
- Do not leave food and drinking water in the laboratory work area.
- Do not share protective clothing worn in the laboratory with normal clothing.

Safe in the testing process

- Absolutely do not drink pipet by mouth.
- Do not put anything in your mouth.
- Do not use saliva to label.
- All operations should be performed in a manner that minimizes the generation of droplets or aerosols.
- Minimize the use of pumps and needles.
- Do not use needles or syringes to replace pipettes or for any purpose other than injection, infusion or aspiration of laboratory animals. When spilled, broken, spilled or potentially exposed to infectious material, report to laboratory personnel.
- There should be a record and a record of these incidents. The procedures for handling incidents occurring in laboratories must be elaborated and properly implemented. Sterilized solutions must be disinfected before being discharged to the combined sewage system. A separate waste water treatment system may be required depending on the risk assessment of the biological agent used.

Laboratory working area

- The laboratory needs to be tidy, clean and leave only what is needed for the job.
- At the end of each working day, tables and chairs should be decontaminated after the spillage of hazardous materials.
- All contaminated materials, articles and culture media must be disinfected before being discarded or washed for reuse.
- Package and transportation of the specimen must follow national or international regulations.
- If opening windows, an insect-proof net is required.

Waste Treatment

- Sorting, equipping garbage containers and disposing of waste from the laboratory must meet the standards of hospital waste treatment issued together with Decision No. 43/2007 / QD-BYT, November 30, 2007. of the Ministry of Health.

Chemical safety, fire, electricity, radiation and equipment

- People working in a microbiological laboratory are not only exposed to pathogenic microorganisms, but also likely to be exposed to chemicals. They must have the necessary knowledge about the toxicity of these chemicals, the type of exposure and the dangers that may occur when used and stored. Material safety data or information on hazardous chemicals are given by manufacturers or suppliers. Laboratories using hazardous chemicals should seek this information.
- All electrical equipment and power lines should comply with national electrical safety standards and regulations. Regular testing of all electrical equipment, including the grounding system, is essential. In addition, it is necessary to install power lines, the outlet must be about 40 cm higher than the laboratory background, not near where there is a faucet. Each laboratory needs a circuit breaker, fuse or apt to cut power when needed.

Addressing laboratory hazards

- There are many problems that can occur in a laboratory. These incidents may be due to errors in the operation of testers such as spillage of TNGB-containing solutions, sharp objects piercing hands and feet when working with TNGB or incidents due to power outages, natural disasters, fires. .. Testers must be alerted to possible incidents and

instructed to handle them. Specific guidelines will be included in the biosafety training. The principle of handling in case of an accident is as follows:

- Handling in place according to the procedure;
- Record incidents and handling measures taken;
- Report the laboratory lead about this problem.

Incident of being stabbed by a sharp object while working with a pathogen

- Tell colleagues who work nearby (if any);
- Expose the wound (eg, take off or tear off gloves);
- Flush the wound immediately under clean running water (about 5 minutes);
- Allow the wound to bleed itself for a short time, without squeezing or rubbing the wound;
- Use gauze with an appropriate antiseptic to cover the wound;
- Leaving the laboratory;
- Record and report the incident to the laboratory head;
- Depending on each specific case, appropriate handling measures will be followed.

Spillage of solution containing pathogens in biosafety cabinets

- In laboratories should prepare the disposal toolbox containing spills of TNGB. In this box, it is necessary to have decontamination solution, blotting paper, pincers, clamps, infectious waste bags, and appropriate personal protective equipment. They must be made of materials that are not corroded by the chemicals in the laboratory.
- When spilling solutions containing RTCs in BSCs, testers must not turn off the cabinets and take the following steps:
- Tell colleagues who are working nearby (if any).
- Allow the cabinet to operate for 10 minutes before proceeding with the appropriate handling measures to ensure that all aerosols have been filtered through the cabinet's HEPA filter.
- Replace clean gloves and take sample spill troubleshooting kit.
- Cover the spilled solution with absorbent paper, pour disinfectant (Bleach diluted 10 times or 0.5% NaClO), allow about 30 minutes for the disinfectant to take effect.
- Collect sharp objects (if any) with a sharp clip in the sharps container.
- Collect absorbent paper in a sterile waste bag to disinfect.
- Wipe the work surface of a BSC.
- End of processing.
- After finishing the test and leaving the laboratory, the case must be recorded and reported to the biosafety officer and laboratory manager.

Spillage of solution containing pathogens on the floor or test table

- When spilling the solution containing pathogens onto the floor or bench, the testing staff should proceed with the following handling steps:
- Immediately alert colleagues working in the same laboratory.
- Change into clean gloves and protective clothing if the solution containing TNGB splashes on the clothing.
- Pick up sharp objects if you have clips.
- Cover the entire surface with absorbent solution in sequence from outside to inside.
- Pour disinfectant chemicals (10 times diluted Bleach solution or 0.5% NaClO) onto the covered paper in a vertical direction from the outside.
- Wait 30 minutes.

- Collect absorbent paper and all infectious items into the waste container for sterilization.
- Wipe down areas that are collapsed.
- End of processing.

After the end of the testing process, go outside, take notes and report to the laboratory person in charge of the incident and the remedies that have been taken.

5.3. ENVIRONMENTAL QUALITY MONITORING PROGRAM

5.3.1. Environmental Quality Monitoring

The environmental quality monitoring will be conducted during the construction and operation phase according to **Table 5.8** with the estimated costs in

Table 5.9. The monitoring location is presented in the Appendix.

Table 5.8. Environmental Quality Monitoring

Parameter and frequency	Location
Construction phase	
Air quality Applied regulations: QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT, QCVN 05:2013/BTNMT	
Noice, vibration, TSP dist, CO, SO_2 and NO_2 Once in 3 months	KK1 – Zone 3 – at entrance of VNU-HN. KK2 – Zone 3 – Opposite to VNU-HN guest house area. KK3 – At the beginning of the transportation route in zone 3 intersecting with Hoa Lac- Hoa Binh road KK4 – Construction site in zone 3; KK5- Construction site in Zone 1. KK6 – At the beginning of the transportation route in zone 1 intersecting with Hoa Lac- Hoa Binh road. KK7 – Construction site in zone 4;
Surface water quality Applied regulations: QCVN 08-MT:2015/BTNMT)	
pH, T, turbidity, DO, COD, BOD5, TSS, Cu, Zn, Fe, Cd, AS, Pb, oil and grease, coliform Once in 3 months	NM1 – Surface water of the ditch near Zone 3 NM2 – Surface water of the ecological lake in Zone 3 NM3 – Surface water of the stream near Zone 4 NM4 – Surface water of Da Lat lake, near construction site in Zone 4
Wastewater Applied regulations: QCVN 14:2008/BTNMT)	
pH, TDS, TSS, BOD_5, NH_4^+, NO_3^-, PO_4^{3-}, oil and Coliform Once in 3 months	NT1 – Wastewater at construction site in Zone 3 NT2 – Wastewater at construction site in Zone 1 NT3 – Wastewater at construction site in Zone 4
Operation phase (in the first two years)	
Air quality Applied regulations: QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT, QCVN 05:2013/BTNMT	
Noise, vibration, TSP, dust, CO, SO_2 and NO_2 Once in 3 months	KK1- in the direction of wind in construction site of the WWTP in Zone 3. KK2- at the end of the prevailing wind in construction site of the WWTP in Zone 3 KK3- in the direction of wind in construction site of the WWTP . KK4- at the end of the prevailing wind in construction site of the WWTP
Surface water quality Applied regulations: QCVN 08-MT:2015/BTNMT)	
pH, turbidity, DO, COD, BOD_5, TSS, oil and grease, coliform. Once in 3 months	NM1 – Surface water of the ecological lake near the discharge outlet of the WWTP in Zone 3 NM2 - Surface water of the ecological lake 50m distanced from the discharge outlet of the WWTP Zone 3 NM3 - Surface water of the ecological lake 100m and 1km downstream distanced from the discharge outlet of the WWTP in zone 3.

Table 5.9. Cost Estimate for Environmental Quality Monitoring

No	Content for monitoring	Unit	Quantity	Unit price (VND)	Total (VND)
1.1	*Air quality*				*87,300,000*
-	Noise	Sample	60	70,000	4,200,000
-	Vibration	Sample	60	150,000	9,000,000
-	TSP	Sample	60	140,000	8,400,000
-	CO	Sample	60	448,000	26,880,000
-	SO_2		60	343,000	20,580,000
-	NO_2	Sample	60	304,000	18,240,000
1,2	*Surface water*				*178,176,000*
-	Temperature	Sample	64	34,000	2,176,000
-	pH	Sample	64	34,000	2,176,000
-	Turbidity	Sample	64	70,000	4,480,000
-	DO	Sample	64	92,000	5,888,000
-	COD	Sample	64	172,000	11,008,000
-	BOD_5	Sample	64	163,000	10,432,000
-	TSS	Sample	64	115,000	7,360,000
-	Copper (Cu)	Sample	64	217,000	13,888,000
-	Lead (Pb)	Sample	64	229,000	14,656,000
-	Zinc (Zn)	Sample	64	217,000	13,888,000
-	Ferrous (Fe)	Sample	64	217,000	13,888,000
-	Cadmium (Cd)	Sample	64	229,000	14,656,000
-	Asenic (As)	Sample	64	272,000	17,408,000
-	Total grease	Sample	64	418,000	26,752,000
-	Coliform	Sample	64	305,000	19,520,000
1,3	*Domestic water (one sample/location x 4 locations x 8 times)*				*23.856.000*
-	pH	Sample	12	41,000	492,000
-	NH_4^+	Sample	12	146,000	1,752,000
-	Sunfate	Sample	12	420,000	5,040,000
-	BOD_5	Sample	12	192,000	2,304,000
-	TSS	Sample	12	119,000	1,428,000
-	NO_3^-	Sample	12	146,000	1,752,000
-	Total grease and oil	Sample	12	430,000	5,160,000
-	PO_4^{3-}	Sample	12	184,000	2,208,000
-	Coliform	Sample	12	310,000	3,720,000
	Total				***289,332,000***

Waste Monitoring: Monitoring activities associated with the management of hazardous and non-hazardous waste should include:

Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes are generated and stored on site, monitoring activities should include:

- Inspection of vessels for leaks, drips or other indications of loss

- Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
- Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
- Checking the operability of emergency systems
- Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapor, or groundwater)
- Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage.

5.3.2. Contractor's Environmental and Social Management Plan (CESMP)

After contract signing, based on the approved ESIA and contractual conditions, the contractors will prepare a Contractor's Site-specific Environmental Management Plan (CESMP) for each contract packages and submit to the CSC and PMU for review and clearance.

The objective of the Contractor Environmental and Social Management Plan (CESMP) is to provide information for environmental management during the proposed works/activities on site of VNU-HN subproject. This is to ensure that the Contractor (and any subcontractors) have minimal impact on the environment. The CESMP will detail how the contractor will mitigate construction impacts and documents the contractor's response to inspecting, monitoring, verifying, internal auditing and correcting or improving environmental performance. The CESMP must be site-specific and should include details of control measures that will be implemented on site to minimize any potential environmental impacts from the proposed works/activities. If the proposed works/activities contained within the CESMP are altered during the Contract, the CESMP will be required to be modified by the Contractor to reflect these changes or modifications. The contents of the CESMP should include the followings:

(i) A statement of policy, providing a definition of the Contractor's environmental policy and an indication of commitment to the execution of its Site Environmental Management Plan.

(ii) A brief document description; Date of issue; Revision status; Distribution list; and preparation personnel details and signoff.

(iii) Applicable laws and regulations associated with the requirements in the subproject ESMP.

(iv) Identification of the contractor licenses, permits and approval associated with the CESMP.

(v) Details on how the environmental impacts identified in the subproject ESIA will be managed on site, including: 1) the site-specific measures to mitigate impacts during construction; 2) ECOPs; 3) the Contractor ESMP to be developed after the contractor is selected and before construction starts; and 4) the Contractor's Dredging Management Plan that the contractor is required to develop.

(vi) Contractor's plan to carry out self-monitoring of implementation of the CESMP.

(vii) Detailed environmental training that all site contractor personnel (including subcontractors) are required to undertake. As a minimum all contractor personnel working at the subproject sites must: i) be familiar and understand the CESMP for the works; ii) be aware of their environmental responsibilities and legal obligations on site; and iii) undertake health and safety and emergency response training.

(viii) Specific capabilities, support mechanisms and resources necessary to satisfactorily implement the CESMP. Detailed environmental responsibilities of all contractor personnel including subcontractors working on site with appropriate knowledge, skills and training for specific tasks shall be identified.

(ix) The contractor shall be responsible for preparing monthly environmental reports, as a section within the Progress report required in the bidding document, including accidental report if any, for submitting to the subproject owner. The contents of these reports may include following details:

- Implementation of the Contractor's CESMP complying with the agreed program;
- Any difficulties encountered in the implementation of the CESMP and recommendations for remedying them for the future;
- The number and type of non-compliances and proposed corrective actions;
- Reports from the Subcontractors involved in the implementation of the CESMP, including minutes of meetings and discussions held by the Contractor;
- Minutes of meeting from discussions held with the subproject owner regarding implementation of the CESMP.

Contractor's Site Environment Officer - SEO

The Contractor shall be required to appoint a competent individual as the Contractor's Site Environmental Officer (SEO). The SEO must be appropriately trained in environmental management and possess necessary skills to transfer environmental management knowledge to all personnel involved in the contract. The SEO will be responsible for monitoring the contractor's compliance with the ESMP requirements and the environmental specifications. The duties of the SEO shall include but not limit to the following:

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methods with respect to pollution control and adequacy of environmental mitigation measures implemented;
- Monitor compliance with environmental protection measures, pollution prevention and control measures and contractual requirements;
- Monitor the implementation of environmental mitigation measures;
- Prepare audit reports for the environmental monitoring data and site environmental conditions;
- Investigate complaints and recommend any required corrective measures;
- Advise the contractor on environment improvement, awareness and proactive pollution prevention measures;
- Recommend suitable mitigation measures to the contractor in the case of non-compliance. Carry out additional monitoring of noncompliance instructed by the EO/ES;
- Inform the contractor and ECO/ES of environmental issues, submit contractor's ESMP Implementation Plan to the ECO/ES, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

Independent Environmental Monitoring Consultant - (IEMC)

The Independent Environmental Monitoring Consultant (IEMC) contracted by PMU shall carry out the monitoring.

- Provide training for PMU and the CSC, and the representatives of the Contractors on socio-environmental, health and safety issues related to construction;

- Evaluate environmental quality at the areas affected by the construction activities (including site observations, reviewing environmental monitoring reports provided by the CSC);
- Review contractor's environmental compliance including the implementation of mitigation measures and documentation;
- Review PMU and CSC compliance to ESMP.
- The IEMC will also provide technical advice and assistance to the PMU and the EO in environmental matters.

Environmental Supervision during Construction

During th e construction phase, a team of qualified Environmental Supervisors (ES) as part of the Construction Supervision Consultant (CSC) shall carry out environmental supervision as part of construction supervision. Both the CSC and ES will be mobilized before the commencement of any construction activities. The CSC and ES are responsible for inspecting and supervising all construction activities to ensure that mitigation measures adopted in the ESMP are properly implemented, and that the negative environmental impacts of the Project are minimized. Specifically, the ES will:

- Review and assess on behalf of the PMU whether the construction design meets the requirements of the mitigation and management measures of the ESMP;
- Review and clear contractor's SEMP;
- Coordinate with PMU Environmental Officer (EO) in reviewing environmental compliance at newly proposed borrow pits and quarries and advise PMU on whether these are eligible for use by the Project;
- Verify and confirm with PMU environmental supervision procedures; parameters, monitoring locations, equipment and results;
- Supervise contractor's implementation of its CESMP including their performance, experience and handling of site environmental issues, and provide corrective instructions if needed;
- Provide training about HIV /Aids awareness for the contractor's workers, CSC team and PMU officers;
- Implement the environmental quality sampling and prepare periodical environmental monitoring reports, including reports on ESMP implementation status to the PPMU and prepare environmental supervision statement during the construction phase; and
- Review payment requests related to environmental mitigation costs if applicable

Noting that the involvement of the community in the process of implementing the ESMP is an activity entirely voluntary in nature, for the benefit of the community and his family. Therefore, the involvement of communities in monitoring the ESMP will not be receiving salaries.

Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with the general contractual condition on environmental protection and pollution control requirements in the bidding document, the subproject ESMP, and the CESMP, but also with environmental protection and pollution control laws of the Socialist Republic of Vietnam.

All the works method statements submitted by the Contractors to the ES for approval shall also be sent to the EO to review whether sufficient environmental protection and pollution control measures have been included.

The ES shall also review the progress and program of the works to ensure that relevant

environmental laws have not been violated, and that any potential for violating the laws can be prevented.

The Contractors shall copy relevant documents to the EO and the ES. The documents shall at least include updated work progress reports, updated work measures, and application letters for different license/ permits under the environmental protection laws, and all valid license/ permits.

The EO and the ES shall also have access, upon request, to the Site Log-Books.

After reviewing the documents, the EO or the ES shall advise and the Contractors of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the EO or the ES concludes that the status on license/ permit application and any environmental protection and pollution control preparation works may not comply with the work measures or may result in potential violation of environmental protection and pollution control requirements, they shall advise the Contractor accordingly.

Penalty System

In the compliance framework, if non-compliance with the Contractor's ESMP and environmental regulations is discovered by the CSC/ES during site supervision, 2% of interim payment value of the contractors of the month will be held back. The Contractors will be given a grace period (determined by the CSC/ES) to repair violation. If the Contractors satisfactorily perform the repairs within the grace period (confirmed by the CSC/ES), no penalty is incurred and the upholding money will be paid to the contractor. However, if the Contractors fail to successfully make necessary repairs within the grace period, the Contractors will pay a third party to repair the damages (deduction from the retained amount).

In case that the CSC/ES do not detect non-compliance with environmental regulations of the Contractors, they will be responsible for payment to repair the violation.

5.4. IMPLEMENTATION ARRANGEMENT AND RESPONSIBILITIES

5.4.1. Implementation Arrangement

The key stake holders in environmental management of the Project include VNU-HN, the Project Management Unit, the Construction Supervision Consultant, the Contractor, Ministry of Natural Resources and Environment, Department of Natural Resources and Environment, People's Committees at town/districts and communes levels. The relationships and contacts between the key stakeholders in the environmental management of the project are shown in **Figure 5.1** below

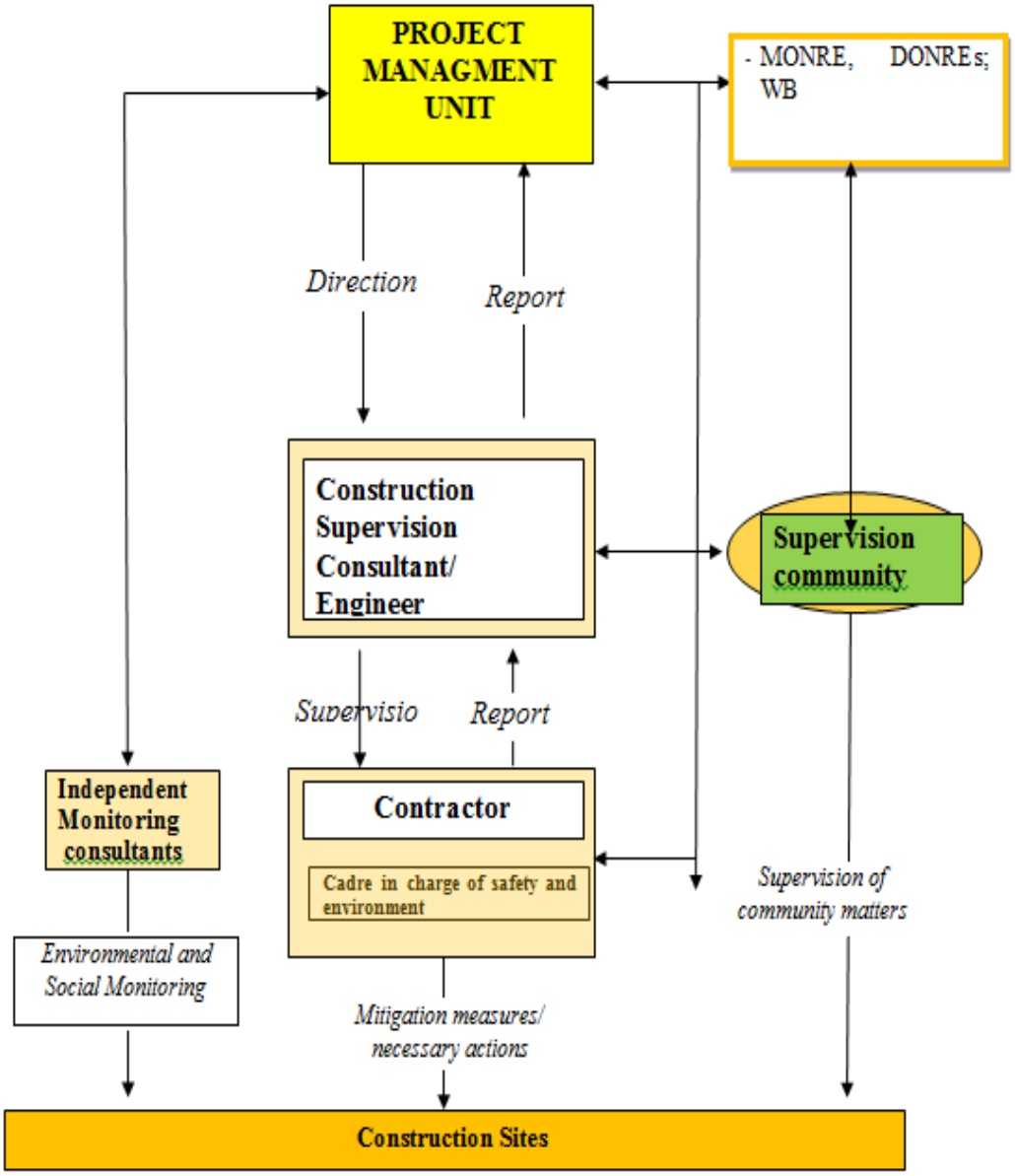


Figure 5.1: Environmental Management Institutional Chart

5.4.2. Role and Responsibilities

PMUs will: (i) allocate adequate resources for ESMP implementation, monitoring and reporting. Each PMU will allocate two staff being responsible for Safeguards monitoring; (ii) monitor and supervise ESMP implementation including incorporation of mitigation measures into detailed designs, bidding and contractual documents; and (iii) report on ESMP implementation. The detail design consultant will be responsible for incorporating environmental solutions into engineering design; The contractors will be required to comply with ESHS terms and conditions in construction contracts including the preparation of C-ESMP prior to construction commencement. Independent Environmental Monitoring Consultant (IEMC) will be hired by PMU for providing environmental capacity building and compliance verification; The construction supervisors will be responsible for day-to-day monitoring and supervision the contractors on Environmental, Social and Health Safety (ESHS). Independent Monitoring Consultants will be contracted by the PMU to carry out environmental capacity building for the PMU and related stakeholders, implement environmental quality monitoring program, and carry out periodical independent monitoring to verify project compliance to ESMP.

Specifics responsibility of stakeholders are shown in **Table 5.10** below.

Table 5.10. Roles and Responsibilities of Stakeholders

Community/agency	Responsibility
Project Management Unit (PMU)	- PMU will be responsible for monitoring the overall subproject implementation, including environmental compliance of the subproject. Specifically, the PMU will: (i) closely coordinate with local authorities in the participation of the community during subproject preparation and implementation; (ii) monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents; (iii) ensure that an environmental management system is set up and functions properly; (iv) be in charge of reporting on ESMP implementation to the DONRE and the World Bank. PMU will assign 02 Environmental Staff(s) (ES) to help with the environmental aspects of the subproject
PMU's Environmental specialist	(i) Supervise the consultants in meanstreaming the relevant mitigation measures outlined in the ESMP into the detailed technical designs, bidding documents, and construction contract documents; (ii) Incorporate the task of supervising implementation of ESMP into the ESIA and the Contract of Construction Supervision Consultant (CSC) and other consulting consultants. (iii) Prepare terms of reference, monitor the recruitment process and monitor the services of an independent environmental monitoring consultant (IEMC). (iv) Review reports submitted by CSC and consultants; (v) Regularly check the construction site; (vi) Coordinate with CSC and IEMC to propose mitigation measure for any arising environmental and social issues; vii) prepare periodic environmental reports together with project progress reports to submit to relevant agencies and WB.
Construction supervision consultant (CSC)	- CSC will support the Environmental and Social officer (s) and will be responsible for the regular supervision and monitoring of all construction activities and to ensure that the Contractor complies with the requirements of the contract and ECOP. CSC will attract a sufficient number of qualified personnel (e.g. Environmental Engineer) with full knowledge of environmental protection and construction subproject management to perform necessary tasks and supervise. Contractor's performance. - CSC will also assist the PMU to report and maintain close coordination with the local community.
Contractor	- Prepare the Contractor's ESMP (C-ESMP) for each bidding package, submit it to PMU and CSC for review and approval before starting construction. - Implement measures to ensure safety, environment, social and health (traffic control and traffic division, earthwork, labor safety, etc. before civil works) in accordance with ESMP and contract

Community/agency	Responsibility
	terms - Appoint an individual with a suitable certificate to be the Contractor's onsite Safeguard Environmental Officer (SEO) responsible for internal monitoring of contractor compliance with health and safety requirements, with CESMP and ECOP requirements, and environmental, social, safety and health training for workers. - Communicate with community and local authorities to inform construction progress and coordinate implementation as necessary. - Ensure that all employees and workers understand their processes and tasks in the environmental management program. - Report to the PMU and CSC about them. - Report to the PMU and CSC on any arising environmental or health incidents or social issues and coordinate with stakeholders for resolution. +
Ha Noi Department of Natural resources and Environment	Supervise and check compliance with the environmental report approved by the Ministry of Natural resources and Environment.

5.5. PMU'S CAPACITY FOR IMPLEMENTATION OF SAFEGUARDS POLICIES AND THE CAPACITY BUILDING PLAN

5.5.1. Technical Assistance Support for the Implementation of Safeguards

At the present, the PMU has a social safeguard officer. In addition, some staffs of the PMU have implemented a number of ODA projects from various sources such as ADB, JICA, etc.

An assessment of safeguards implementation capacity of existing PMU staffs indicate that PMU staffs have limited knowledge on WB safeguard requirements as well as limited knowledge of environment and social issues. Such lack of capacity represents a risk to subproject implementation of safeguards requirements contained in the ESMP and, as required by the WB policy, is to be addressed through capacity building. Therefore, it is proposed to provide capacity building through technical assistance that will support the PMU during the implementation of the safeguards requirements. The technical assistance will provide the necessary technical support the PMU in its work with contractors as well as other entities involved in the implementation of the ESMP.

The scope of the technical assistance would cover support from experts and training that would cover both the knowledge on safeguards requirements and procedures for the subproject as well as training that covers both specific knowledge on safeguard procedures and requirement for the subproject staffs, consultants, and national contractor would be important. This would include, for example, assistance in the preparation of documents and implementation of training program on environmental management and environmental monitoring for contractors, CSC and relevant staffs of PMU (environmental staffs and coordinators of packages) to do their tasks. It would also include assisting the PMU's environmental staffs with the review of contract documents on the bidding packages for construction items of the subproject to ensure compliance with environmental protection policies and impact mitigation and monitoring requirements as well as provide general environmental guidance as requested by the PMU to enhance overall subproject implementation and performance.

Given the nature, locations, and scale of construction, it is anticipated that the safeguard technical assistance support and training will be provided at least during the first 3 years of the subproject implementation. The WB safeguard specialists will participate in the capacity building in particular in the training activities as appropriate.

5.5.2. Proposed Training Program

Table 5.11 below provides examples of the basic trainings for safeguards during subproject implementation. The training programs will be developed and delivered by the Technical Assistance team for the implementation of safeguards for the PMU training. The PMU with the support of the Technical Assistance team for the implementation of safeguards will provide the training to contractors, CSC and other groups.

Other more specific and tailored training will be developed and agreed upon between PMU and the Technical Assistance team for the implementation of safeguards during subproject implementation based upon an reassessment of needs and the status of safeguards implementation.

- ✓ *Target groups for the training:* include PMU staffs, ESU staffs, field engineers, CSC, construction contractors, local authorities, and community representatives in the subproject area. Training of workers and drivers is the responsibility of the contractor.
- ✓ *Training schedule:* At least 1 month before the construction of the first contract. The training can be adjusted in line with the implementation schedule of the sub subproject/contracts.

- ✓ *Training frequency*: The basic training programs proposed in **Table 5.11** will take place every six months on a yearly basis and its content updated and adapted to implementation issues. Training frequency and content will be reassessed during implementation depending on needs. It is foreseen that the training program for PMU staffs will continue until year three of implementation. Three days of training for CSC and contractors are also planned to take place twice a year on an annual basis for at least two years.

Table 5.11. Training Programs for Capacity Building on Environmental Supervision and Management

I. Objects	**SUBPROJECT MANAGEMENT UNIT (PMU)**
Training course	Environmental supervision, monitoring and reporting
Participators	Environmental staffs and technical staffs
Training Frequency	Soon after subproject effectiveness but at least 1 month before the construction of the first contract. The follow-up training will be scheduled as needed.
Time	Four days of training twice a year to be repeated on a yearly basis until year three of implementation
Content	- General environmental management relating to subproject including requirements of WB, MOET, DONRE, cooperating with relevant enterprises - Requirements on environmental supervision; - Supervision and implementation of mitigation measures; - Community participation in environmental supervision - Guide and supervise contractor, CSC, and community representatives in implementation of environmental supervision. - Forms used in environmental supervision; - Risk response and control; - Other areas to be determined; - Receiving approach and submit forms.
Responsibilities	PMU, with support of the Technical Assistance team for the implementation of safeguards
II. Objects	**CSC, CONTRACTOR, COMMUNE/WARDS AUTHORITIES, COMMUNITY REPRESENTATIVES**
Training course	Implementation of mitigation measures
Participators	CSC; on-site construction management staffs; environmental staffs of contractor; commune/ward/group authorities
Training frequency	After bidding, update based on requirements
Time	Three days of training for CSC and contractors and two days of training for other also to be repeated twice a year on an annual basis depending on needs
Content	- Overview of environmental monitoring; - Requirements of environmental monitoring; - Role and responsibilities of contractors and CSC - Content and methods of environmental monitoring; - Response and risk control; - Propagate monitoring forms and guide how to fill in the forms and risk report; - Other areas to be determined; - Preparation and submission of report
Responsibilities	PMU with support of the Technical Assistance team for the implementation of safeguards
III. Objects	**COMMUNITIES AND WORKERS**
Training course	Environmental sanitation and safety
Participators	Representatives of community and/or worker leaders (as appropriate)
Training frequency	As appropriate
Time	One-day presentation and one-day on-the job training twice a year to be repeated on a per needs basis
Content	- Preliminary presentation on environmental protection and environmental overview - Key issues that require community and workers attention to minimize safety risks (roads, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.) - Management of environmental safety and sanitation in work sites and worker camps; - Mitigation measures at construction site and work camps; - Safety measures on electricity, mechanical, transportation, air pollution; - Other areas to be determined; - Procedures to deal with emergency situation

I. Objects	SUBPROJECT MANAGEMENT UNIT (PMU)
Responsibilities	Contractor, PMU

5.6. REPORTING ARRANGEMENT

ESMP monitoring and reporting requirements are summarized in **Table 5.12** below.

Table 5.12. Regular Reporting Requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
1	Contractor to the Employer	PMU	Once before construction commences and monthly thereafter
2	Construction Supervision consultant (CSC)	PMU	Weekly and monthly
4	Community Monitoring	PMU	When the community has any complaint about the subproject safeguards implementation
5	PMU	DONRE/MOET	Every six-month
6	PMU	WB	Every six-month

5.7. COST ESTIMATE

Table 5.13. Cost Estimate for Implementation of Environmental and Social Management Plan

Content	Project's work items	
	VNĐ	USD (1 USD = 22.500 VNĐ)
(a) Minimize in construction process	As part of the contract	
(b) Monitor the compliance with safety policies during construction	As part of the cost of hiring Construction Supervision Consultants (CSC)	
(c) PMU's staffs for environmental safeguard policies	As a part of the cost for PMU	
(d) Environmental quality monitoring		
(e) Independent environmental monitoring consultant (IEMC)		
(f) Environmental training		

5.8. GRIEVANCE REDRESS MECHANISM (GRM)

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three Stages before it can be transferred to the court. The enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the subproject budget.

Complaint procedures and resolution will be performed as follows:

The first level People's Committee of ward/commune. An affected household is to take his/her complaint to any member of the People's Committee of the ward/commune, through the ward head or directly to People's Committee of ward, in written or oral form. The said member(s) of the People's Committee will inform the People's Committee of the ward on the

complaint. The People's Committee of Ward will work directly in person with the said affected household and will decide on the settlement of the complaint 5 days after receiving such complaint. The Secretariat of the People's Committee of the relevant ward is responsible for documenting and recording all the complaints that it is handling.

After the Ward People's Committee issues its decision, the relevant household can make an appeal within 30 days. In case a second decision has been issued but the said household is still not satisfied with such decision, such household can appeal to the municipal (city) People's Committee (CPC).

The second level the *CPC*. Upon receiving a complaint from a household, the CPC will have 15 days after receiving the complaint to resolve the case. The CPC is responsible for filing and storing documents on all complaints that it handles.

When the CPC has issued a decision, the household can make an appeal within 30 days. In case a second decision has been issued and the household is still not satisfied with such a decision, they can appeal to the Hanoi People's Committee.

The third level The Hanoi People's Committee (HPC). Upon receiving a complaint from the household, the HPC will have 30 days after receiving the complaint to resolve the case. The HPC is responsible for filing and storing documents for all complaints to be submitted.

After the HPC has issued a decision, the household can appeal within 45 days. In case a second decision has been issued and the household is still not satisfied with such decision, they can appeal to the court within 45 days. The HPC will then have to pay the compensation into an account.

The Forth Level Provincial Court. In case a complainant brings his/her case to a provincial court and the court rules in favor of the complainant, the provincial authorities will have to increase the compensation up to such a rate as may be ruled by the court. In case the court's ruling is in favor of the HPC, the complainant will be refunded the amount of money that has been paid to the court.

The decision ruling the settlement of complaints will have to be sent to complainants and concerned parties, and shall be publicly posted at the headquarters of the People's Committee of the relevant level. The complainant will receive such ruling three days after the result of complaint resolution at the ward/commune/town level has been decided upon and 7 days at the district or provincial level.

Personnel: The environmental staffs chosen by the PMU will design and maintain a database of the subproject-related complaints from affected households, including information such as: the nature of the complaint, the source and date of receipt of the complaint, the name and address of the complainant, action plan, and current status.

For oral complaints, the receiving/mediator board will record these requests in a complaint form at the first meeting with the affected person.

Contractor and Construction Supervision Consultant:

During construction, the GRM will also be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the subproject. This will be done via the community consultation and information disclosure process under which the contractors will communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

All complaints and corresponding actions undertaken by the contractors will be recorded in subproject safeguard monitoring reports. Complaints and claims for damages could be lodged as follows:

- Verbally: direct to the CSC and/or the contractors' safeguard staffs or representatives at the site offices.
- In writing: by hand-delivering or posting a written complaint to specified addresses.
- By telephone, fax, e-mails: to the CSC, the contractors' safeguard staffs or representatives.

Upon receipt of a complaint, the CSC, the contractors' safeguard staffs or representatives will register the complaint in a complaint file and maintain a log of events pertaining to it thereafter, until it is resolved. Immediately after receipt, four copies of the complaint will be prepared. The original will be kept in the file, one copy will be used by the contractor's safeguard staffs, one copy will be forwarded to the CSC, and the fourth copy to the PMU within 24 hours since receipt of the complaint.

Information to be recorded in the complaint log will consist of:

- The date and time of the complaint.
- The name, address and contact details of the complainant.
- A short description of the complaint.
- Actions taken to address the complaint, including contact persons and findings at each step in the complaint redress process.
- The dates and times when the complainant is contacted during the redress process.
- The final resolution of the complaint.
- The date, time and manner in which the complainant was informed thereof.
- The complainant's signature when resolution has been obtained.

Minor complaints will be dealt with within one week. Within two weeks (and weekly thereafter), a written reply will be delivered to the complainant (by hand, post, fax, e-mails) indicating the procedures taken and progress to date.

The main objective will be to resolve an issue as quickly as possible by the simplest means, involving as few people as possible, and at the lowest possible level. Only when an issue cannot be resolved at the simplest level and/or within 15 days, will other authorities be involved. Such a situation may arise, for example, when damages are claimed, the to-be-paid amount cannot be resolved, or damage causes are determined.

World Bank Grievance Redress Mechanism*:* Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported subproject may submit complaints to existing subproject-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address subproject-related concerns. Subproject affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harms occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and Bank Management has been given an opportunity to respond.For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspection Panel, please visitwww.inspectionpanel.org.

CHAPTER 6. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

6.1. SUMMARY ON PUBLIC CONSULTATION

World Bank policies on Environmental Assessment (OP/BP4.01) and involuntary Resettlement (OP/BP 4.12) require consultation and notification to affected people and local authorities on social and environmental issues during project preparation. Public consultation for ESIA reports must also comply with the requirements of Decree 18/2015/ND-CP dated February 14, 2015, Decree 40/2019/ND-CP dated May 13, 2019, and Circular No. 27/2015/TT-BTNMT dated May 29, 2015 by the Ministry of Natural Resources and Environment on environmental impact assessment and environmental protection plan.

Public consultation is conducted with the purpose of: (i) sharing information about the project's items and expected activities with the project area community and stakeholders; and (ii) Collecting comments and concerns of local authorities and people about local typical characteristics and environmental sensitive issues in the project area. Accordingly, community concerns can be proposed in the Social Environmental Assessment and project solutions.

6.2. RESULTS OF PUBLIC CONSULTATIONS

6.2.1. Consultation with Commune People's Committee and Organizations Affected Directly by the Project

Consultation with the Commune People's Committee was carried out by the Project Owner on November 7, 2019 through group meetings with the leaders of the People's Committee and representatives of locl community organizations. The main contents of consultation with local authorities include:

- Present general information of the project, identify the area/residential area in the project area.
- Introduce the World Bank's safeguard policies on environment and resettlement.
- Current status of environmental sanitation of the construction sites in the wards and pending issues.
- Contribute community's solutions to minimize the environmental impacts and associations in the process of project implementation.
- Comments on the construction of works.

Results of consultations with authorities and community organizations in Thach Hoa commune are:

- Thach Hoa Commune People's Committee supports the project implementation. The project was started 20 years ago. Basically the project has completed the work of compensation and clearance. But the construction progress of the project is slow, leading to unstability of people's lives, and constraining local economic development . The local authority and community all expect the project to be soon implemented
- The project owner needs to strictly implement the approved environmental monitoring program for the project, in compliance with the standards of the Government of

Vietnam and the Donor.

- It is recommended to recruit local labor to implement the project, create jobs for people and reduce the pressure from immigration.
- The project owner should fully implement environmental protection measures to avoid negative impacts on local people.
- Local government will create favorable conditions and provide maximum support for the project.

6.2.2. Consultation about On-going Projects in the Area of VNU-HN Village

In the area of VNU-HN village, there is HT1 Building of the investment project to build some works in Zone 4 for University of Science (QG-HN07) which is under construction. The project owner and the consultant have conducted a field survey and consulted with the representative of the construction contractor, Huy Hoang Investment and International Trade Joint Stock Company on December 11, 2019.

The consultation was attended by Mr. Phuc - in charge of the construction site. Content of consultation:

- Discuss how the site works;
- Know about transportation route;
- Get information about workers, camps, living conditions at the construction site;
- Get information on materials, disposal;
- Get information on labor safety on the construction site;
- Comments for better implementation of other projects in the area in the future, ensuring environmental, safety and social conditions.

The project owner and the consultant have received enthusiastic cooperation from the contractor and obtained valuable comments for the implementation of the project such as:

- Should take advantage of local workers who have experience in construction of projects such as HN07 project;
- Strictly control workers during construction to avoid conflicts between workers and each other and the community;
- There should be a continuous process of training workers on labor behavior and safety;
- VNU –HN Village needs a chief architect to guide the whole landscape planning work, in order to keep the landscape environment in harmony with the construction works.

6.2.3. Result of the first consultation

The project owner and the Consultant have coordinated with the People's Committee of Thach Hoa Commune to organize a public consultation meeting on November 13, 2019 at the guest house area of VNU-HN in Hoa Lac.

Participants in the public consultation meeting included:

- Representative of VNU-HN.
- Representative of Thach Hoa Commune People's Committee
- Affected households
- Consultant.

Content of the public consultation:

- Present an overview of the project, project objectives, volume, items of the project.
- Summarize natural, socio-economic conditions in the project area

- Forecast potential environmental and social impacts, risks/incidents and corresponding mitigation measures in all three stages of project (preparation, construction and operation);
- Summarize proposed environmental management and monitoring program in all 3 phases of project.
- Discuss, acknowledge the comments of the authorities and organizations, affected households in each project area.
- Feedback/explanation of the Project Owner for comments/questions.
- Conclude and close the meeting.

Table 6.1. Results of Public Consultations

No.	Participants	Number of people	Comments	Consultant/project owner feedback
1	- Representative of VNU HN - Representative of CPC - Representative of the household -	40 people (17 people)	- Agree with the project and the environmental mitigation measures proposed for the project. - There is an outstanding issue for the environmental impact of the project, which is presence of the households living along Lang - Hoa Lac and Son Tay - Xuan Mai roads. The existing traffic volume is high. Thus, the increase in traffic volume caused in the project's construction phase does not greatly affect the people. - The project should strictly follow the process, technical assurance, project schedule - When construction, local groundwater should be protected. - There should be code of practices for workers of contractors during construction. Avoid conflicts, disturbance in the community.	- The project owner has seriously taken into account the issues that the People's Committee and the community have commented. - The project owner commits to fully implement environmental protection measures as presented in the environmental impact assessment report.

In general, the community has contributed positive comments to the project. They all are aware of the positive and negative impacts of the project and expect the project to be implemented soon.

Figure 6.1: Public Consutations in Thach Hoa Commune

6.2.4. Result of the second consultation

The consultant conducted a second consultation with households located in the area expected to be affected by the project (villages 6, 7, 8, 9, 10; Thach Hoa commune) on January 16, 2020 and departments. , the institute's institute on January 18, 2020. The location, time, participants and content of the 2nd consultation are presented in the following table:

Table 6.2. Results of the second public consultations

Date, location	**Participants**	**Opinions of the participants**	**Feedback of the Subproject Owner**
I	**Local people (villages 6,7,8,9,10; Thach Hoa commune)**		
16/1/2020	- Representative of VNU - Vietnam Fatherland Front - Veteran association, - Women's association, - Youth Group - Representatives of households expected to be affected by the	- The Subproject Owner was proposed to take the mitigation measures and ensure the traffic safety when the waste and material trucks enter into the residential areas.	- The Subproject Owner will request the construction units to arrange at least 2 persons to control the traffic in rush hour. The Subproject Owner should contact with the Public Transport Unit to setup the warning sign and traffic lamp in the intersections.
		- The Subproject Owner should take the measures to water the road every day to minimize dust in the road section surrounding the ward's residential area.	- The project owner will ensure watering on transportation routes near residential areas at least twice daily on dry days.

	project (villages 6, 7, 8, 9, 10) - Number of attendees 40 people	- When the workers are mobilized, the local authority must be contacted to register the temporary residence and manage the human resources.	- The Subproject Owner will request the construction unit to obtain the HR follow-up records and contact with the ward's People's Committee for temporary residence registration.
		- When the accidents are available, the People's Committee must be notified to supervise and handle the accidents.	- The Subproject Owner is committed to report the People's Committee and find out the corrective measures for the accidents and release the official dispatch to complete and recover the available accidents.
II	Institutes and research centers		
18/1/2020	- University of Natural Sciences - Technology University - Institute of microbiology - biotechnology - Institute of Natural Resources and Environment - Information Technology Institute - Faculty of interdisciplinary sciences - Number of attendees: 20 people	- The specific schedule must be worked out so that the units may displace to new location.	The project owner will make a notice before preparing to relocate the departments.
		- During the relocation, laboratories need to select specialized units to ensure the operation of the machines after reinstallation.	- The project owner will select qualified contractors.
		- When the functions are arranged, the divisions should consult the units to arrange the utilities properly.	- The Subproject Owner shall request the subsubproject design contractor to work closely with the units to be displaced in new buildings to design properly.
		- Laboratory wastewater treatment line needs to be carefully researched and guaranteed to be supervised during operation.	- The project owner will hire specialized units to design, construct and build the wastewater treatment system; at the same time, appoint the person in charge of operating and monitoring the station.

6.3. INFORMATION DISCLOSURE

The first draft ESIA in Vietnamese had been published at the offices of VNU-HN on Feb, 2020 for public consultation. Basing themselves on the contents of the ESIA, the local people could get the project information and contribute their opinions/comments on environmental issues.

The final draft ESMP in Vietnamese language was published at the offices of VNU-HN on March 2020 for public consultation.

The final draft ESMP in English will be disclosed at the World Bank's internal and external websites on March, 2020.

The report continued to be consulted and updated during the project implementation.

CONCLUSIONS AND RECOMMENDATIONS

Overall, the subproject would bring about significant positive socio-environmental impacts. Most of these positive impacts are expected to be achieved during the operation phase of the subproject.

Once the subproject is completed and the listed facilities are put into operation, the project area would be benefited greatly.

Apart from social positive impacts, once the project comes into operation, it will bring about positive impacts on environment: (i) form a university urban geology area with green space and creative area, etc. creating positive academic climate for students and lecturers of the University; (ii) Increase the coverage of green trees within the University campus; (iii) invest high-end infrastructure with two WWTPs, system in accordance with the standards; (iv) have environmental friendly structures with the purpose of using green energy and energy saving.

On the other hand, some potential negative environmental and social impacts and risks may also happen during the construction and operation of the facilities provided under the project. However, these impacts are predicted to be at moderate level, and manageable through the environmental and social management plan proposed for this project. Therefore, the project should be implemented.

Annex 1- Copy of MONRE's Decision on EIA Approval

Annex 2A – Some Notable Details about the Interdisciplinary Laboratories to be Financed by the Proposed Project

Interdisciplinary labs

(1) Falab: design electronic-mechanical equipment for the production, measurements and testings of agricultural, environmental and medical products/samples. The lab include metal and wood workshops.

(2). Life-Science Labs

2.1 Medlab: Include biomedical testing/gene and cells/immune solutions labs. Main outputs will be technical procedures and solutions for for disease diagnos and treatment.

2.2. BioLab: Hitech agricultural lab, including dry/frozen/liquid nitrogen reservation rooms, fermentation technology, molds/bacteria /actinomycetes labs, DNA/RNA/protein chip production room etc.

Possible products could be organic fertilizer, pesticise, microbioligical products for environmental treatment and microbal test kits

(3). Environmental Science Labs

3.1. NatuLab: equipment including spectrometers, LA MC-ICP-MS, sample storage/ preseravation/treatment and data storage units

3.2. ClimaLab*:* durable measurement stations, GIS, weather forecast/warning modules, weather and climate impact simulation labs. Main expected products include climate database, natural hazard simulation models, valuable gene conservation and exploitation models

3.3. EQLab: (Environmental Quality Testing labs)

Sample preservation and storage including samples of hazardous materials, testing equipment of air and water quality, hazardous materials, radiation analyser, portable equipment

3.4 AnaLab: Analyse food samples (meet standard ISO/IEC 17025:2017; ISO 22000:2018**)**

Include equiments and machines for common analysis, chemical analysis, atomic adsorption, high frequency induction, radiation

Expected products are rapid/online/portable test kits for food safety/medicine tests ,

(4). Quantum technology labs (AI và ICT)

4.1. DigiLab: ICT Industry Laboratory (1,000 m^2)

Specialized service and application labs – data formulation and treatment

Possible main products could be smart equipment for digital University/ urban/ government

4.2. Qbitlab: Technogy and chips for Quantum computers (1000m2)

Quantum labs with electron beam lithography (EBL), electron beam evaporator, dry corrosion, nanomet-sized fittings production.

Annex 2B – Information about the labs to be relocated/set-up by the proposed project

Overview

VNU-HN already have existing well-set up laboratories crossing various field. The laboratories have been well operated and managed. The focus labs are under the management

of HNU leaders, and management of some specific field laboratories are in charge by the respective faculty directors. Below are detail information the existing laboratories proposed to be relocated to the new campus.

1. Lanotary for Bioenergy Development

Main Research targets: Develop advanced technology related to biological energy, biofuels, hydrogen production, medicinal substances

Examples of expected products: quality Vitamin E as food, cosmetics and pharmaceuticals, Phytosterol foods that support blood fat reduction and cancer treatment, reduce blood pressure, the omega acid as functional food, fuel B5, B10, B20, B50, technology using dual-metal nano catalysts produces high-performance hydrogen, thermogenic additives for polymers; Plasticizers of rubber and plastics; Additives reduce freezing temperature for crude petroleum and biodiesel; Cosmetic additives, pharmaceutical products.

Main equipment:

- Material manufacturing system: Sputtering system with 3 guns, Sputtering system with 6 guns; Laser pulse condensation system (LPD);
- Small-scale Clean Room with 4-inch Si blade processing equipment; UV optical system; Spraying machine, Wetbench; Dry corrosion system, Plate welding machine; Wire welding machine, etc.
- Analytical devices: XRD; AFM, SEM, TEM ...
- Measuring devices, typical characteristics of arrogance, components: Lake Shore VSM; Magnetometer, magnetometer etc.

2. Laboratory Advanced materials for green development

Main Research targets: 5 key research directions: Nano composit Environmental treatment; Adsorbent materials, green industry; Green chemical metabolism; Advanced materials.

Main products: nano materials with high photocatalytic activity; nano structure photocatalytic materials; photocatalyst composites on carriers; adsorbent material; modified materials derived from natural minerals in Vietnam; special materials (hybrid-nanocomposite on the basis of carbon nanotube, grapheme and metal oxides, geopolymer materials, etc.), materials derived from agricultural and industrial wastes, nano materials with catalytic activity .

Main research equipment (estimated investment): Vacuum and gas tube furnace (CVD), high pressure hydrothermal system, Vacuum drying oven, Photochemical reaction device, Nanobubble generation system, Machine Nanosight particle size measurement, Air quality indicators, Aerogel fabrication equipment, Airborne nanoparticle measuring device, Aerogel fabrication equipment, Visible ultraviolet spectrophotometer system for solid samples , Embedded Coating System, Spin-coating Film Making Equipment, Solid Sample Reflecting Microscope, UV-VIS Reactive Dynamic Determination Device, Surface Area and Pore Size Measure, Ion Chromatograph , Liquid chromatography system of mass spectrometry LC/MS/MS.

3. Laboratory for Environmental Geography and Climate Change Response

Main research interests: Environmental change; Climate change impacts; Sustainable use of resources; Climate change response.

Main products:

- Results of restoring ancient climate conditions in some key areas of Vietnam
- Set of indicators, directives, processes for assessing and forecasting environmental changes and climate change impacts; Evaluation and forecast results are presented in the form of map systems, models and other forms of environmental changes and climate change impacts for selected regions.

- Solutions and proposals to proactively respond to climate change on the basis of geology and geology, sustainable use of natural resources and environmental protection
- Urban and rural models to cope smart with climate change
- Set of indicators, solutions, proposals and maps of distribution and sustainable use of natural resources
- Solutions, proposals for sustainable development and use of ecosystems, improving human health on the basis of environmental conditions
- Geotechnical process technology for pollution treatment and application of geo-environmental technology process in some polluted areas
- Advisory reports to the State, ministries / departments and agencies on natural resources and environment, sustainable development, agriculture and rural development, etc.) and enterprises on impacts and solutions mitigate and respond to environmental change and climate change

4. Laboratory for Analytical Technology for Environmental Inspection and Food Safety

Major research directions: 5 key research directions: Localization of groundwater, capillary electrophoresis equipment, organic pollutants, biologically active substances, food safety.

Main products:

- Analytical procedures for new pollutants.

- Natural products, supporting the treatment of a number of diseases that have been chemically determined and confirmed their activity.

- New biological tools for identifying and evaluating biochemical compounds for research on environmental toxicity and food safety.

- The system of miniature measuring devices, automation, can even be produced by 3D printing technology, types of electrochemical sensors, accompanying optical sensors, applications for environmental monitoring and control purposes. Food safety, quality control of pharmaceuticals, functional foods and biofuels.

5. Laboratory for science of multi-scale calculation for complex system

Main research directions: 5 key research directions: Multi-scale simulation; Biological physics; Molecular computational pharmacology Biological physics.

Main products:

- Multi-scale simulation algorithms
- Multi-scale biological simulation library software
- Simulation software for experimental studies, laboratories of biology, chemistry, medicine and pharmacy in VNU according to requirements and capabilities
- Simulating experimental systems available in VNU upon request and ability

6. Laboratory Micro and nano technologies

Main research interests: Micro-nano structure of spintronics and spinstrainics; Components and equipment used in precision measurement, automatic control.

Main products:

- Electronic compass and gyroscope chips

- Biological chips and diagnostic kits using nanoparticles

- Integrated microchip dedicated in traffic and banking surveillance cameras.

- Satellite receiver stations (fixed and mobile on ships).

- Research, design, manufacture multi-band L-band for real-time field monitoring.

- Warning system in smart buildings.
- Large specialized integrated circuits (VLSI).
- Wireless camera system, security and video encryption serving security and defense.
- Wireless sensor network system.
- Microchips applied in the field of space technology, field monitoring.
- Ultra high-frequency chip for satellite information system on earth stations and on satellite and radar.
- Comprehensive integrated systems (including sensors, electronic circuits, terminal transceiver circuits) for satellite communication, biomedical and environmental monitoring.

7. Laboratory Inteligent intergrated system

Main research interests: Circuit Design (VLSI FPGA / ASIC Design); Image processing (image processing); System on a chip (System-on-Chip); Intelligent transmission systems and networks; Embedded systems; Knowledge technology; Signal processing (signal processing); Safety information.

Main products:

- Designing and integrating systems on chip, network on chip
- Hardware architecture for multimedia applications
- Internet of Things (IoT)

8. **National Key Laboratory of Enzyme and Protein Technology**

Main research directions:

- Research into the production of enzymes and proteins has many applications in molecular and medical biology research.
- Detect and identify proteins in humans that play a role in disease (blood cancer, liver cancer, colorectal cancer) or stress response (acid, oxidation).
- Develop and apply techniques, kit and biosensor to detect and diagnose certain human diseases and / or pathogens.
- Develop probiotic products to support the treatment and prevention of some gastrointestinal diseases in children and the prevention of white spot virus disease in shrimp.
- Pre-clinical evaluation of substances that have antitumor / immunomodulatory activities.

Main products:

- Production process and heat resistant DNA polymerase preparations.
- Procedures and kit for simultaneous detection of Plasmodium falciparum and Plasmodium vivax malaria parasites.
- CD0408 kit counts CD4 and CD8 lymphocytes.
- DNA SY ladder.
- IMMUNOBRAN functional food (Arabinoxylan boosts the immune system)
- Preparations Bio-GABA (Gama Aminobutyric Acid).
- Pre-clinical evaluation process of substances with antitumor activity.

9. Laboratory of Organic Chemistry and Pharmacy

Main equipment:

- Automatic microbiological fermentation system (20L / time)
- The device system reacts in supercritical conditions
- MP Braun solvent cleaning device

- Modern organic synthesis devices (Rotavapor Buchi, reaction equipment -78 ° C Hanke, 5, 10, 20L stable thermostats, nitrogen gas supply equipment, etc.)
- Microwave reactor controls power and temperature
- LC / MS high resolution mass spectrometer, GC / MS gas chromatography; HPLC high performance liquid chromatography, ...

Main research directions:

- Research and develop new drugs with natural origin
- Research and develop new organic synthesis methods applied in pharmaceutical chemistry
- Research and develop new drugs by developing "Drug candidates" from the molecular modeling database

Main products:

- The process of preparing derivatives of Pichromene 1, selects a number of derivatives for the development of blood cancer drugs.
- The process of extracting Cephalotaxine and Homoharringtonine as a fuel source for the production of Omacetaxine anticancer drugs

10. Laboratory of Analysis Sciences and Environmental Treatment Technology

Main research directions

- Manufacture of manual, automatic, and portable capillary electrophoresis equipment systems that can be used in the field, 1-channel or multi-channel.
- The process of analyzing water quality (anion, cation, heavy metal, pharmaceutical residue), product quality (some impurities in biodiesel), biological samples (drug residues, stimulants).
- Physical and chemical methods: kinetics, catalysts for wet oxidation, adsorbents for environmental treatment.
- Design, deployment and technology transfer: manufacture of domestic, industrial and medical wastewater treatment systems using coordinated technologies.
- Manufacturing and manufacturing equipment for scientific research, water treatment and waste water treatment.
- Research and manufacture nanocarbon materials (graphene) used in environmental treatment.

Main equipment:

- Gas chromatograph paired with the GCMS-QP2010 universal block
- LC 20AB liquid chromatograph combines UV and RF detectors
- Atomic absorption spectrum (AAS)

- Total carbon organic meter
- Capillary electrophoresis electrophoresis (SIA) system
- Capillary electrophoresis system manipulated manually (manual).
- Processing technology team
- High-pressure reactor Parr / 4525
- BioEngineering / R'ALF respirator and respiratory system
- Retsch / AS200 basic particle separator
- Buchi Glasuster / Minipilot 5 chemical recovery device
- Crusher, Retsch / PM100
- Potentiometer Zeta, P CAD Instrument / Zeta compact
- Oriel-Newport / 96000/70260 radiometer and radiometer
- Sterlitech / Sepa CFII membrane filter system.

Main product: Single-channel capillary electrophoresis system uses manual-conductive conductivity detector (C4D) of manual control.

Automatic capillary electrophoresis device system 1 channel sequential sample pump (SIA) uses non-contact conductivity detector (C4D), controlled by software (for environmental monitoring).

11. Life Science Research Laboratory

Main research areas:

- Plant cell tissue culture of animals, plants and genetic analysis.
- Application of microorganisms for agriculture and pollution treatment.
- Research applied molecular biology in medicine.
- Study the influence of environmental factors on biodiversity and ecological environment and propose solutions to biodiversity conservation and development.

Main equipment:

- Normal microscope system (Primo Star); fluorescence microscope; backlit microscopy connecting computers (Axio, Imager. A2, Carl Zeiss, Germany); microscope used in cell research; Synchronous scanning laser microscope (Olympus, Japan)
- Perkin Elmer gene device (USA), Eppendorft (Germany), Biorad (Germany)
- Deep refrigerator storage system (Nuaire, USA); preserved in liquid nitrogen;

- Sterile incubator cabinet system used in plant and animal tissue culture
- System of forging machines, microprocessors, and ultra-thin cutting knife grinders used in stem cell research
- System of centrifugal equipment of Beckman (USA) including centrifugal Avanti J-301; Optima LE 80K centrifuge

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Annex 3 - National Technical Standard 8332 : 2010

ISO 15190: 2003

Medical laboratories - Requirements for safety

Selected Applicable Requirements

5. Management Requirements

5.1 Management Responsibilities

Laboratory management shall have responsibility for the safety of all employees and visitors to the laboratory. The ultimate responsibility shall rest with the laboratory director or a named person of equivalent standing.

5.2 Management of Staff Health

All personnel shall have documented evidence of training related to potential risks associated with working with any medical (clinical) laboratory facility.

All personnel should be advised to inform their family doctor/personal physician that they work in a medical laboratory. All personnel should be strongly encouraged to have immunizations to prevent infections associated with organisms to which the person is likely to be exposed. For example, all personnel working with or handling human blood, sera, body fluids or human tissue should be offered hepatitis B vaccine. Records of immunizations should be kept in accordance with ISO 15189.

6 Designing for Safety

6.1 Preliminary Considerations

When new construction is being considered, or where a laboratory is already established and structural changes are proposed, appropriate national and local building regulations and building codes containing specific architectural safety standards for laboratories shall be followed. No structural or engineering work shall be undertaken without the appropriate permission being given by the laboratory director or his/her nominated representative.

6.2 General Design Requirements

Laboratories shall be designed to ensure that containment of microbiological, chemical, radiological and physical hazards is appropriate to the level of assessed risks in technical work areas, and provides a safe working environment in associated office areas and adjoining public space to limit risk to the surrounding community. Corridors and passages to the exits shall be clear of obstructions.

The laboratory should be designed to ensure a clear separation of phlebotomy facilities where they are included in the laboratory area, sample reception, administrative and analytical areas. Each area should have environmental controls and facilities, furnishings, work surfaces and floor finishes appropriate to the activity being performed there. There should be sufficient unobstructed space for safe working, including adequate space around large pieces of equipment for maintenance personnel. There should be suitable and adequate designated spaces, proximal to, but safely separated from, laboratory working space for the safe and secure storage of samples, chemicals, records, and for rubbish or designated laboratory waste prior to disposal.

Dedicated handwashing sinks should be fixed within all areas where biological materials are handled. Wherever possible, hand-operated sink handles should be replaced with motion-, elbow-, knee- or foot- operated equipment. Sinks installed for hand washing in areas where biological materials are handled should have unimpeded drainage (i.e. no stoppers in the basin) and the temperature of the hot water supplied should be such that hands can be held comfortably in the water flow.

A water temperature of 45 °C is recommended.

NOTE If taps (faucets) are hand-operated, it is good practice to turn them on using a paper towel or similar material to avoid hand contamination.

In designing the air-circulating system for the medical laboratory, effective separation between contaminated areas should be considered. Each area should have an individual air-circulating system.

6.3. 6.3 Physical Conditions

6.3.1 Lighting

Laboratories shall be illuminated naturally or artificially to a level that is optimal for safe working. Glare and distracting reflections should be minimized.

6.3.2 Temperature

Any equipment generating excessive heat or chill shall be isolated from the general workspace. Personal protective equipment, including thermal protective gloves and appropriate clothing, shall be provided to allow for personnel safety and comfort.

Ambient temperature in laboratories should be controlled as far as possible to a level compatible with laboratory worker comfort.

6.3.3 Ventilation

Any equipment with the potential to generate exhaust fumes or emit excessive heat, steam, odour or toxicity shall be isolated from the general workspace and placed under a suitable extraction hood. If such arrangements are not possible, special arrangements for worker comfort shall be provided.

Local natural or mechanical ventilation is advised where unpleasant or nauseous odours could arise from certain manual processes.

Ambient humidity and changes of air in laboratories should be made compatible with laboratory worker comfort and safety.

Air flowrates should be monitored regularly to ensure adequate ventilation and should be engineered to avoid dispersion of potentially infectious agents and toxic fumes.

Ventilation ducts should be isolated from the general workspace in order to avoid dispersion or airborne infectious agents or smells in the rest of the workplace.

6.3.4 Noise

Excessive noise levels shall be avoided within the laboratory workspace. Selection and location of equipment shall take account of individual pieces of equipment and their contribution to the cumulative noise levels in the work place. Steps shall be taken to minimize or attenuate noise generation.

6.3.5 Ergonomic Factors

Laboratory activity, workspace and equipment (e.g. chairs, laboratory workstations, computer keyboards and displays), as well as vibration-producing and ultrasonic equipment, etc., shall be designed or positioned to reduce the risks of ergonomic distress disorders and accidents.

6.3.6 Design for Working with Viable Pathogens

All laboratories working with viable biological agents shall have design characteristics appropriate to the containment of microorganisms of moderate to high risk to the individual. Laboratories designed to work with organisms of Risk Group III or above shall include design characteristics for greater containment.

6.3.7 Door Signs

Laboratories shall be identified at each entrance and exit point, with emergency exits marked so as to distinguish them from normal exits. Signs at each site shall include the internationally accepted hazard indicators (e.g. biohazard, fire, radioactivity) and other relevant statutory signs.

6.3.8 Laboratory Security

Laboratory entrances shall have lockable doors. These door locks shall not prevent exit in an emergency. Laboratory access shall be restricted to authorized personnel. Locks may be required for internal doors, to restrict entry while high-risk samples are being examined. Additional security measures, such as lockable doors, locked freezers, limited access to specific personnel, etc., may be required when storing high-risk samples, cultures, chemical reagents or supplies. The threat of theft and tampering with biological agents, samples, drugs, chemicals and confidential information should be assessed, and appropriate steps taken to prevent these acts from happening.

7 Staffing, Procedures, Documentation, Inspection and Records

7.1 Laboratory Safety Officer

An appropriately qualified and experienced Laboratory Safety Officer shall be designated to assist the managers with safety issues. This person shall develop, maintain and monitor an effective laboratory safety programme.

An effective laboratory safety programme should include education, orientation and training, audit and evaluation, and programmes to promote safe laboratory practice.

The Laboratory Safety Officer shall be authorized to stop activities that are unsafe. If there is a Safety Committee, the Laboratory Safety Officer shall be at least an ex officio member of this Committee, if not its chairholder.

7.2 Procedures

The standard operating procedures for the laboratory shall include detailed instructions concerning any hazards involved and how to carry out the procedure with minimum risk. Procedures shall be reviewed and updated at least annually by the management representative responsible for the work place activity. A written plan, including protocols for hazard communication, shall be developed. The plan shall include the following:

a) arrangements for visitors/contractors;

b) staff health surveillance;

c) arrangements for risk assessments to be carried out, findings recorded, and action to be taken;

d) procedures for monitoring inventory for identification of chemical and other hazardous materials, including appropriate labelling requirements, and safe storage and disposal;

e) procedures for safe practices in handling hazardous materials;

f) procedures to prevent theft of high risk/contaminated materials;

g) methods for identifying training needs and documentation;

h) procedures for obtaining, maintaining and distributing Material Safety Data Sheets (MSDS) for all materials used (to ensure that employees have 24-h access to this information);

i) procedures for the safe decontamination and maintenance of equipment;

j) emergency procedures including spillage protocols (see Annex A on action plans and Annex C decontamination of spills);

k) incident recording/reporting and investigation; and l) disposal of clinical waste

7.3 Safety Programme Audits and Inspection

7.3.1 Safety Programme Audits

The safety programme shall be audited and reviewed at least annually (by appropriately trained personnel) including, but not limited to, the following elements:

a) safety and health policy;

b) written work procedures that include safe work practices;

c) education and training of laboratory-associated staff;

d) supervision of workers;

e) regular inspections;

f) hazardous materials and substances;

g) health surveillance;

h) first aid services and equipment;

i) investigation of accidents and illnesses;

j) health and safety committee review;

k) records and statistics;

l) review of safety programme with requirement for follow-up to ensure that all required actions arising from the audit are completed.

NOTE Checklists, tailored to the area to be surveyed, are effective aids to auditing (see Annex B on conducting a laboratory safety audit).

7.3.2 Safety Inspection

Laboratory management is responsible for ensuring that safety inspections are undertaken.

Work sites shall be surveyed/inspected at least annually. This is to ensure

a) the proper state of readiness and function of fire emergency apparatus, alarms and evacuation procedures,

b) the status of procedures and materials for hazardous spillage containment, including emergency showers,

c) the proper containment and control for the storage of flammable and combustible, infective, radioactive, toxic materials, and

d) the status of decontamination and disposal procedures.

It is good practice for the safety committee to participate in safety surveys. Regular safety inspections also serve to remind all personnel of potential hazards, ensure compliance and reinforce supervisor responsibility..

7.4 Safety Manual

A safety manual shall be readily available in work areas as required reading for all employees. The manual shall be specific for the laboratory's needs including, but not limited to, the following major categories:

a) fire prevention;

b) electrical safety;

c) chemical safety;

d) radiation;

e) microbiological hazards; and

f) hazardous waste disposal.

The safety manual shall include detailed instructions for workplace evacuation and the protocol for dealing with an incident (see Annex A for more information on action plans). The Safety Manual shall be reviewed and updated at least annually by laboratory management.

Other information sources available in the laboratory shall include, but shall not be limited to, MSDS on all chemicals and agents handled in the laboratory and other reference materials including texts and authoritative journal articles..

7.5 Records

7.5.1 General

Records shall be kept in accordance with ISO 15189. It should be noted that international, national or regional regulations or guidelines may apply.

7.5.2 Occupational Illness, Injury, and Adverse Incident Records

There shall be a mechanism for recording and reporting occupational illness, injury, adverse incidents or accidents, and consequential actions, while at the same time respecting the confidentiality of individuals.

Personnel training records shall be kept. They should include dates of safety orientation and annual updates of safety preparedness for each employee.

7.5.3 Risk Assessment Records

There shall be a formalized system of risk assessment. In addition to any formal workplace risk assessments that may be required, a safety checklist can be a satisfactory way to record and document the review programme (see 7.3).

7.5.4 Hazardous Waste Records

Hazardous waste disposal records shall be an integral part of the safety programme. Records of hazardous waste disposal, risk assessments, safety surveys and consequential actions shall be retained in an accessible file for the period of time required by national or local legislation.

8 Identification of Hazards

Hazardous areas shall be systematically and clearly identified, and be appropriate to the hazard concerned. In certain circumstances, it may be appropriate to identify the hazardous area using both signs and physical barriers.

Specific hazardous materials to be used within the laboratory or laboratory units shall be clearly identified.

All entrances and exits to work areas shall be marked as to the hazards present within. Special attention shall be paid to fire hazards and flammable materials, and to toxic, radioactive, harmful or biologically hazardous materials. Laboratory managers are responsible for regularly reviewing and updating this hazard-identification system to ensure its relevance to the hazards known to be present. This activity shall be carried out at least annually.

Maintenance personnel who are not part of the laboratory staff, contractors and subcontractors shall be made aware of any hazards they may encounter.

Employees shall be trained, familiar with, and have specific written instructions concerning emergency procedures.

Identification and review of the potential hazards to the health of pregnant women shall be undertaken. A risk assessment shall be carried out and recorded..

9 Reporting of Incidents, Injury, Accidents and Occupational Illnesses

The laboratory shall have a programme for reporting laboratory incidents, injuries, accidents and occupational illnesses, as well as potential hazards.

Reports shall be filed for all incidents, including injuries, and shall include a detailed description of the incident, an assessment of the cause, recommendations for preventing similar incidents, and actions taken to implement the recommendations.

Incident reports, including remedial actions, shall be reviewed by a senior manager, the safety committee or the Laboratory Safety Officer.

10 Training

The laboratory director shall ensure that worker safety training programmes are implemented for all laboratory-associated personnel, including transport and cleaning staff. Training in safe work practices should be emphasized. A comprehensive training programme begins with a written plan, and should include an introduction for new employees as well as periodic

retraining for experienced employees. Employees shall be required to read the appropriate safety manual before beginning to work in an area. Confirmation in writing should be obtained from the staff member that they have received appropriate training and that safety manuals have been read and understood, including the dates when these were carried out. At a minimum, a safety training programme shall address fire prevention and preparedness, chemical and radiation safety, and biological hazards and infection prevention. The curriculum should be tailored according to the employee's job description, and should include appropriate considerations for conditions such as pregnancy, immunodeficiency and physical disability. There should be a system for evaluating each employee's understanding of the information given to them.

11 Personnel Responsibilities

11.1 Food, Drink and Like Substances

Food, drink, and like substances shall be allowed only in areas designated for their preparation and consumption.

Food and drink for consumption shall be stored only in specifically designated refrigerators located in nonlaboratory areas. Food shall not be stored where reagents, blood or other potentially infectious material are stored.

Refrigerators shall be appropriately labelled to indicate their intended use.

Smoking shall be prohibited in the technical work area.

11.2 Cosmetics, Hair, Beards and Jewellery

Application of cosmetics and the handling of contact lenses shall be prohibited in technical work areas.

Long hair shall be secured back. It is important to keep hair out of moving equipment. Men with beards shall observe the same precautions provided for hair.

Rings, earrings, wristwatches, bracelets, necklaces and other jewellery shall not be worn in laboratory technical areas if there is any danger of them being caught in equipment or contaminated by infectious substances or chemicals.

11.3 Immunization Status

All laboratory workers should be strongly encouraged to have immunizations to prevent infections associated with organisms to which the person is likely to be exposed.

All personnel working with or handling human blood, sera, body fluids or human tissue should be offered hepatitis B vaccine. Records of immunizations should be kept in accordance with national, regional and local requirements.

The immunization programme for a given laboratory should be based upon a documented laboratory infection¬risk assessment, and on advice from local public health officials. International, national or regional regulations or guidelines may apply..

11.4 Personal Property

Personal property, clothing and cosmetics shall not be placed in designated areas where contamination can occur.

Secure storage such as lockers should be provided .

11.5 Festive Decorations

Festive and other decorations that present potential contamination and/or fire hazards shall not be used in technical work areas.

Decorations should never be attached to lights, light fixtures or technical instruments

12 Clothing and Personal Protective Equipment (Ppe), Including Gloves, Eye, Face, Foot And Respiratory Protection

12.1 Protective Clothing in the Laboratory

The laboratory shall ensure that an ample supply of clean protective clothing (e.g. coats and gowns), appropriate to the level of risk, is available for those working in or visiting within the laboratory.

When not in use, clean protective clothing shall only be hung on hooks provided for that purpose. These hooks shall be away from radiators, steam pipes, heating instruments, and open flames. Contaminated protective clothing should be placed and transported in appropriately identified bags that prevent leakage. They should be appropriately washed to ensure chemical and biological decontamination.

Protective clothing shall be changed at appropriate intervals to ensure cleanliness and shall be changed immediately if it is known to be contaminated with hazardous materials.

Protective clothing shall be removed before leaving the laboratory area.

12.2 Protective Clothing Outside the Laboratory

Phlebotomists and other workers whose duties take them out of the laboratory shall be required to wear clean coats or gowns while working with patients.

12.3 Face and Body Protection

Splash guards or similar devices shall be available for use if there is the potential for splashing of samples or reagents to occur.

Aerosol-generating procedures performed on samples potentially containing microorganisms should be performed within a microbiological safety cabinet.

Approved safety glasses, facial shields or other eye and face protection shall be available to be worn when handling hazardous materials.

Contact lenses offer no protection from splashes. Additional eye protection shall be worn with contact lenses.

12.4 Gloves

Gloves shall be available for use in laboratory operations to provide protection from chemicals, biological hazards, radioactive contamination, cold and heat, product contamination, sharp edges and abrasions.

Gloves shall meet comfort, fit, flexibility, grip, abrasion resistance, puncture resistance and tear resistance requirements for the type of manipulation performed, and shall adequately protect from the hazards involved. Laboratories shall provide unpowdered gloves and/or alternative materials for workers who suffer from allergies and other reactions, e.g. reaction to natural latex, talc, starch or vinyl.

Laboratory workers shall be trained in glove selection, fitting and removal before and after appropriate use.

Gloves should be

a) inspected for leakage before wearing,

b) worn to completely cover the hands and wrists and, where appropriate, overlap the laboratory gown or coat sleeve.

c) replaced if torn, damaged, or if internal contamination is suspected, and

d) use of gloves should be task-specific, i.e. they are only to be used during contact with potentially contaminated material and are to be removed and disposed of in accordance with local safe practices when the task is completed or interrupted.

Soiled gloves shall be removed before handling reference materials, telephones, keyboards, etc

12.5 Footwear

Footwear shall be comfortable, with nonslip soles. Open-toed sandals are inappropriate as laboratory footwear. Leather or synthetic, fluid-impermeable footwear is recommended. Disposable, fluid-resistant shoe covers may be worn for jobs where splashing is anticipated.

For routine work in the laboratory, flat ergonomically comfortable shoes are recommended.

12.6 Respiratory Protection

Where respiratory protection devices (e.g. masks, personal respirators) are required for use during a technical activity, instructions on their use and maintenance shall be included in the text of the safe operating procedure for that activity. Respirators shall be used only in accordance with instructions and training.

Arrangements should also be made for workplace monitoring, medical evaluation, and for respirator users' supervision to ensure the equipment is being used correctly. Respirators may require individual-fit testing. Personnel with beards cannot be fully protected by respirators.

12.7 Handwashing

Laboratory workers shall wash hands immediately after actual or possible contact with blood, body fluids or other contaminating materials, even if gloves have been worn.

Hands should be routinely washed after removing gloves, before and after using the toilet, before leaving the laboratory, before eating or smoking, and before and after contact with each patient.

All personnel working in or visiting the laboratory shall wash hands whenever they have been contaminated, as well as at all times prior to leaving the technical area.

Laboratories should provide alternative materials for handwashing for workers who suffer from allergies or other reactions to specific compounds contained in certain antiseptic agents. Hypoallergenic skin lotion should be provided at all wash stations.

12.8 Training

The laboratory shall ensure that there are personnel trained in first aid. Materials and procedures shall be provided to mitigate adverse effects and incidents occurring to people within the laboratory involving chemical, toxic or potentially infectious materials. There shall also be guidelines for the treatment and, where required, immediate emergency medical attention consistent with the hazards likely to be experienced within the laboratory. All staff should be familiar with the procedures to be taken following needlestick injuries.

12.9 Equipment

The laboratory director shall ensure that, at a minimum, the following facilities for first-aid and emergency procedures are available within the laboratory:

a) a first aid box;

b) first aid equipment;

c) eye irrigation equipment;

d) antidotes to poisonous chemicals used in the laboratory, and instructions for their use;

e) protective clothing and safety equipment for the person rendering first-aid; and

f) provision for summoning medical assistance and prompt transfer to a hospital when required.

12.10 Eyewash stations

Eyewash stations shall be conveniently located wherever acids, caustics, corrosives and other hazardous chemicals or hazardous biological materials are in use, or where work with radioactive materials is undertaken. These eyewash stations shall be of an approved fixed design or be a simple, approved spray-type device attached to the water, or isotonic saline supply by a flexible hose. Simple spray devices with ample supply of easy-open containers of

sterile water are an acceptable alternative in facilities where the risk of splashes exists and access to plumbing is not available.

Devices attached to the water supply should be tested each week to ensure proper functioning and to flush out stagnant water.

12.11 Emergency showers

Emergency showers shall be available and convenient to the location where caustic and corrosive chemicals are used.

These devices should be tested periodically for proper function. The number of such emergency showers depends on the complexity and extent of the laboratory. Comfortable water temperatures should be provided where possible. Floor drains should normally be provided in proximity to such emergency showers.

13 Good Housekeeping Practices

A person shall be designated to oversee good housekeeping practices. The laboratory shall designate technical areas as either clean or contaminated.

Work areas shall be kept tidy and uncluttered at all times.

Storage of large amounts of disposable materials that may result in obstruction and trip hazards in the workplace should be prohibited.

All equipment and work surfaces that are used for processing contaminated materials shall be cleaned and disinfected with appropriate agents at the end of each working shift and whenever spills or other contamination has occurred.

All spills of samples, chemicals, radionuclides, or cultures shall be cleaned up and the area decontaminated after risk assessment (see Annex C on decontamination of spills). Approved safety precautions, safe methods, and personal protective equipment shall be used during clean-up.

Changes in housekeeping practices or materials shall be communicated with the laboratory director to ensure that unintended risks or hazards can be avoided.

Changes in laboratory practices, working habits, or materials that may result in potential hazards to housekeeping and/or maintenance staff shall similarly be communicated with the laboratory director and in writing to the managers of the housekeeping and maintenance staff.

Some incidents of spillage may require the immediate evacuation of all personnel from the area. The impact of these spills may be affected by both the amount and nature of the agent concerned. The Safety Manual protocol for dealing with such events should be utilised (see Annex A for more information on developing action plans for spills).

Specific protocols shall be established for the decontamination, cleaning, and disinfection of each piece of equipment in case of accidents or spills that result in biological, chemical, or radioactive contamination, and also prior to equipment being serviced or repaired (see Annex C for more information on decontamination, cleaning and disinfection of equipment).

14 Safe Work Practices

14.1 Safe Work Practices with All Material of Biological Origin

In all medical laboratories, the policies and procedures for handling, examination and disposal of material of biological origin shall utilise good microbiology practice standards.

Work practices shall be such as to reduce the risk of contamination. Work practices in contaminated areas shall be implemented such as to prevent personal exposure.

All potentially infectious or toxic quality control and reference materials shall be stored, handled and used with the same degree of caution that would be appropriate to samples of an unknown risk..

If samples are damaged or leaking upon receipt, they shall be opened by trained persons wearing appropriate personal protective equipment in order to avoid spillage or aerosols. Such containers should be opened in a microbiological safety cabinet. If contamination is excessive, or the sample is considered unacceptably compromised, it should be safely discarded without being opened. The sender should be informed immediately.

Mouth pipetting shall be prohibited.

Laboratory workers shall be trained in safe handling and use of sharp instruments and devices.

Sharps, including used needles, shall not be sheared, bent, broken, recapped or resheathed by hand, or manually removed from syringes. Reviews of working practices should include the objective to reduce the use of sharps wherever possible.

Sharp objects for disposal, including needles, glass and disposable scalpels shall be placed in puncture-resistant containers immediately after use. National, regional or local regulations may apply.

Sharp containers should not be filled to more than two-thirds of their capacity before replacement. Safe disposal of the used containers and their contents should be in accordance with local guidelines. National, regional or local regulations may apply

14.2. Special Requirements for Working in Microbiology Laboratories

These requirements should normally be applied to other medical laboratory disciplines whenever practicable.

All samples, cultures and waste shall be assumed to contain viable biological agents that can be associated with transmission of infectious disease, and shall be handled in a safe manner.

All potentially infectious or toxic quality control and reference materials shall be stored, handled and used with the same degree of caution that would be appropriate to samples of an unknown risk.

Gowns may be worn at all times while working with samples, serum or cultures. Gowns should be closed at the front and neck, and have long sleeves with cuffs.

Preferably, gowns should be made of moisture-resistant materials.

Gloves shall be worn as a barrier precaution to prevent contamination of hands while handling samples and cultures. However, gloves should be removed at the completion of work to avoid contaminating the workspace. Wearing gloves shall not be considered as an alternative to thorough handwashing (see 12.7).

Hands should always be thoroughly washed when gloves are removed.

Electronic incineration devices preferably should be used for microbiological loop sterilization.

15 Aerosols

Laboratory work practices shall be designed and undertaken in such a way as to reduce the possibility of personal contact with harmful aerosols, whether of chemical or biological origin.

Samples should be centrifuged only in safety-capped enclosures.

All samples being vortex-agitated should be contained in containers with lids.

The use of localized air containment for large pieces of analytical equipment that could generate aerosols, and the use of custom-built extraction hoods to handle small apparatus manipulation is strongly recommended. Localized air extraction is essential where harmful chemical fumes may be present.

16 Microbiological Safety Cabinets, Chemical Safety Hoods and Cabinets

Where laboratory staff works with samples of Risk Groups I and II, recirculation of air from biological safety cabinets is permitted, provided the air is passed through high efficiency

(HEPA) filters before being discharged. Where laboratories work with cultures that may contain microorganisms of Risk Group III or above, recycling of air shall be prohibited.

In some jurisdictions, double HEPA filters are required.

Biological safety cabinets and chemical safety hoods shall be installed and certified annually by a competent individual.

Biological safety cabinets shall be frequently monitored to ensure that they function as designed. Records shall be kept of the inspection and any functionality testing results. Proof of inspection should be indicated by a certification label displayed on the cabinet.

The location, design and type of biological safety cabinet utilized shall be appropriate to the level of risk containment required for safe working.

All biological safety cabinets shall be used in such a manner as to avoid compromising the cabinet's function.

Venting of biological safety cabinets, chemical safety hoods and cabinets shall be appropriate to the microbiological and/or chemical risk and be consistent with safety requirements.

17 Chemical Safety

17.1 Measures to Avoid Chemical Contamination

In all medical laboratories, the policies and procedures for storage, handling, use and disposal of chemicals shall always be in accordance with good chemistry laboratory practice standards.

The nature and risk of hazards concerning each product shall be marked on every stock container, in compliance with International Standards, as well as in clear, unambiguous labelling of containers of "in-use" products.

There shall be adequate control measures available for chemical, physical and fire hazards. These controls shall be routinely monitored to ensure their effectiveness. Records of the results of the monitoring process shall be maintained.

Hazardous liquids, such as acids or alkalis, shall be stored below eye level. Large containers shall be securely stored near the floor, but at a height that allows for safe ergonomic handling.

Appropriate facilities complying with national, regional or local requirements shall be provided for the safe handling, storage and use of compressed gases and cryogenic materials.

Securing devices (e.g. chain and shelving lips) shall be installed to prevent unintended movement of gas cylinders, reagents or glassware.

All personnel shall be required to work according to safe operating protocols, including the use of safety equipment or devices that have been deemed appropriate for the task(s) undertaken.

Appropriate protective clothing shall be worn at all times by all personnel within analytical areas, supplemented by appropriate personal protective equipment when indicated by the nature of the activity being undertaken (see Clause 12).

17.2 Emergency Measures Applicable when Chemical Contamination has Occurred

Eyewash facilities shall be provided in all analytical areas where there is potential for eye damage due to chemical contamination.

Where the nature of the chemical hazard is such that there may be a risk of gross body contamination, drench showers shall be provided (see 12.11).

Suitable chemical spill measures shall be provided, including neutralizing agents, spill containment, and absorbents appropriate for the chemicals used in the workplace.

17.3 Discarded chemicals

There shall be a clear written procedure for the discarding and safe disposal of every chemical product used in the laboratory. This shall include sufficient details of the local regulatory

process to enable full compliance with the mechanisms through which such materials can be safely and legally released from the laboratory's control.

18 Radiation Safety

18.1 Radionuclides

The Laboratory Director shall assess the justification for, extent of, and location of proposed use before permitting work with radionuclides.

The laboratory shall keep adequate records of radionuclide acquisition, use and disposal. All radiochemicals shall be safely and securely stored.

All laboratory personnel who work with or have exposure to radionuclides shall be instructed and trained in radiation-based and associated techniques and in radiation protection, and shall comply with radiation safety policies and procedures.

The laboratory shall have written standard operating procedures and local rules appropriate and sufficient for the work.

These procedures shall include clear instructions, a summary of which shall be displayed prominently in the workplace where radionuclides may be used, detailing the actions to be taken to deal with radiation accidents and spills.

The procedures shall detail methods of safe disposal of unused radioactive materials and materials that have been mixed with or contaminated by radioactive materials.

Appropriate approved warning and prohibition signage shall be displayed.

In addition to national, regional, and local regulations, reference should be made to [11].

18.2 Radiation Protection Advisors, Officers, and Supervisors

Where work with radionuclides is undertaken, the laboratory shall seek the advice of the local authorized Radiation Protection Advisor (RPA) on radiation protection practice and legislative requirements, and institute appropriate measures to enable compliance with the advice received, including any required laboratory design and equipment standards.

The laboratory shall appoint a Radiation Protection Officer (RPO) who shall report to the RPA. The RPO shall have particular responsibilities for the design of the operational radiation protection programme, its implementation, and maintenance.

The Radiation Protection Officer should report managerially to the Laboratory Director and professionally to the Radiation Protection Adviser.

The laboratory shall appoint Radiation Protection Supervisors (RPSs) to supervise day-to-day work with ionizing radiation to ensure the use of good radiation practice. The RPSs report to the laboratory RPO.

Local rules shall dictate the availability, roles and responsibilities of the RPA, RPO and RPSs.

The formation of a Radiation Safety Committee is strongly recommended where this is not already a statutory requirement.

18.3 Workplace Monitoring

A programme of systematic monitoring shall be established to ensure that comprehensive and frequent monitoring of the workplace is undertaken. Monitoring records shall be maintained.

A protocol for routine cleaning and decontamination shall be designed and adopted.

The use of radionuclides shall be regularly reviewed, work practices frequently monitored and modified as dictated by the RPA and RPO. Remedial action or procedural changes shall be recorded and held for the period of time dictated by statute or locally agreed rules.

Radioactive waste shall be labelled and held in a secure and radiation-protected store dedicated for this sole purpose, in such a way that there are clear indications of the nature and level of risk in each discarded package. Storage and disposal shall be determined by legislation and local rules.

18.4 UV and Laser Light Sources (including Light from High-intensity Sources)

Wherever UV and laser light sources are used, suitable and adequate personal protective equipment shall be provided, appropriate approved signs displayed, and training provided for the safe use of equipment. These light sources shall be used only for their designed purpose.

Housing for such light sources should be opened only by maintenance staff qualified to service such equipment.

18.5 Microwave Equipment

Microwave equipment shall be regularly inspected, monitored and serviced to ensure that performance and safety standards are maintained.

Where high-powered microwave and radiowave devices merit additional precautions, they should include extra shields and protective covers. The possibility of interference with the performance of other pieces of equipment should be considered when locating such devices. Signs should be posted to warn of the effects such devices can have on people wearing pacemakers. Personnel who have pacemakers fitted should be prohibited from the immediate location of high-powered microwave and radiowave devices.

Flammable substances shall not be placed in microwave equipment.

19 Fire Precautions

19.1 Construction

Architectural specifications shall be based upon the type of laboratory hazard to be contained. Primary exit routes shall be designated.

Medical laboratories within inpatient facilities should be separated from medical areas by fire resistant construction. Where flammable gases are stored, spark-proof or spark-protected lights and switches should be installed. Electrical equipment should be specially designed for use within such areas.

19.2 Secondary Exits

Secondary exits shall be provided to ensure safe evacuation of personnel from laboratories.

Designated fire exits should open into a fire-protected area.

19.3 Alarm Systems

Automatic smoke or heat detection and alarm systems shall be provided for every laboratory area where flammable gases or liquids are used or stored.

Alarm systems should be regularly tested to ensure their function and to familiarize all personnel with their operation.

19.4 Fire Risk Reduction Strategies

Only minimum quantities of flammable gases and liquids shall be kept in the technical areas of the laboratory.

Flammable gases and liquids shall be used only in well-ventilated areas.

Work involving release of flammable vapours shall be conducted only in a laboratory fume hood or cupboard.

Flammable liquids and gases shall be kept away from heat and sources of ignition, including electric motors and direct sunlight.

Piped-in gas supplies require the installation of emergency shut-off valves and pipework in accordance with national, regional or local regulations.

Spill kits shall be immediately available to contain small quantities of flammable spillage.

In case of a spill, fire department assistance shall be sought immediately. National, regional and local regulations shall apply.

19.5 Storage of Flammable Materials

Containers for flammable liquids and gases shall be kept as small as possible, compatible with laboratory needs.

Containers for flammable liquids shall be kept closed except when in use.

Flammable liquids and gases shall be stored only in approved cabinets or stores. Storage should comply with prevailing national standards.

Refrigerated flammable liquids shall be stored only in "explosion-safe" nonsparking refrigerators.

Metal storage containers for bulk flammable liquids shall be bonded and grounded to a common site to avoid static charge.

Portable safety containers shall be used for storing, transporting and dispensing flammable liquids.

Decanting or transferring combustible liquids from stock drums to small containers should be done within a storage room especially reserved for this purpose or within a chemical fume hood. Proper grounding of metal containers is required

19.6 Fire Safety Training Programmes

Instruction and training shall be given to all laboratory workers and personnel who share the building. This shall include

a) recognition and evaluation of fire hazards,

b) planning to reduce the risk of fire, and

c) all actions to take when fires occur.

19.7 Firefighting Equipment

Appropriate equipment shall be in place to extinguish containable fires, and to assist in the evacuation of personnel from the vicinity of a major fire.

It is the responsibility of laboratory personnel to ensure people's safety by orderly evacuation rather than by attempting to extinguish fires.

Selection, location and maintenance of extinguishers and fire blankets shall be appropriate for the types of fire possible within the laboratory, and in accordance with the local fire authorities

20 Emergency Evacuations

An action plan for emergency evacuation shall be developed (see Annex A for more information on development of action plans). As an alternative, the plan shall take into consideration chemical, fire and microbiological emergencies. This shall include measures to be taken to leave the unoccupied building in as safe a state as possible.

All personnel, including visitors, shall be made aware of the action plan, routes of exit, and assembly points for emergency evacuation.

All personnel shall participate at least once a year in a fire drill.

21 Electrical Equipment

Electrically operated equipment shall be designed and manufactured to comply with appropriate safety requirements. Recognized standards include the ISO/IEC 61010 series, Safety requirements for electrical equipment for measurement, control, and laboratory use (see Bibliography). To ensure safety, some items of equipment must be connected to back-up power supplies.

New, modified or repaired equipment shall not be put into use until a competent person (e.g. a qualified electrician or biomedical engineer) has carried out electrical safety tests and is satisfied that the equipment is safe for use.

Users of electrical equipment shall be trained in its proper use, and shall handle it in such a way that electrical safety is not compromised.

Users of electrical equipment shall routinely inspect the equipment for damage that could lead to electrical fault.

If conducting liquid is accidentally spilt on equipment, the latter shall be disconnected from the electrical supply and carefully dried. It shall not be reused until a competent person has approved it for use. Steps to decontaminate equipment shall be taken to reduce the risk of chemical or biological contamination exposure to the maintenance personnel (see also Clause 13, Annex A and Annex C).

Only competent persons shall be permitted to carry out work on electrical equipment and circuitry. Unauthorized work shall be forbidden

22. Transport of Samples

The laboratory director, or an appointee, e.g. the laboratory safety officer, shall be responsible for the provision of appropriate guidance and direction to all sites that submit samples to the laboratory.

All samples shall be transported to the laboratory in such a manner as to prevent contamination of workers, patients, or the environment.

Samples shall be transported in approved, inherently safe, leakproof containers.

Samples sent within a facility's premises shall comply with the facility's rules for safe transport. Samples sent outside the facility shall comply with prevailing regulations regarding the transport of infectious and other materials of biological origin.

Samples, cultures and other biological material transported between laboratories or other facilities shall be sent in a manner compliant with facility safety rules. Where applicable, international and national regulations pertaining to transport of dangerous materials for road, rail and ship shall apply.

Materials deemed by national or International Standards as dangerous goods intended for national or international air transport shall be packaged, labelled and documented in compliance with current national or international regulations or requirements.

23 Waste Disposal

Laboratory waste disposal shall be managed in accordance with national, regional, or local regulations.

Laboratory waste management shall have the following objectives:

a) minimizing the hazards in handling, collecting, transporting, treating and disposing of waste; and

b) minimizing harmful effects to the environment.

All samples, cultures and other biological material no longer required shall be discarded in containers specifically designed, intended and marked for disposal of hazardous waste. Biological waste containers should not be filled beyond their designed capacity.

Sharps, including needles, scalpels, metal and glass, shall be discarded directly in puncture-resistant containers.

Laboratory management shall ensure that hazardous waste is handled by appropriately trained personnel using appropriate personal protective equipment.

Rubbish and laboratory waste shall not be allowed to accumulate. Filled containers shall be removed from work areas on a regular basis. They shall be held in a designated secure place, normally within the laboratory area, prior to decontamination or final disposal. Laboratory rubbish and routine paper waste that has not been contaminated with reagents or body fluids

can be handled and processed as nonhazardous waste. Appropriate and safe disposal should occur at least daily.

All discarded microbiology laboratory samples, cultures and contaminated waste shall be made intrinsically biologically safe before being taken from the laboratory facility.

Biological safety may result from processing by autoclave, or other approved technology, or by packaging in appropriate containers.

Transport of waste that has not been treated may be allowed, provided that the material is packaged and transported in a manner consistent with hazardous waste regulations to a facility for safe and appropriate disposal.

Laboratory waste that is known to be contamination-free can be handled and processed as nonhazardous waste.

Annex A

(informative)

Action-plan outline for implementation of this International Standard

A.1. Introduction

A.2. Establishing the safety system

A.2.1 Step 1: Safety lead

Identify a Laboratory Safety Officer with sufficient experience to take the lead on safety issues. This individual should be given sufficient time to undertake the task. In a small laboratory, this time commitment may be minimal, but it may increase with laboratory complexity.

A.2.2 Step 2: Identifying hazards

Working with the senior laboratory personnel, the Safety Officer should list the hazards that exist or could arise within the laboratory or result from its activities. It is important to include issues that are not those of direct laboratory origin, for example linked to the building structure or the external environment.

A.2.3 Step 3: Risk assessment

The Safety Officer, in close conjunction with senior laboratory personnel, should assess the level of risk associated with each hazard, both inherently within the hazard itself and as a component of a group of associated hazards. Risk assessment requires evaluation of both task-specific and environmental hazards. Records should be made of the perceived level of risk, who could be affected, with what consequences, and to what degree of severity.

A.2.4 Step 4: Prioritizing risk

As part of Step 3, possible ways to reduce the level of risk will be identified. Working with senior laboratory personnel, the Safety Officer should prioritize risks according to those requiring immediate, intermediate, or long-term risk reduction strategies. This should be based on the potential for harm, not on economic grounds, although this component cannot be ignored. There will be some occasions when a difficult decision has to be made to cease a particular activity, as the risks are so high as to outweigh any potential benefit.

A.2.5 Step 5: Reducing risk

There can never be a total absence of risk in the medical laboratory. The aim should be to decrease risk as much as possible, taking account of all factors involved. Action Plans should be prepared and implemented to reduce risk(s) to acceptable levels by an agreed target date by all concerned parties, both within the laboratory and with others affected by its operation. The actions planned and implemented are the responsibility of the senior laboratory personnel, advised and assisted by the Safety Officer. Decisions made and actions proposed should be carefully recorded, together with supporting information as to why the action was taken

A.2.6 Step 6: Reviewing risk strategies

As part of risk-reduction strategies, there should be careful monitoring of action-plan implementation. The programme should be one of constant improvement in the risk reduction process. It should involve all laboratory personnel, although the implementation depends on positive leadership by senior laboratory personnel and competent direction from the Safety Officer.

A.3 Maintaining the established safety system in the laboratory

Regular safety awareness training for laboratory personnel is recommended. Attendances and programme records should be kept.

Regular programmed safety audits and/or inspections of the workplace (both analytical and nonanalytical areas) are recommended. These should not be less than annually, and in areas of increased risk at more frequent intervals. Careful documentation should be kept. The annexes of this International Standard contain itemized checklists to assist this process.

Instruction manuals, methods and operational guidance documentation should include relevant safety information that is both practical and fully operational. This information should be kept current.

All new equipment and processes should be assessed for risk both before and after commissioning, and appropriate risk-reduction strategies implemented.

Untoward incidents and accidents should be fully investigated, documented, and subsequent steps taken to reduce the possibility of recurrence.

All personnel should be encouraged to identify potential hazards and to work in a manner so as not to put themselves or others at risk.

Annex B
(informative)
Laboratory safety audit

B.2. Instructions

a) Follow instructions on each page:
- indicate Y (yes), N (no) or NA (not applicable) in the second, third or fourth column;
- answer all questions; and
- list, explain and/or clarify responses in the last column.

b) If there is insufficient space on the form for all of the required information:
- include the information on a separate page;
- attach it to this form; and
- indicate on the form that there is additional information attached.

c) You will need to update your policies and procedures in the following situations:
- when you add new tasks and procedures that affect occupational exposure; or
- when you change or modify tasks and procedures that affect occupational exposure.

Make sure that you are in compliance with every item you check or date in this audit.

Table B.1 — Work practice/engineering controls

The following work-practice/engineering controls are in place in this department	Y	N	NA	Comments/Explanations
1 Handwashing sinks are available for staff use in work areas where exposure to blood/body fluids can occur. - Handwashing sinks are used for disposal of blood/body fluids. If yes, explain.				
2 In instances where handwashing facilities are not readily available, antiseptic hand cleanser and clean				

The following work-practice/engineering controls are in place in this department	**Y**	**N**	**NA**	**Comments/Explanations**
towels or towelettes are available. Indicate method used.				
3 Handwashing is required in the following instances: - if hands become contaminated with blood or body fluids; - when gloves are removed; and - between patient contacts. Is this policy being followed? If not, please explain.				
4 Is recapping of sharps and bending and breaking of needles prohibited under all circumstances in this department? If no, see 4 a). 4 a) Needles shall be recapped in the procedures listed. 4 b) Method for recapping is: with one-handed scoop (passive recapping); a recapping device is used; or other (describe your method).				
5 Leakproof, puncture-resistant sharps containers, with appropriate labels or colour coding, are readily available for disposal of used sharps. If not, please explain.				
6 Are there any reusable sharps used in the lab? Please list them. 6 a) Reusable sharps contaminated with blood or other infectious materials are processed and stored so that personnel are not readily able to reach into these sharps containers.				
7 Handling of sharps: After use, all sharps (needles, scalpels, capillary pipettes, slides, coverslips, disposable pipettes, and other sharps) are placed in appropriate puncture-resistant containers for reprocessing or disposal. Employees have been trained in these procedures and have been instructed not to overfill containers.				
8 Eating, drinking, applying cosmetics, smoking and handling contact lenses is prohibited in work areas where there is any risk of occupational exposure. Employees have been informed of this rule and are in compliance.				
9 Mouth pipetting is prohibited in the laboratory. 9 a) Mechanical pipetting devices are available in the laboratory.				
10 Storage of food and drink for consumption is prohibited in places where blood or other potentially infectious materials are kept. This applies to refrigerators, freezers, shelves, cabinets, countertops and benchtops. Employees have been informed of this rule and are in compliance.				
11 Sample handling: Leakproof primary containers are used for all samples. 11 a) All samples (blood or other potentially infectious materials) are placed in leakproof secondary containers during transport. Requisitions are attached to the outside of the secondary container. 11 b) When packages that contain blood or other potentially infectious materials are shipped from the laboratory to another mailing address, they are				

The following work-practice/engineering controls are in place in this department	Y	N	NA	Comments/Explanations
appropriately packaged and a biohazard label is affixed to the outside of the package. 11 c) Pneumatic tube system: Employees are instructed on the proper packaging of the carriers to transport samples without leakage.				
12 Equipment that becomes contaminated with blood or other potentially infectious materials is decontaminated immediately or as soon as possible. 12 a) Equipment is also inspected before it is repaired or shipped, and decontaminated if possible. If it cannot be decontaminated before repair or shipment, staff have been instructed to attach a biohazard label that clearly identifies the site(s) of contamination.				
13 Regulated waste: Closable leak-proof containers with the appropriate colour coding or labelling are available. 13 a) Bulk body fluids (urine, vomitus, faeces, etc.) are disposed of properly through a sanitary sewer system. 13 b) Containers of body fluid (pleurevacs, blood bags, suction liners, etc.) are placed in biohazard waste containers for incineration or other approved disposal. 13 c) Laboratory samples are disposed of in biohazard bags (autoclavable, if appropriate) in leakproof containers with tight-fitting covers. 13 d) Laboratory samples are autoclaved before disposal when applicable. 13 e) If autoclaves are used for treatment of waste, they are monitored with biological indicators on a regular basis. Please define how often. 13 f) Tissues, organs and other body parts are placed in biohazard waste containers and sent for incineration or other approved disposal.				
14 Other solid waste (gloves, dressings, etc.) is placed in sturdy plastic bags and is tightly closed for transport.				
15 Procedures that can cause splashing, spraying or splattering of blood or body fluids are performed in a biological safety cabinet or behind an appropriate protective shield. Please list procedures. 15 a) Biological safety cabinets are inspected on an annual basis.				
16 Written laboratory biological/infection control safety policies are readily available to employees. 16 a) The Laboratory or Hospital Exposure Control of Infection Plan is readily available to employees. 16 b) A copy of an appropriate national or international publication covering the protection of laboratory workers from occupationally acquired infections is readily available to all employees.				

Table B.2 — Personal protective equipment (PPE)

The following fluid-resistant PPE is available to employees of this department free of charge	**Y**	**N**	**NA**	**Comments/Explanations**
1 Disposable gloves, in appropriate sizes, are available to all at risk of exposure, for either discretionary use or as required. 1 a) Are gloves worn: - during contact with blood or body fluids, mucous membranes or the non-intact skin of patients? - when handling items or surfaces soiled with blood or body fluids? - when performing vascular-access procedures (phlebotomy)?				
2 Hypoallergenic gloves and liners are available to workers who are allergic to latex gloves.				
3 Utility gloves are available when indicated, checked before use, and replaced as necessary.				
4 Is face protection needed? 4 a) If face protection is needed/required, the type(s) of face protection available are as follows (indicate all that apply): - mask with glasses with solid side-shields - mask and goggles - mask with splash shield - chin-length face shield List other face protection available if not listed.				
5 Is protective body clothing required? 5 a) Type(s) of protective body clothing available (indicate all that apply): - clinic jackets - gowns - laboratory coats - aprons List any other protective body clothing that is available.				
6 Is footwear and headgear required? 6 a) Type(s) of footwear and headgear available are as follows (check all that apply): - surgical caps/hoods - shoe covers - short - knee-high List other footwear and headgear available.				
7 Is reusable protective clothing being reprocessed by either of the following?: - hospital laundry services - outside laundry services If an outside laundry service is used, provide the following information: name of service; address; items processed by service; and whether the service meets appropriate standards.				

8 Is resuscitation equipment required? 8 a) Types of resuscitation equipment available are: - mouthpieces - resuscitation bag List other available equipment.				
9 The PPE mentioned above is available in all work areas where needed and is maintained on a regular basis.				

Table B.3 — Housekeeping

Item	Y	N	NA	Comments/Explanations
1 Employees decontaminate work surfaces with an appropriate disinfectant, immediately after completion of procedures, after their work shift, and as soon as feasible when contaminated with blood or body fluids.				
2 Blood and body fluid spills. 2 a) Broken glass: Staff have been instructed never to pick up by hand any broken glassware that might be contaminated. 2 b) A brush, dust pan, forceps and/or tongs are available for picking up broken glassware. 2 c) Are the following procedures routinely used for spill cleanup? - soak up spills with absorbent material (paper towels) - decontaminate the area with an appropriate disinfectant - dispose of contaminated materials appropriately				
3 Disinfectant is ready and available for use at all times. Please list the disinfectant used to decontaminate blood or body fluids in this laboratory.				
4 Laundry: Staff have been instructed to consider all used linen as potentially infectious and to wear appropriate PPE when handling used laundry. 4 a) Staff have been instructed to handle contaminated laundry as little as possible. 4 b) Staff have been instructed to place laundry directly in the standard laundry bag. 4 c) Staff have been instructed to double bag as necessary to prevent leakage.				
5 Biohazard warning signs are used to identify the following contaminated materials: - containers used to store or transport contaminated materials, including pneumatic tube carriers; - containers used to store or transport regulated medical waste;				

- refrigerators or freezers that hold potentially infectious materials.				
5 a) Biohazard warning signs are posted on laboratory entrances. 5 b) Biohazard labels are placed on generally accessible equipment (telephones, computer terminals, etc.) used by personnel wearing gloves. No one shall use this equipment without wearing gloves.				

Annex 4 - Minutes of Community Consultation Meeting

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM

Độc lập – Tự do – Hạnh phúc

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BIÊN BẢN THAM VẤN CỘNG ĐỒNG

Dự án: Phát triển các trường Đại học Quốc gia Việt Nam – Tiểu dự án Đại học Quốc gia Hà Nội (Vay vốn WB)

1. **Thời gian tổ chức:**.....Ngày..... tháng.....năm 2019
2. **Địa điểm tổ chức:**....Nhà...khách...đại học quốc gia Hà Nội tại Hòa Lạc
3. **Thành phần tham dự:**

a. Đơn vị chủ đầu tư

- Ông (bà):..Nguyễn Đức Hằng.....Chức vụ....GĐ.TT.PT.ĐHQG HN tại Hòa Lạc
- Ông (bà):..Vũ Đức Hảo.....Chức vụ...P.GĐ.TT.PT.ĐHQG HN tại Hòa Lạc

b. UBND xã

- Ông (bà):..Nguyễn Văn Thá.....Chức vụ.CT..UBND xã Thạch Hòa
- Ông (bà):.....Chức vụ.....

c. Đại diện tư vấn

- Bà : Nguyễn Thị Thuý Chức vụ : Tư vấn
- Ông (bà):..Lê Thị Phương Khanh..Chức vụ.....Tư vấn.....
- Ông (bà):..Đào Thị My Linh.....Chức vụ.....Tư vấn.....

d. Địa diện hộ dân:

- Ông (bà):.....Chức vụ.....
- Ông (bà):.....Chức vụ.....

4. **Nội dung cuộc họp**

Ông Nguyễn Văn Thá giới thiệu chung về cuộc họp, nội dung dự án xây dựng ĐHQG HN tại Hòa Lạc trên địa bàn xã Thạch Hòa. Dự án xây dựng ĐHQG HN tại Hòa Lạc đã bắt đầu từ năm 2005, đến nay tiến độ thực hiện rất chậm. Lãnh đạo xã nhân dân địa phương rất mong muốn dự án phát triển các trường đại học quốc gia Việt Nam xây dựng xã hội nhanh chóng để ổn định kinh tế và phát triển, cải thiện đời sống cho các hộ dân đang sinh sống trong khu vực

Bà Nguyễn Thị Thuý góp thêm các nội dung đầu tư của dự án, các vấn đề về tuyên truyền, vận động dự án đầu tư xây dựng và các biện pháp giảm thiểu cho các tác động dự kiến.

Ông Nguyễn Văn Thá địa phương đồng tình, thống nhất với các vấn đề và biện pháp giảm thiểu chủ đầu tư đưa ra. Hiện nay, trên địa bàn địa phương không có tên tàu các vấn đề môi trường lớn. Vấn đề môi trường nổi cộm của địa phương là của các hộ dân xung quanh tuyến đường Láng - Hoà Lạc và tuyến đường đi Xuân Mai - Sơn Tây, các tuyến đường này do lưu lượng xe và tải trọng các xe lưu thông lớn. Vì vậy, việc xây dựng làm tăng lưu lượng giao thông của dự án không làm ảnh hưởng lớn đến người dân.

Ông Nguyễn Văn Cường (thôn 10) người dân địa phương rất ủng hộ để dự án triển khai nhanh. Dự án cần đảm bảo thi công bảo đảm an toàn, đúng tiến độ để người dân an tâm sinh sống.

Ông Nguyễn Văn Tiến (thôn 7) người nuôi ngan của địa phương khá đắt nên khi thi công cần chú ý bảo vệ người nuôi ngan.

Ông Quang Thế Nam (thôn 2) thu thi công, công nhân của các nhà thầu cần có những cử xử đúng đắn, tránh gây mất trật tự, xáo trộn trong cộng đồng dân cư địa phương.

Bà Cao Thị Tường hoàn toàn đồng tình ủng hộ, thống nhất với dự án và các biện pháp giảm thiểu tác động của dự án. Mong chủ dự án thực hiện đúng các biện pháp đã đề ra.

Ông Nguyễn Đức Đăng Cán bộ P.T.N.M.T xã Hoà Lạc: Đại lộc được giá Hà Nội cần đất thực hiện các biện pháp đã đề ra, đảm bảo cuộc sống cho người dân yên tâm sinh sống, canh tác.

2

5. Kết luận

Lãnh đạo và nhân dân địa phương hoàn toàn thống nhất với các ý kiến đã đề ra trong cuộc họp.

Cuộc họp kết thúc vào lúc.....cùng ngày

Đại diện cộng đồng	Đại diện chính quyền địa phương
	CHỦ TỊCH Nguyễn Văn Thá
Đại diện Tư vấn	**Đại diện Ban QLDA**

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM

Độc lập – Tự do – Hạnh phúc

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DANH SÁCH THAM DỰ

STT	Họ và Tên	Địa chỉ	Ký tên
1	Lê Văn Tuyến	Thôn 7	Tuyen
2	nguyễn văn Hoàn	thôn 7	Hoàn
3	nguyễn Thị Sinh	thôn 8	Sinh
4	Hà Thị Hường	Thôn 7	Chính Hường
5	Lê Thị Chính	Thôn 7	Chính
6	Nguyễn Thị Hồng	Thôn 6	Hồng
7	Bùi Thị Mậu	thôn 9	Mậu
8	Vũ Thị Hoà	thôn 9	Hoà
9	Cấn Thị Tường	Thôn 8	Tường
10	Nguyễn thị Huyền	Thôn 2	Huyen
11	Trần Thị Luyến	Thôn 7	
12	Khuất duy Tân	thôn 7	
13	Nguyễn minh Lai	T 10	
14	Dương Đức Thọ	T 10	
15	Lê Thị Thảo	T 10	Thảo
16	nguyễn Thị Hà	T 10	Hà
17	Phùng Văn Tạo	Tg	
18	Đặng Văn Phấn	Tg	
19	Hoàng Trần Hiệp	Tổ	
20	Khuất Tùng Ân	Tổ	

Người lập biểu

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

Tên dự án: **Dự án phát triển các trường Đại học quốc gia Việt Nam – Tiểu dự án Đại học Quốc gia Hà Nội**

Thời gian họp: ngày ... tháng ... năm ... Nhà văn hoá thôn 10 - xã Thạch Hòa

Địa chỉ nơi họp: ....

1. Thành phần tham dự:

1.1. Đại diện Ủy ban nhân dân

PCT UBND xã: Nguyễn Văn Hùng

1.2. Đại diện chủ dự án

....

1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường

1.4. Đại biểu tham dự: đại diện của Ủy ban mặt trận Tổ quốc, các tổ chức chính trị - xã hội, tổ chức xã hội nghề nghiệp, tổ dân phố.

2. Nội dung và diễn biến cuộc họp:

2.1. Người chủ trì cuộc họp thông báo lý do cuộc họp và giới thiệu thành phần tham dự.

2.2. Chủ dự án trình bày tóm tắt báo cáo ĐTM của dự án gồm các nội dung của dự án, các tác động tích cực và tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giảm thiểu.

2.3. Thảo luận, trao đổi giữa cộng đồng dân cư chịu tác động trực tiếp với chủ dự án, Ủy ban nhân dân về các vấn đề mà chủ dự án đã trình bày tại cuộc họp.

- Ý kiến thảo luận

Ông Nguyễn Quốc Vượng: Cần phải đảm bảo vệ sinh của khu nhà vệ sinh của công nhân và khu vệ sinh tập trung.

Ông Lê Tiến Bảy: Dự án đã kéo dài rất lâu rồi, thêm nay khu vực dự án có lượng công nhân rất lớn cần phải có những biện pháp xử lý nước thải. Nếu làm không đúng bị dẫn ra kênh mương sẽ ảnh hưởng đến nước ngầm.

- Tránh gây xáo trộn về trật tự an ninh xã hội, tư vấn cụ thể về các biện pháp đảm bảo

Vào mùa khô cần đảm bảo tình trạng bê tông không thì
khi vận chuyển nguyên vật liệu.
- Cần đảm bảo tuyến đường vào chuyển nguyên vật liệu, che kín tuyến phải tưới nước để tránh phát tán bụi, đường.

- Ông Trần Đình Hưởng: Các công trường xây dựng cần phải quản lý công nhân chặt chẽ tránh kiện tụng, vệ sinh bừa bãi làm bẩn môi trường xung quanh, vì số lượng công nhân lớn thì việc quản lý và với số lượng công nhân lớn khó khăn cần sự phối hợp trật tự xã hội là vô cùng khó khăn cần sự phối hợp chặt chẽ của đại học quốc gia và nhà thầu.

- Ông Dương Đức Thư: hoàn toàn nhất trí với các biện pháp giảm thiểu dự án đề ra. Mong chủ dự án thực hiện các biện pháp này.

- Bà Nguyễn Thị Sơn: Mong dự án sớm chóng tiến hành, thực hiện đủ các biện pháp giảm thiểu và các chế độ chính sách dành cho người dân.

- Ông Dương Hoàng Quân: Mong chủ dự án là ĐHQGHN tạo ra việc làm cho các hộ dân sống trong khu vực làng đại học.

3. Người chủ trì cuộc họp tuyên bố kết thúc cuộc họp

ĐẠI DIỆN UBND	ĐẠI DIỆN CHỦ DỰ ÁN
(Ký, ghi họ tên)	(Ký, ghi họ tên)

PHÓ CHỦ TỊCH
Nguyễn Văn Hưng

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM

Độc lập – Tự do – Hạnh phúc

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DANH SÁCH THAM DỰ

Dự án: Phát triển các trường đại học Quốc gia Việt Nam – TDA đại học Quốc gia Hà Nội

Thời gian: .....

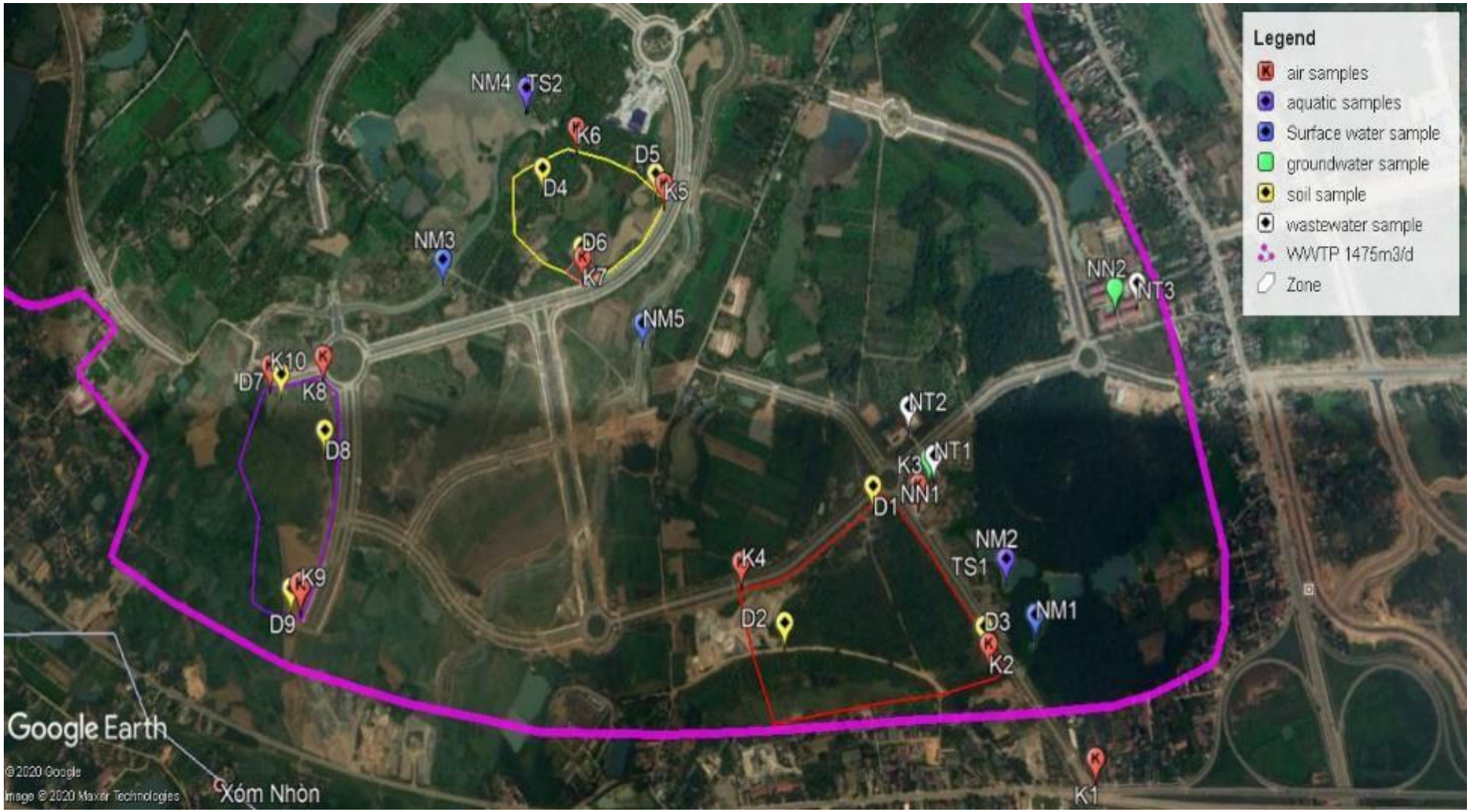
Địa điểm:.....

STT	Họ và Tên	Địa chỉ	Ký tên
1	Nguyễn Thị Nương	xã Thạch Hà	Nương
2	Trần Thị Thắng		Thắng
3	Lê Thị Tuyên		Tuyên
4	Nguyễn Văn Nâu		Nâu
5	Vũ Thị Oanh		Oanh
6	ng Thị Sửi		Sửi
7	Bùi văn Kích		Kích
8	Mai Văn Tình		Tình
9	Đặng doanh Quân		Quân
10	Nguyễn manh Lợi		Lợi
11	Đặng Đức Tiến		Tiến
12	Nguyễn Quốc Vương		Vương
13	Phan ngọc xí		
14	Lê Tiến Dũng		Dũng
15	Nguyễn Văn Hồng		Hồng
16	Trần Đình Thuỷ		Thuỷ
17	Ng văn Cường		Cường
18	Đỗ Thị Ngọc		Ngọc

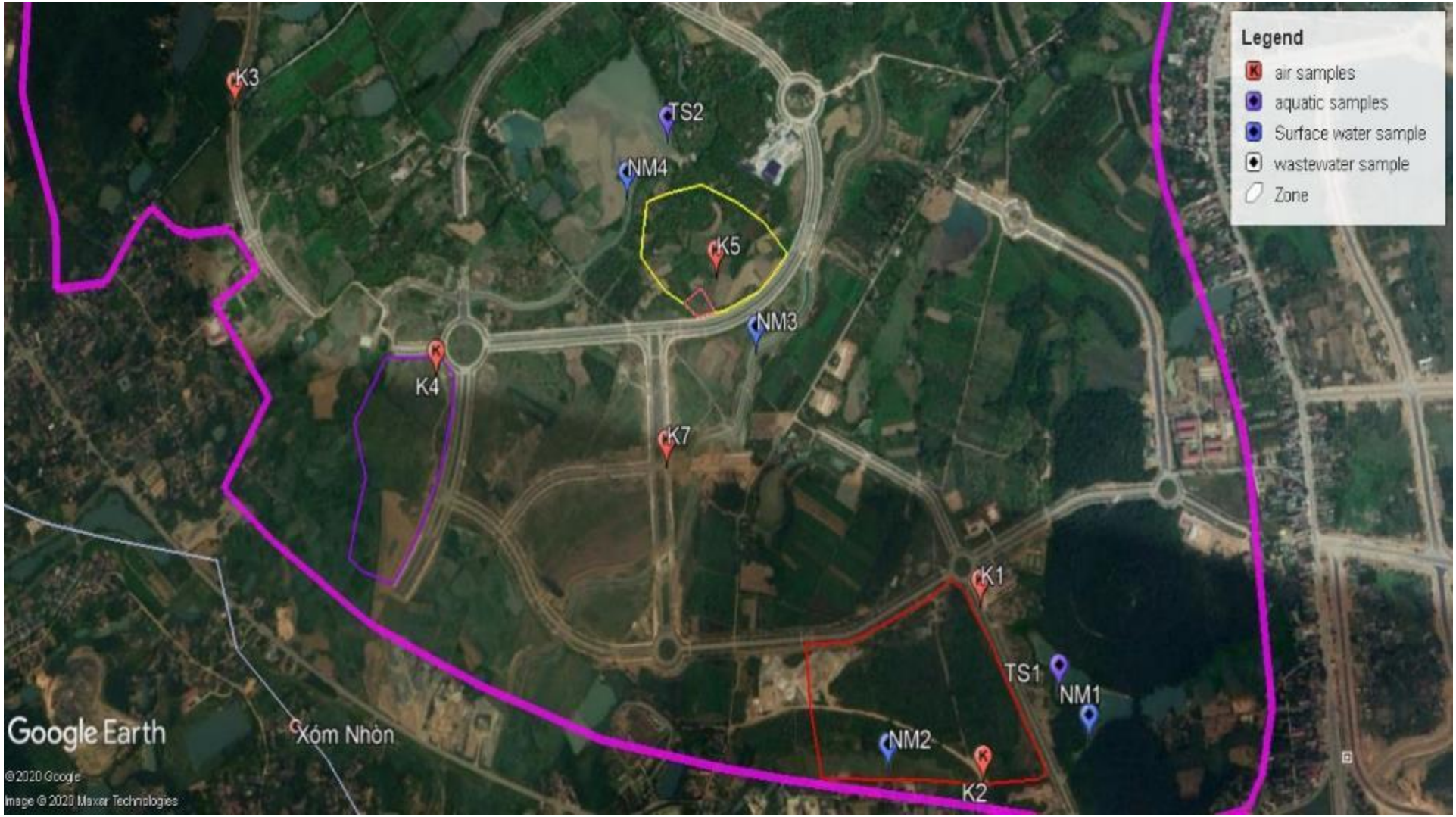
Người lập biểu

Annex 5 - Sampling map

1. Field sampling map



2. Sampling sample of construction phase



3. Sampling map of operation phase