Executive Summary

Environmental Impact Assessment Report

Project Name : **Natural gas transporting pipeline project for Muang Rayong Combined Heat and Power Generation Plant**

Project Location : **IRPC Industrial Park Choengneon Subdistrict, Amphor Muang, Rayong Provice**

Project Owner's Name : **IRPC Public Company Limited**

Project Owner's Address : **555/2 Energy Complex Tower B, Floor 7, Vipawadee Rangsit Rd., Chatujak, Bangkok 10900**

Authorization :

(/) The Project Owner has given Power of Attorney to Thai Environmental Technic Limited to submitted the report.

( ) The Project Owner has not granted Power of Attorney

Prepared by

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Maung Rayong Combined Heat and Power Generation Plant
By IRPC Public Company Limited.

1. Introduction

1.1 Thailand natural gas pipeline system

1.1.1 Current demand of natural gas in industrial sector

According to PTT Public Company Limited (will be called “PTT” in this report), in B.E. 2530, the company delivered natural gase to 7 clients while the demand subsequently has been increasing in the broader range of demand among industries. Natural gas has become more popular and is currently used as altenative fuel source for various industries, for examples, heat power generation plant, petrochemical industries, ceramic/ sanitary ware/ glass/ mirror industry, beverage industry, textile industry, steel industry and etc. To decrease the use of imported oil and other fuels with higher cost as well as to mitigate environmental impacts, the Thai government is accelerating the support on expanding the use of natural gas as energy source across the country. PTT is involved with natural gas source development in Thailand cooperated with neighbouring countries in providing sufficient sources of natural gas based on stability, which could serve the demand with fuel reservation for appropriate consumption.

1.1.2 Natural gas transporting pipeline system

It was suggested that natural gas transporting via pipelines is a safe process which is accepted by international standard protocol. In Thailand, PTT has operetaed the process since B.E. 2524 while it also supports the national energy policy. PTT has provided master plan for natural gas transporting pipeline network no. 3 (B.E. 2544-2554) to serve increasing demand during the next 10-15 years as well as to support natural gas free trading in ASEAN region. The piplines networks are divided as onshore and offshore natural gas pipelines.

The onshore natural gas transporting pipeline is divided into 2 systems as Transmission Pipeline and Distribution Pipeline.

1) Transmission Pipeline

(1) Offshore pipelines with 2,198 km length comprises pipeline system connecting between the source of natural gas in Thai Gulf and Rayong province towards natural gas separation plant no. 1 2 3 5 and 6, as well as transporting pipeline system from Erawan field and Bongkot field to natural gas separation plant no.4 in Amphur Kanom, Nakhon Sritammarat.

(2) Onshore pipelines with 1,437 km comprises east and west pipeline system. The east pipeline system connects between natural gas separation planys in Rayong province to Rayong electric power plant, Bangpakong electric power plant towards natural gas distribution area in Bangkok, Patumtani, Ayuddhaya and Saraburi. The west pipeline system connects from Thai-Myanmar boarder in Kanchanaburi to Ratchaburi electric power plant. Bothe east and west pipeline systems are connected by Ratchaburi-Wangnoi natural gas pipeline so that natural gas transporting system from Thai Gulf and Myanmar can be flexible enoup upon the demand.

2) Distribution Pipeline with a length of 833 km is a sub-pipelines network connecting natural gas transporting system which delivers the gas to clients in industrial sector. This pipeline network is provided for higher demand of natural gas in the next 10-15 years as it is an altenative fuel as a source of energy which currently attracting industrial clients for their manufacturing process in terms of its lower cost and generating lower environmental pollution.

Existing natural gas transporting pipeline system provided by PTT covers area across provinces in Thailand as Rayong, Chonburi, Chacherngsaom Samuprakarn, Bangkok, Patumtani, Kanchanburi, Ratchaburi, Nakhonpatom, Ayuddhaya, and Saraburi where industrial zones are located in such area. This could beneficially help delivering natural gas from existing system to nearby industrial zone safely.

1.2 Objectives of the project

Natural gas transporting pipeline project for Muang Rayong combined heat and power generation (to be referred as “the project” in this report) is a project which connects natural gas pipeline system from block valve station IR4 in the zone responsible by IRPC, where gas delivered to supply as fuel in such Muang Rayong combined heat and power generation (to be mentioned in this report as CHP2 project”), and other industries in IRPC Industrial Park located in Tambon Choengnoen, Amphur Maung, Rayong.

1.3 Rationale of the project

According to the SPP Cogeneration plan developed by IRPC Public co., ltd., it was aimed that natural gas will be used as a main fuel in the plant, which operates combined heat and power generation with a capacity of 240 MW where the pipeline networks are required for natural gas transportation. Therefore, the pipeline system is planned to be installed between block valve station IR4 in IRPC Industrial Park and CHP2 project zone.

1.4 Rationale and objectives for the preparation of environmental impact assessment report

The natural gas transporting pipeline project for Maung Rayong combined heat and power generation can be categorised as petroleum and fuel oil delivered by transporting pipeline project following the enclosed document no. 1 of Natural Resources and Environment ministerial notification Re: the types and specifications of projects that require an Environmental Impact Assessment Report based on the guideline and regulation suggested by the Office of National Environmental Policy and Plannig (ONEP) (issued on 20 June 2012). It is stated that the EIA report will have to be submitted for approval by ONEP following The Enhancement and Conservation of National Environmental Quality Act B.E. 2535.

Therefore, IRPC Public co., ltd. has assigned Thai Environmental Technic Limited (to be mentioned as “the consultant” in this report) to conduct the EIA process and prepare the reportsubmitting for approval from ONEP.

Main objectives of EIA report preparation for this project are as follows

1) To study project details and project operation process, to analyse any problems which may cause environmental and social impacts so that the information can be implemented in providing protection and mitigation measures during the construction and operation phase.

2) To conduct the survey study on existing environment, natural resources and human use values in the study area and pipe alignment zones. This includes the issues of physical resources, biological resources, human use values and quality of life which are later used as baseline data for assessing environmental impacts which may be affected by the project activities.

3) To analyse and assess environmental impact, social impact, and health impact which may be affected by the project operation on natural resources and other values in the study area in terms of both positive and negative impacts.

4) To provide mitigation and protection measures for environmental impacts which may occur from the project construction and operation.

5) To provide environmental monitoring measures for the impact that may occur during the construction and operation phase so that it can be ensured the implementation of environmental impact protection and mitigation measures.

1.5 Scope of the study

1.5.1 Area scope

Area scoping for assessing the environmental impacts is conducted based on the scope of main activities to be operated during the pipeline installation from the project zone to between CHP2 project along 1.5 km distance. Such activities may cause dispersion of dust and loud noise during the construction. Therefore, area scoping for the study is defined as follows,

1) Project zone means area where construction activities are conducted and area where natural gas transporting pipelines are laid. The area covers 50 m distance from the centre of the pipeline. The project zone also includes area where equipment, tools and machines are stored, vehicles parking area, other area in use, and temporary on-site office.

2) Study area means the area which covers 500 m away from the point of 50 m distance from the centre of the pipeline.

The EIA study will be conducted in both the project zone and the study area. In case more impacts may be predicted in the study area, EIA process will be considered to conduct in its surrounding zone. The study area encompasses partial zone of Tambon Choengnoen and Tambon Ban Lang in Amphur Maung of Rayong province as presented in **Figure 1.5.1-1**

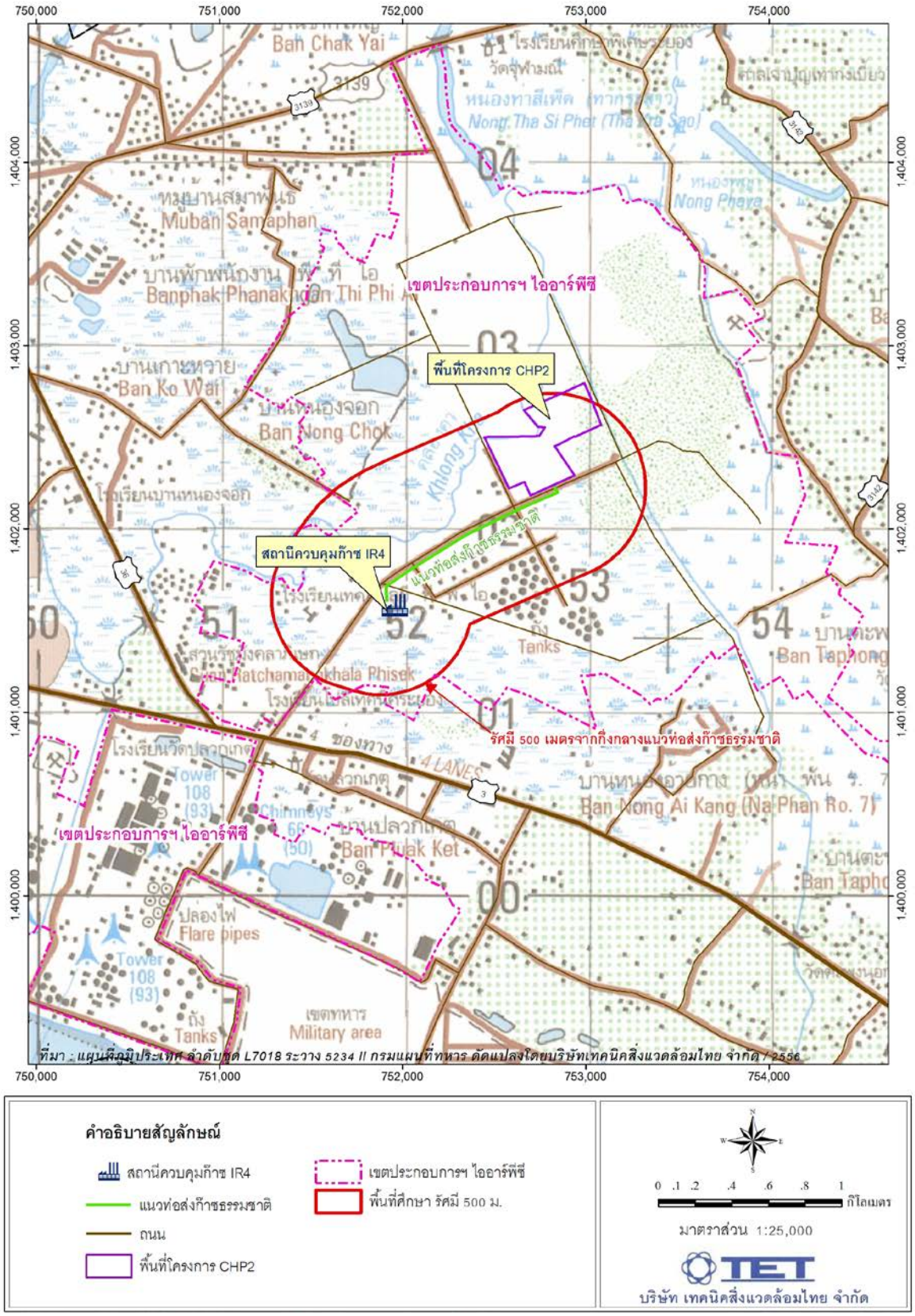

Figure 1.5.1-1 Pipeline and EIA study area

1.5.2 Scope of scientific study for EIA process

Environmental impact assessment process in this study will be conducted based on the guideline suggested by ONEP on “EIA guideline for the project related to petroleum and oil fuel transporting pipeline system” while the scope of this study can be summarised as follows

1) Project detail study

Project detail study includes providing options for pipeline laying paths selection, design criteria and standards, terms of reference for construction protocol, pipeline leakage tests, corrosive protection, natural gas compositions and properties, safety system of transporting pipelines, safety measures and management, the plans for project construction and operation, and etc. This could help investigating activities involved in the project operation which may cause consequences or impacts, suitability of project design, including environmental and safety management during both construction phase and operation phase.

2) Existing environment survey in the study area

Existing environment survey in the study area was conducted based on secondary data collected from local governmental and private organisations in the forms of documents, summary report, and othe leaflets/ press coupled with collecting relevant primary data in the field. The surveyed data was then validated prior to the analysis while the study of existing environment includes following issues

(1) Physical environonmental resources are geographic condition, climate condition, air quality, noise, geology and earthquake, soil resource and soil erosion, water resource and surface water quality, ground water quality and etc.

(2) Biological resources are forest, wildlife, and aquatic ecology.

(3) Human use values include the scope of land use, traffic and transportation, and public utilities.

(4) Quality of life includes the scope on socioeconomics, public health service, aesthetics and tourism.

3) Project public relations and public participation process

Project public relations and public participation process was conducted during the pre-project development phase. IRPC Public co., Ltd. and the consultant had provided public relations working team accessed the communities to deliver the project information to relevant stakeholders in both governmental and non-governmental organisations as well as community members in the study area. This activity was conducted based on the guideline suggested by ONEP on public participation process in environmental and social impact assessment issued in December B.E. 2552. According to the public participation, the findings in terms of public anxiety and comments have been implemented in providing environmental impact protection and mitigation measures which are relevant to the community needs.

4) Environmental impact assessment

In the EIA process, both negative and positive impacts were assessed and predicted in accordance with existing environment in the study area in terms of changes towards physical and biological environmental resources, human use values, quality of life including health impacts of the project workers and community members during both construction phase and operation phase. The short-term and long-term impacts were considered qualitatively and quantitatively.

Health impact assessment was conducted based on the guideline suggested by ONEP on health impact assessment in Thailand EIA process issued in December B.E. 2552.

5) Preparation of the environmental action plan

The envirnemtal action plan for the project operation includes operation guidelines and roles of the relevant secions responsible in the project operation. This plan will be implemented in real practice strictly during construction phase and Operation phase to prevent adverse impacts which may occur from the the project operation.

2. Project description

2.1 Natural gas pipeline network system in the nearby area

At present, natural gas transporting pipelines in the zone responsible by IRPC align across these following areas

1) The starting point of PTT natural gas transporting pipeline with 24-inch diameter, in Map Ta Phut, Maung district, Rayong province, is originated from transmission pipeline no. 3 at the edge, on the left-hand side, of Highway no. 36 (in the north of Sukhumvit rd.). It was laid in parallel along the highway towards Sukhumvit road and IRPC industrial zone, which then laid on the right-hand side of the road towards block valve station IR4, which includes 22 km of the pipeline length in total.

2) The IRPC natural gas transporting pipeline with 20-inch diameter which connects with the block valve station IR4 is laid reversely along the main road of IRPC underneath Sukhumvit road towards IRPC Industrial Park (offshore side) to IRPC combined heat and power generation plants (CHP1) with a distance of 2 km.

Meanwhile, this project, the natural gas transporting pipeline project for Muang Rayong combined heat and power generation plant (CHP2 project) is a project which will lay the pipelines with 24-inch diameter originated from block valve station IR4 towards IRPC main road, on the righ-hand side (in the north of Sukhumvit road) heading to the CHP2 project with a distance of 1.5 km.

2.2 Project details

Natural gas transporting pipeline project developed for Maung Rayong combined heat and power generation is a project that delivers natural gas in IRPC Industrial Park where industrial zone is located while EIA has been conducted. Currently, the zone has been developed according to its approved land use master plan such that the gas transporting pipelines are required to be laid in the approved zone. The pipes are made of carbon steel material designed following ANSI B31.8 and API 5L standards. The pipe type used is API 5L GradeX65, with 0.688 inches thickness with special structure of YIELD STRENGTH 65000 psi. Its length is 12m each joint with natural gas transporting pipeline system from the block valve station IR4 where the 24 inches valve is used as a connection joint. The joint is in the zone of the block valve station IR4. The pipelines are laid in the north of the joint towards CHP2 project along the line of IRPC main road (in the north of Sukhumvit road) with a distance of 1.5 km.

2.3 Project location

This project, the natural gas transporting pipeline project for Muang Rayong combined heat and power generation plant (CHP2 project) is a project which will lay the pipelines with 24-inch diameter in the IRPC Industrial Park (in the north of Sukhumvit road) originated from the block valve station IR4. The pipes are laid along the line of the main roads, 4E2 and 4E4 road that are reinforced concrete roads as dual carriageway with 4 traffic lanes, which divided into 2 lanes for each carriage way, separated by a central reservation, heading to the CHP2 project with a distance of 1.5 km.

The pipeline alignmen is on the right hand side along the main road of IRPC (in the north of Sukhumvit road), where the land has been developed, towards CHP2 project as the details presented in **Table 2.3-1** and the pipeline alignment and existing environment is showed in **Figure 2.3-1**

Table 2.3-1 Existing environment aling the natural gas pipeline alignment

Phase	Distance (m)	Existing environment along the pipeline alignment
KP. 0+000 to 0+040	40	Block valve station IR4
KP. 0+040 to 0+105	65	Road area in IRPC industrial zone
KP. 0+105 to 0+160	55	Crossing 4E4 Road and paralleled along the Pipe rack in the right of way of 4E2 road
KP. 0+160 to 0+820	660	Paralleled along the Pipe rack in the right of way of 4E2 road
KP. 0+820 to 0+855	35	The entrance of Lube Oil plant
KP. 0+855 to 0+960	105	Paralleled along the Pipe rack in the right of way of 4E2 road
KP. 0+960 to 1+020	60	Crossing 4N1 Road
KP. 1+020 to 1+040	20	Paralleled along the Pipe rack in the right of way of 4E2 road
KP. 1+040 to 1+050	10	The entrance of Ethyl Benzene Styrene Monomer (EBSM) plant
KP. 1+050 to 1+100	50	Paralleled along the Pipe rack in the right of way of 4E2 road
KP. 1+100 to 1+140	40	Crossing 4N1 Road
KP. 1+140 to 1+290	150	Paralleled along the Pipe rack in the right of way of 4E2 road and crossing 4E2 road
KP. 1+290 to 1+470	180	CHP2 project zone

Table 3-1 Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
1.Generic measures		- Strictly follow environmental impact protection, mitigation and monitoring measures in accordance with environmental management operation plan as suggested in EIA report of Natural gas transmission pipeline project for combined heat and power generation plant in Maung Rayong By IRPC Public Co.,Ltd. Implement such measures as guidelines in impact control and monitoring by the citizen and relevant organisations 1) Apply description in environmental management plan to providing terms and conditions on the design of construction contract, operation contract, with clarification, so that effectiency and effectiveness on implementing operational plan can be achieved. Annouce and deliver the operational plan to communities in the surrounding area so that they are informed and follow the plan. Perform public relations since pre-construction phase, regularly, until construction phase and operation phase to encourage public participation in the project development process.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		2) Provide information on project description with location map presenting the pipeline network clearly prior to submit to the organisation which are area owners where the pipeline are laid across, so that they can use the information in land development planning. This could help protect and mitigate the accident along the pipeline. Also submit the map to ONEP by attaching with environmental performance report. 3) IRPC Public Co., Ltd. must provide and propose environmental performance report according to provided impact protection, mitigation and monitoring measures based on the guideline suggested by Department of Industrial Works to ONEP and organisations that allow the project to lay pipeline network in their zone, at least 1 time for Construction phase, and every 6 months for Operation phase.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		4) In case monitoring result of the environmental impacts shows tendency of environmental problem, the project will have to take action on sloving such problem as soon as possible. If any incident which may cuse the environmental impact, the project must inform Department of Industrial Works and ONEp as sson as possible for further required actions. 5) IRPC Public Co., Ltd. will have to fix or compensate damaged properties which may cause from the construction and post-constrcution according to the consensus of time frame to mitigate the conflicts with community. 6) In case community concerns remained on the projevt operation, the project must fix such problem to terminate the conflicts in the community immediately. 7) In case IRPC Public Co., Ltd. intends to change the project description/ or environmental management operation plan that differs from previously presented in EIA, the company must inform approval authority as follows;	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		• If approval authority considers that the change will not affect the approved EIA, the company will inform this note to ONEP. • If approval authority considers that the change may affect the approved EIA, the company will have to present the result of the study from environmental impact assessment in the changed part, comparing between old and new data, to EIA expertise committee for approval prior to any operation. 8) Practice emergency response plan with people from community, enterprises, local disaster protection and mitigation office, traffic office, and other organisation in the area regularly so that readiness on the plan, commanding, coordinating and equipment can be prepared in case of emergency. 9) In case any danages may cause by the project operation, IRPC Public Co., Ltd. will have to pay compensation to the affected persons at first hand in order to initially mitigate an urgent distress.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- In case monitoring result of the environmental impacts shows tendency of environmental problem, the project will have to take action on sloving such problem as soon as possible. If any incident which may cuse the environmental impact, the project must inform Department of Industrial Works and ONEP as sson as possible for further required actions. - IRPC Public Co., Ltd. will have to fix or compensate damaged properties which may cause from the construction and post-constrcution according to the consensus of time frame to mitigate the conflicts with community. - In case community concerns remained on the projevt operation, the project must fix such problem to terminate the conflicts in the community immediately. - In case IRPC Public Co., Ltd. intends to change the project description/ or environmental management operation plan that differs from previously presented in EIA, the company must inform approval authority as follows;	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental comp onents and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		● If approval authority considers that the change will not affect the approved EIA, the company will inform this note to ONEP. ● If approval authority considers that the change may affect the approved EIA, the company will have to present the result of the study from environmental impact assessment in the changed part, comparing between old and new data, to EIA expertise committee for approval prior to any operation. - Practice emergency response plan with people from community, enterprises, local disaster protection and mitigation office, traffic office, and other organisation in the area regularly so that readiness on the plan, commanding, coordinating and equipment can be prepared in case of emergency. - In case any danages may cause by the project construction phase, the contractor will have to pay urgent compensation to the affected persons at first hand in order to initially mitigate an urgent distress , but for operation phase, PTT Public co.ltd. will have to pay the urgent compensation to the affected person.	

Table 3-1 (con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation, and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2. Physical resources **2.1 Geography** Rayong province is located on the east coast of Thai Gulf with an area size of 3,552 km^2, or 2,220,000Rai, approximately, estimated to be 10.33% of total area of the east region of Thailand. It is 179 km away from Bangkok. In the south of Rayong, the landscape is mainly sandy shore with long sandbank across from east-west of the coast. The area next to the coast is floodplains during the whole year. The main area of Rayong can be described as undulating and rolling, while many mountains are found in the north, east and the center of the province across the north-south. The study area is located in Amphur Maung Rayong, locating in the south of the province with a tidal flat geography at the coastal area from the sandbank to the north, including Rayong estuary. General characteristic of such area are floodplains during the whole year while the next zone can be described as alluvial plain and flood plain.	**1. Impacts on geography** **1) Construction phase** **- The project zone and the study area** Geography in IRPC Industrial Park (in the north of Sukhumvit Road) can be described as graded area for industrial plants construction. The natural gas pipeline alignment area is located in right of way along the main road of the IRPC Industrial Park. Therefore, the graded area is appropriate to the pipeline laying, machine operation, pipeline arrangement and alignment. Such activities may affect the topography in such zone temporarily in a short time which is estimated to be at acceptable levele. When considering the impact of Open Cut construction, such activity wil be conducted only temporary during the construction phase while the area will be graded by covering with lower soil and top soil to bring back the former condition of the area surface. However, it could be said that such impact is temporary which is unlikely to affect the geography of the area (0) with no level of the impact (0). **2) Operation phase** **- The projecy zone and the study area** No activity which may affect the geography conducted during the operation phase in the project zone (0) such that no impact found (0)	-	-

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
1.2 Geology and earthquake **1) Geology** Geology in Amphur Maung Rayong and Amphur Ban Khai can be described as: floodplain deposits which comprises sandy sediments, silt; culluvial deposits which are gravels, sand, soil, and latterite; beach-sand deposits influenced by sea waves as beach sand, sandbar, and sandbank; and coastal deposits influenced by tides with a topography of mud, mire, fine sand, mangroves, swamp forest and wetland.	**1) Construction phaseและOperation phase** **- The project zone and the study area** **(1) Geology condition** The study area can be described as coastal sediments area (Qcm) where is unlikely to be affected by the pipeline system because the pipeline system is located underground at 1.5 m depth which is identified as upper soil layer. Therefore, the construction and operation activities are unlikely to affect geology condition in the project zone (0) with no impact (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2) Earthquake The study area is in region no. 1, which is categorised as a low risk zone. However, if there is an incident of earthquake, few damages may occurs while people in high rise buildings may sense the earthquake. Building designs are required to provide strong foundation which can be safe from 5-7 Mercalli of the earthquake vibration. The incident could be panicking Ineffective designed building may be damaged It encompasses area in the north, partial of the central, the west and the upper south of the country	**(2) Earthquake** The project zone is located in region no.1, is considered as low risk zone in probality of earthquake. The vibration can be felt by residents in high-rise building with the scale size of 3-4 Mercalli. The pipeline used in this project is designed based on ASME B31.8 standard concerning the scale of vibration with may cause from construction activities in community, earthquake probality, temperature, including soil properties, which may cause the change of pressure towards the pipelines. However, the pipeline design has not considered the for big scale of earthquake upto 7 Rictor which may cause severe damages towards pipeline system. This is because such earthquake scale has never happened in Thailand according to recorded history. Therefore, it is unlikely that earthquake factor will cause damages towards the natural gas pipeline system (0) with no adverse impact (0)		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2.3 Soil resources and soil erosion **1) Soil resources** According to Rayong soil series map scale 1:100,000 of soil, it was found that the study area is located over 2 soil series on low plain zone. The soil series are Ban Torn soil series and Walapriang soil series with following characteristics a) Soil series with similar characteristics of Ban Torn soil series (Bh) is originated from sea sediments mixed with terrace deposits under brackish condition. The area can be described as plain area with 0-1 % slope. The drainage property is not good, having slow runoff flow, with low percolation rate. Land in this area is mainly used as a rice field. More distribution of this soil series is found in the south-central of Thailand and found some in the southern region. b) Soil series with similar characteristics of Walapriang soil series (Wp) is originated from brackish sediments accumulated on the plain, which was previously floodplains. The area can be described as plain area with 0-1 % slope. The drainage property is not good, having slow runoff flow, with low percolation rate. Land in this area is mainly used as rice field distributed across coastal plains.	**1. Impacts on soil resources** **1) Construction phase** **- The study area** The study area includes vacant area and filling improvement area for land use purpose. The construction would unlikely to afftect such area as the activities will be conducted in particular zone without disturbing most area of the study zone. Therefore, the construction is unlikely to affect the soil resources (0) with no adverse impact (0). **- The project zone** Activities conducted during the construction phase which may affect soil quality include open cutting by trenching to prepare the working space for laying the pipelines. Changes from such operation could affect soil resource as follows; **a) Changes of soil structure** (a) Trenching and stockpile may cause soil mixing between top soil and lower soil. This could cause the soil structure changes. However, the project will store top soil and lower soil separately so that it can return to its place during backfilling. In addition, such area is not used with other purposes apart from using as a gas control station. Therefore, the construction activities is unlikely to affect the soil resource (0) with no impact level (0)	**1) Pre-construction phase** - Plan in advance prior to working so that soil erosion can be prevented based on appropriate construction activities conditions related to area condition in different zone of working space. - Plan in advance prior to preparing working area appropriately. In case of no planning for area preparation, such task will not be allowed to conduct. Also, provide time scale to complete area reinstatement before wet seaon. **2) Construction phase** - Soil erosion must be protected during the open-cut excavation while excavated soil will be used as backfill after the pipeline alignment. - In area with sandy soils or eroded soils, be cautious in grading the surface as least as possible during the pipeline alignment work. - Maintenance works should be done only on hard ground with appropriate storage, not in the construction area. - Provide adsorbent material ie. Sawdust, rags,sand, etc for cleaning spilled oil/ fuel oil in working area.	**Construction phase** Inspect the construction zone at least 1 time/ week to check soil erosion points so that relevant actions can be taken immediately, including to measure particulate matter during dry and wet seasons. **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
c) Low plain area is a coastal plain which is originated from sea sand. Such area is flat with 0-1% slope, good drainage property, and rapid flow of runoff. The soil properties on percolation is high percolation and absorption is low. Such type of the area can be found along the coastal zone. **2) Soil erosion** Soil erosion level in the study area is considered as low level when comparing with soil erosion records in Thailand.	(b) Backfilling: if the backfilling soil is not compacted well over the pipelines alignment, the soil could erode and cause small puddle(s). Therefore, this activity may cause negative impact on soil esources (-) with low level of impact but possible to improve/ prevent (-1) **b) Changes of soil properties** Soil characteristics may change due to contamination of the spillage or leakage of used oile/ lubricant, used in machines or engine, during the construction phase. Therefore, the construction activities may cause negative impact towards soil properties (-) with mild level of the impact, which is possible to mitigate/ improve (-1). The project has provided operation measures to protect the impacts of soil structure and properties. **c) Impacts on soil nourishment** Soil in this area is considered slightly acidic which is not appropriate for plantation, however, this area is for industrial activity purposes. According to soil nourishment assessment based on nutrient contents in soil, it was found that the nourishment level of the soil in the project zone and the study area is at medium level. Meanwhile, the construction activities seem to have no impact on increasing or decreasing the levels of nutrients in soil. Therefore, the construction does not affect the soil nutrients (0) with no significant impact on soil nourishment (0).	- Material or equipment used in cleaning spilled oil/ fuel oil must be disposed the same way as that of hazardous waste.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	2) Impacts on soil erosion Soil erosion rates of the excavating area, for pipeline alignment, with and without soil conservation measures are considered and compared. The calculations suggested that the erosion rate of soi in excavating zone with soil conservation measures is 0.79 tonnes/ year while the latter condition, without soil conservation measures, is 1.24 Tonnes/ year, respectively. This suggests that providing soil conservation measures for excavated area could help saving the soil surface along the pipeline alignment route. Meanwhile, the loss of soil surface may not happen in the same time according to the construction procedure, which is counducted on a basis of excavating and backfilling. Therefore, the construction may lead to negative impacts on soil resource (-) with low level of significant impacts which is possible to be improved (1) **3) Operation phase** After the construction phase, backfilling has been completed such that the area has been reinstated, therefore, none of impact would affect the soil nourishment and soil erosion during the operation phase. As such, it can be summarized that operation activity is unlikely to affect the soil resource (0) with no impact (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2.4 Climate and air quality **1) General climate** The weather condition in Rayong can be described as semi-humid and dry, influenced by 2 monsoons: south-west and north-east monsoon which cause three different seasons in Thailand. Referring to the weather condition and location of Bangkok, the climate in this zone can be categorised as a Tropical Savana Climate (AW), based on Wladimir Koppen. **2) Meteorology** Data recorded by Rayong metheorology station, located at latitude 13 degree 38 lipda north and longitude 101 degree 21 lipda East, are used as a representative meteorology condition in this study. The climate data of 30 year cycle (B.E. 2525-2554) is considered as summarised below **a) Atmospheric pressure** Mean annual atmospheric pressure is 1,009.52 HPa with Mean Daily Range between 3.13-4.13 HPa. Extreme Maximum atmospheric pressure is between 1,012.98-1,021.99 HPa (the highest is in March) and Extreme Minimum atmospheric pressure is in the range of 1,000.18-1,005.92 HPa (the lowest is in November).	**1) Construction phase** Activities conducted during the construction phase is unlikely to affect the air quality over the construction zone and its surrounding area. This is because the air pollutant level during the construction works is likely to be lower than the specified standard level. The operation work is designed to be completed within 1 day for each daily task so that dust dispersion may happen during a short period, and limited within the construction area. Therefore, the construction activities may cause from pollutants dispersed from construction equipment which may generate impacts on air quality (-) with low level of the impact (-1) **2) Operation phase** None of activitiy during the operation phase is likely to affect the air quality. This is because equipment maintenance works will be performed at gas control satation located on the ground and no dispersion of dust occurs. In terms of gas leakage impact which may affect air quality, the leaked gas tends to quickly emit to atmosphere according to its light weight and this is unlikely to affect the air quality (0)	**1) Construction phase** - Limit materials transporting vehicle speed at not exceed 30 km/hr in the zone and not exceed 80 km/hr in general area. - Provide regular inspection and good maintenance for engines and machines that the contractor uses in the construction activities. - Any materials to be transported must be covered to prevent material blowing, falling and dispersion. - Clean road surfaces and road shoulders by removing soil debris or construction waste away to mitimate particulate dispersion. - Clean dirty wheels before leaving the construction zone - Provide warning signs on speed limits at the entrance-exit of the construction zone and other requiring points. - Consider and plan distance of open-cut excavation appropriately for each operation range based on the procedure that the task should be completed within 1 day in terms of pipe stringing, trenching, pipe lowering, and backfilling.	**Construction phase** **Parameters :** - TSP (24 hr) - PM-10 (24 hr) - Wind speed and wind direction (WS/WD) **Monitoring location :** IRPC Techology college (Figure 1) **Measuring methods :** Measure the air quality during the pipe low-in of the construction phase, 1 time, which means the measurement is conducted for 5 days continuously (including working day on open-cut work for pipe lowering, and day off time) **Responsible official :** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
b) Temperature Mean annual temperature is 28.24 ºC, mean annual maximum temperature is 32.6ºC, mean annual minimum temperature is 24.98 ºC, the highest measurable temperature is 40.0 ºC (in April), and the lowest measurable temperature is 13.3 ºC (in December). **c) Relative humidity** Mean annual relative humidity is 72 % with the range of 64-88%, mean maximum relative humidity is measured in October as 93 % while the mean minimum relative humidity is detected in December as 52 %. The lowest detectable relative humidity is 21% in January and November. **d) Evaporation** Mean annual evaporation rate is 1,687.45 mm, the highest evaporation rate is detected in March as 161.34 mm whereas the lowest evaporation rate is detected in September as 114.81 mm.		- During the construction works being conducted in low-density land use area, spray water over the area where construction tasks are operated, open cut zone and nearby roads, at least 2 times/ day to mitigate dust dispersion. - During the construction works being conducted in low-density land use area, cover the zone where open cut is being operated with canvas/ covering materials. - Dust generated from Sand Blast can be reduced by placing Hard Barricade surrounding the working space and covered the top zone with canvas (the working area size is approximately 2x2.5 m^2), to protect dust dispersing from such area. Collected dust will be disposed by a company authorised by Department of Industrial Works.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
e) Precipitation Mean annual precipitation is 1,397.26 mm, with total days of precipitation as 116 days, the highest precipitation of 254.35 mm is measured in September with 18 days of precipitation. December is the month when precipitation is the lowest as 7.36 mm. When considering the relations between precipitation, evaporation, and average temperature; the periods of seasons can be classified into 2 types: as dry period (between December-February) and wet period (between March-November).			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
3) Air quality The consultant has collected secondary data on atmospheric air quality monitoring in the study area and its neighbouring zone from Rayong industrial project performance report on environmental management regarding impact mitigation and monitoring measures B.E. 2552-2556 by IRPC Public Co., Ltd. The air quality monitoring station located in the study area and nearby zone is IRPC Technology college station (A2), monitored and recorded air quality parameters are Sulfurdioxide (SO2), Nitrogendioxide (NO2), and Total Suspended Particulate (TSP). The air quality according to such parameters are summarised as follows; **(1) Total Suspended Particulate (TSP)** The 24-hr average TSP was recorded as 38-166.61 microgramme/m^3 while the highest level was measured in January B.E. 2552. The air quality in such area is complied with ambient air quality satards following National Environment Board Notification No. 24 (B.E. 2547) Re: Ambient Air Quality Standards.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
(2) Sulfurdioxide (SO_2) The 24-hr average Sulfurdioxide was recorded as 0.001-0.025 ppm while the highest level was measured in B.E. 2553. However, the measured SO2 level was improving and complied with air quality standards following National Environment Board Notification No. 24 (B.E. 2547) Re: Ambient Air Quality Standards. **(3) Nitrogendioxide ($N0_2$)** The average Nitrogendioxide was recorded as 0.001-0.034 mg/m3 , which is complied with air quality standards following the National Environment Board Notification No. 24 (B.E. 2547) Re: Ambient Air Quality Standards.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2.5 Noise According to secondary data of sound level in the study area and its neighbouring zone collected from Rayong industrial project performance report on environmental management regarding impact mitigation and monitoring measures in January-June B.E. 2552-2556 by IRPC Public Co., Ltd., the monitoring station located in the study area and nearby zone is IRPC Technology college station (A2), the 24-hr average sound levesl during B.E. 2554-2556 was 55.0–64.2 dBA which is complied with the specified standard. The consultant had conducted the sound level measurement at the IRPC Technology monitoring station during Thursday 28 th February – Tuesday 5th March B.E. 2556, and it was found that the 24-hr average sound level was between 51.1-54.8 dBA which is complied with the specified standard.	**1) Construction phase** Main activities during the construction phase for pipeline system alignment are trenching, pipe stringin, pipe lowering, and backfilling. Such activities may cause loud noise, however, the activities will not happen all at once in the same time, inspead, they will be operated orderly. As such, the noise which may generate from construction tasks is unlikely to affect the syrounding sensitive area. **2) Operation phase** During the operation phase of the natural gas transporting pipeline project, noise impact is likely to be at low level. This depends of the sources at Metering/Regulating Station (MRS), located in the Rayong CHP project zone of IRPC Public co., ltd., where may generate continuous noise. The noise may be mainly generated from joint connections and flow control equipment during the operation of metering equipment. However, the source is considered non-specific as it is located in the plant boundary. Therefore, it is estimated that the impact will not affect residents and industrial plants in the surrounding area.	**1) Pre-construction phase** - Plan well on construction activities over sensitive area surrounding the pipe alignment route based on the shortest time in operating the construction. - Inform the construction plan in advance to community in surrounding area where the construction is about to be conducted at least 7 days before the construction. **2) Construction phase** - Limit time for constrcruction activities which may cause specific loud noise to avoid impacts towards the nearby community. If overtime working is needed, the project will have to inform local organisation or nearby plants in advance. - Control noise at sources; equipment and vehicles, by maintain them for a good condition and be ready for operation. Maintenace works are subjected to be conducted in case unusual signs, i.e.noise, are detected during the operation. - Workes are subjected to wear personal protective equipment the whole time when working in loud noise area.	**Construction phase** **Parameters :** - Leq (24 hr) - Leq (8 hr) - Lmax - L90 **Monitoring location :** IRPC Technology college (Figure 2) **Measuring methods :** Measure sound level 1 time which means the measurement is conducted for 5 days continuously (including working day on open-cut work for pipe lowering, and day off time) **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Arrange working shifts for workers those perform duties in the area with over 90 dBA of sound level, the worker can not work in such area longer than 8 hr - Control speeds of material transporting vehicles at 30 km/hr when passing residential zone, and at 80 km/hr in general zone, as well as control activities which may cause loud noise in commercial and residential zone.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2.6 Water sources and surface water quality **1) Water sources** The study area is located in lower coastal basin of rayong procince. Surface water sources in the study area and the nearby zone are small canals, which then flow through Thai Gulf. There 8 main canals in this area: Klong Kar, Klong Tubma, Klong Kuekrit, Klong Tagad Yai, Klong Yai Da, Rayong River, Klong Bangkacher, and irrigation canal no.2. **2) Surface water quality** The consultant has collected environmental data monitored in the study area and its neighbouring zone from Rayong industrial project performance report on environmental management regarding impact mitigation and monitoring measures between B.E. 2552-2556. The surface water quality was measured at SW1, the point where Klong Kar canal flows through the IRPC Industrial Park. The results suggested that most of the measuring parameters are complied with standards specified in National Environmental Board Notification no. 8 (B.E.2537) Re: Surface water quality standards (Type 3 water quality for agricultural purposes), except Dissolved Oxygent, BOD, Ammonia, Nitrate, and Coliform Bacteria that are over the standard evels allowed during some of the time when collecting samples for laboratory analysis.	**1) Construction phase** **- The project zone and the study area** It can be estimated that the pipe laying activities is unlikely to affect hydrology condition in the project zone. This is because the pipe route is on the main road of IRPC Industrial Park and no pipe alignment installed over any source of surface water. Impacts towards surface water quality during the construction phase may occur from soil surface excavating, trenching, leakage test, construction machines, and wastewater generated by routine activities of construction workers as follows; **a) Area grading and trenching** Area grading and trenching during the construction phase may cause 4-5 folds of soil erosion, particularly, in rainy season, when the sediment soil flow down through lower land prior to surface water sources nearby. This may cause the contamination of sandy soil sediment in watercourse such that the canal could become shallower and water turbidity may become higher. The project has provided impact protection and mitigation measures by limiting the open cut area each day as least as possible as well as conducting reinstatement of such area after the pipe alignment, including avoiding laying pipeline across water sources during rainy season.	**1) Construction phase** **a) Wastewater management in construction office zone** (a) Provide sufficient temporary toilets for workers with a ration of 15 persons per 1 box, located at least 30 m away from surface water sources. (b) Inspect engines used in the construction activities regularly to protect oil contamination towards surface water sources. (c) Do not wash any device or equipment which are used in the construction activities in the watercourse. (d) Do not drain wastewater generated by construction workers or construction activities to surface water sources. **b) Control of effluent generated from pipeline test** (a) Do not add any chemicals in water which is used in hydrostatic test (b) Provide scrrening to remove sludge or solid materials from hydrostatic test water prior to discharging to wter drainage system or environment. Collect the trash and contaminated materials for further disposal by appropriate methods.	**Construction phase** **Parameters :** - pH - Suspended solids (SS) - Temperature - Oil&Grease - Turbidity **Monitoring location :** Effluent discharge point **Measuring methods :** Standard Method for Examination of Water and Wastewater specified by APHA, AWWA, and WPCF. **Frequency :** 1 time when discharging effluent from conducting Hydrostatic Test along the pipeline route. **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	Therefore, impacts towards the water quality according to area grading and trenching is likely to be at acceptable level. **b) Hydrostatic Testing** Hydrostatic testing along the pipe route will be conducted 1 time by using tap water from IRPC Industrial Park. Water volume generated at this satge is approximately 450 m^3. In addition, the project has provided impact protection and mitigation measures for solving problems which may cause from the test effluent. **c) Wstewater generated from routine activities at the construction site from workers and office building.** The project does not allow construction workers to reside onsite, therefore, wastewater generated are from general activities performed during the day as routine activities of workers and office building i.e. cleaning water, toilet wastewater, etc. There are approximately 50 workers, as the maximum, therefore, the wastewater volume can be approx. 1.8 m3/day (calculated based on water use ratio as 45 litres/ capita/ day, when wastewater volume is calculated as 80% of water use volume, according to the manual for Waste water treatment plant engineer&manufacturer volume 2 by Pollution Control Department, B.E. 2537).	(c) If the effluent parameters are not acceptable by the standards, it will be collected and treated by wastewater treatment system of IRPC Industrial Park.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	The project has stated that wastewater On-Site Treatment will be provided for treating toilet wastewater so that it can be discharged on land, however, the water quality must be complied with the effluent standards provided for effluent which is allowed to discharge directly on land, including routinely inspect the treatment system if it is working effectively. Therefore, the activities during the pipeline alignment process tend to affect surface water quality at low level (-1). **2) Operation phase** During the operation phase, it is likely that no activity may cause any impact on hydrology and surface water flow. This is because natural gas transportation via pipelines is processed underground at the depth level of 1.5 m. Meanwhile, low volume of water is likely to be used in maintaenace works, mainly from equipment washing and cleaning. Therefore, no activity may affect the hydrology and water quality in the canals in the project zone and the study area (0)		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2.7 Hydrogeology and groundwater quality **1) Hydrogeology** Hydrogeology was studied based on hydrogeology map with a ratio scale of 1:50,000, made by the Department of Mineral Resources. It suggests that the hydrogeology in the study area and its neighbourhood consist of Chao Phraya Aquifers (Qcp) which is a main aquifers in this area. It was found that there is 5-20m as average thickness of gravels and sand, which occurs at present age, found in streams and on both sides of the banks. Most deposits are comprised of fine sand and clay except in the granite zone where gravel and coarse sand deposits are found mixng with clay in the watercourse. Rayong basin encompasses an area from Amphur Ban Khai across Amphur Maung Rayong and Huay Yai (Amphur Banglamung). Majority of the deposits consists of gravels, sand, and clay that are all originated from granite. The average thickness of the deposit layer is 10-15 m, water flow is approx. 2-7 m3/hr, the width of Rayong basin is 1-2 km, averagely.	**1) Construction phase** Construction works on natural gas alignment will be conducted at soil surface with depth level of approximately 1.5 m, which is unlikely to affect hydrogeology and undergroundwater in any case. Impact of contaminated wastewater from routine construction activities counducted by the contractor's workers is unlikely to affect the quality of underground water. This is because the contractor has provided On-Site Treatment for the treating the generated wastewater to meet acceptable standards. Therefore, The construction activities tend to have no impact on underground water in the project zone and the study area (0). **2) Operation phase** No activities could affect hydrogeology and underground water during the operation phase, therefore, no impact may affect underground water in the project zone and the study area (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2) Groundwater quality According to gas transporting pipeline project, for combined heat and power generation plant in Maung Rayong, is located in IRPC Industrial Park; the consultant has collected secondary data of underground water quality in the study area and its neighbouring zone from port project performance report on environmental management regarding impact mitigation and monitoring measures in B.E. 2 5 5 1-2 5 5 4 by IRPC Public Co., Ltd. Underground water quality was measured at 1 station as Nam Bor Thuen Soi Prachapattana station (UW1) on indicative parameters: Chloride, Turbidity, and Conductivity. The result of water quality collected was in the range that is complied with the standards stated in Naatural Resources and Environment Ministerial Notification Re: Indentification of academic criteria and standards for public health protection on toxic environment B.E. 2551.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure e

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
3. Biological resources **3.1 Terrestrial ecology** **1) Forest resources**: The whole figure of forest ecology in Rayong is in a perfect condition. Most of the area is called Dry Evergreen Forest shedding the leaves upon tropical climate which is influenced by the sea, which cause raining the whole year in such area. Sizes of plants, growing densely, could vary from small size to Seedling and Sapling size. However, medium sizes plants can be rarely found according to previous cropping and gardening in such area (Kasetsart University, B.E. 2536). Vital economical plants in this area are i.e. *Hopea ferrea*. Pierre, *Hydnocarpus ilicifolia* King, *Afzela xylocarpa* (Kurz) Craib, *Anisoptera Costata* Korth, *Lagerstroemia colyculata* wall, and *Dipferocarpus alatus* Roxb, etc.	**1) Impacts on plants** **(1) Construction phase** **- The project zone** Majority of the study area can be described as vacant zone, enterprises, industrial factories, with no forest area. The construction activities will be limited in the right of way boundary. Ecological environment of shrubbery can be observed in this area such as *Imperata cylindrica.* The construction activities are not performed in such area where such plants are grown. Nevertheless, in case the construction may affect any of the plants, the project will provide substitution plants in such affected area. Therefore, the constructionactivities may lead to negative impact (-) at low level (-1)	-	-

Table 3-1 (Con'd) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation, and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2) Wildlife resources: the consultant has classified details of wildlife diversity based on the forest area system, namely, Khao Laem Yha-Samed island national park, Ban Pae national floral park, Pa Kached-Pae-Glang forest national park, and Nong Sanom national floral park. It can be said that the condition of terrestrial ecological resources in this area, particularly, in national forest conservation area and national floral parks are diverse with wildlife. This is because such zones are protected and enforced by national forest management laws along with public participation on forest proetection and recovery. However, when comparing with existing environment in the study area, it has been converted from forest area to residential, agricultural, and industrial area such that original ecology has been changed to the environment taht wild life could not be found in this area anymore. Therefore, no conserving wild life can be found in the study area.	**- The study area** The study area of this project can be described as vacant area with soil filling without plantation whereas perennial trees can be seen i.e. Thai acacia, Manila tamarind, and Jamaican cherry, etc. Meanwhile, in the water source area, aquatic weed such as morning glory, water hyacinth, and cat-tail are found growing densely over the water surface. In the surrounding area, flowring plants, ornamental plants, such as Lagerstroemia, persimmon and fruits are planted. The construction activities is unlikely to affect the area with such plants according to the operation will be conduct in particular zone, therefore, the construction would not affect the plants in the study area (0) with no impact (0).		

Table 3-1 (Con'd) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation, and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	(2) Operation phase **- The project zone** The pipe laying zone is in underground controlled by system which will not cause any damage on soil condition in the project zone such that the plantations in this area are affected. Therefore, the project is unlikely to affect the plants (0) with no impact (0) **- The study area** The pipe laying zone is in underground controlled by system which will not cause any damage on soil condition in the project zone such that the plantations in this area are affected. Therefore, the project is unlikely to affect the plants (0) with no impact (0) **2) Impact on wild life** **(1) Construction phase** **- The project zone** According to the survey on 4 groups of wildlife: amphibians, reptiles, birds and mammals, it was found that none of such animals inhabiting in the project zone. Birds could be seen occasionally while most animans are rarely found in the project zone due to the land use functioned in such area which may disturb them. Therefore, no affected wild life could be found during the constructionpase such that no impact is likely to occur (0) with no level of impact (0)		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	- The study area In terms of impacts of the construction activities on wild life in the study area, it was found that no effluent from construction phase is discharged in natural watercourse such that amphibians and reptiles are unlikely to be affected in terms of their habitat in the watercourse. Concerning birds and mammals, and nocturnal animals may be affected from noise and dust from the construction activities. This could influence them emigrating from the area, however, the construction is counducted during limited time such that short-term impacts may occur. Therefore, the construction may cause negative impact on some groups of animale in the study area (-) with low level of impact (-1).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	(2) Operation phase **- The project zone** The pipe laying zone is in underground controlled by system which will not cause any damage on soil condition in the project zone such that the animals living in the soil are affected. Therefore, the project is unlikely to affect the animals in soil (0) with no impact (0). **- The study area** The pipe laying zone is in underground controlled by system which will not cause any damage on soil condition in the study area such that the animals living in the soil are affected. Therefore, the project is unlikely to affect the animals in soil (0) with no impact (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
3.2 Aquatic ecology There are watercourses flow across the study area as small canals i.e. Klong Kar and Klong Kuek Rit. The consultant has surveyed aquatic ecology in terms of phytoplankton, zooplankton, fauna and fisn in both canals: Klong Kuek Rit and Klong Kar at 2 sampling sites as follow. **Sampling site no. 1 :** Klong Kuek Rit was designed as draining canal from Ta Gra Saang irrigation dam. It parts from Klong Kar at Klong Kar upstream flowing downwards through the sea in Tambon Tapong. It is 10 m width with 1 m depth, the canal lines on gravels sand and latterites. **Sampling site no. 2 :** Klong Kar is a big canal is, filled with water, 20 m width and 2 m depth. The canal is covered with water hyacinth with sensitive plants spreading on the riversides.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4. Human use values **4.1 Land use** The study area scoped for the natural gas transmission pipeline project for combined heat and power generation in Maung Rayong is 500 m away from the centre of the pipe route. Majority of the study zone is located in IRPC Industrial Park, Tambon Choengnoen, Maung district, Rayong province. Patiality of the study area is located outside the IRPC Industrial Park. The consultant has applied GIS database system in analysing data obtained from field survey conducted in B.E. 2555 and found that the land use in the study area can be classified into 3 categories as follows; **a) Industrial zone :** an area of industrial activities in IRPC Industrial Park is 1.81 km^2 or 87.44% of the study area. **b) Agricultural zone :** an area of industrial activities 0.20 km2 or 9.44% of the study area **c) Water source area :** an area of surface water sources is 0.06 km^2 or 2.90% of the study area.	**1) Construction phase** **- The project zone** During the construction phase, this area may be affected according to activities involved in construction works of pipe alignment. The area in this zone will be used as stock yard, equipment and machine storage zone.Meanwhile, this area is categorised as righ of way zone which is has its own description for land use purpose. However, the activities during the construction phase will occur temporarily. After the construction, area reinstatement will be performed coupled with the fact that the project has already request for permission to work in the project zone from the land owner. Therefore, the constrcutionmay affect the land use in the project zone negatively (-) with a lower level of such impacts (-1). **- The study area** Road zones may be affected from construction materials transportation from the project. Impacts on transportation will be described in following section. **2) Operation phase** After the construction, backfilling and area reinstatement will be performed such that no impact on land use during the operation phase in the project zone and the study area (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.2 Transportation **(1) Transportation networks** There are 2 main routes of Land transporting route nearby the study area in IRPC Industrial Park as Highway no. 3 and Highway no. 36 as follows; **- Highway no. 3** is a main road used in transporting goods and raw materials from all over the country to Rayong while it is also a main economical route of the east region of Thailand. The highway is started from Bangkok to Samutprakarn, Chonburi, Rayong and Chantaburi. There are 4 traffic lanes except in community zone where parallel roads are added to the the traffic for safety of transportation. **- Highway no. 3 6** is a bypass road connectin between Amphur Banglamung in Chonburi and Rayong which could save 20 km from Highway no. 3.	**1) Construction phase** The project will use medium trucks (6 wheels) for transportin workers and construction tools and equipment approx. 20 trucks/hr as the maximum, or **30** PCU/hr [(10 trucks/hrx 1.5 as a constant factor) = 30 PCU/hr], large trucks (10 wheels) approx.15 trucks/hr or **30** PCU/hr [(15 trucks/hrx 1.7 as a factor constant) = 26 PCU/hr] **, which is** calculated as a total is **56** PCU/hr of the traffic load generated by the project activities during the construction phase. When combining this with traffic load recorded of Highway no. 3 and Highway no. 36 during B.E. 2553-2555 by Department of Highways, it suggests that the traffic load and V/C Ratio of both routes slightly increase.	**1) Pre-construction phase** a) Plan the traffic management during the construction phase so that least impact may occur. This means, period of time, place of the construction site, transporting routes should be specified clearly. It is also important to coordinate with local traffic management organisation about the plan so that the information could help them direct the traffic condition smoothly. All involved persons are requested to follow the traffic rules strictly. b) Do public relations on the project construction to the users of the main road via the project zone, in advance at least 1 month.	

Table 4-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		2) Construction phase **(1) General control** a) The contractor is requested to follow the traffic rules, suggested by traffic management team of IRPC Public Co., Ltd., strictly during the construction phase. b) Prepare the construction zone by dividing it from the traffic lanes by concrete barrier, fence, or plastic traffic cones. c) Arrange machines, equipment,construction materials orderly in provided area of the construction zone d) Provide poster, signs, and light signals to inform road uses on the construction works as well as install them at appropriate location based on the road use. e) In case night working hours are required, warning light signals of the operation must be provided clearly. f) Provide flag staff to cdirect the traffic in the zone with high traffic density. g) Avoid using the road suring rush hours, particularly, the zone nearby communities. The contractor must be responsible and take action on road maintenace properly in case damages of the traffic routes in the project area may be caused by the construction works.	

Table 4-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
(2) Waterway transportation Deep sea ports have been constructed in Rayong to support the development of industries and transportation according to eastern seaboard area development plan. Main seaport in the study area for goods transfer is IRPC port (IRPC Public Co., Ltd.) located in the south of IRPC Industrial Park. The port has 2 sub-ports where goods quantity are transferred. In B.E. 2553, there were 2,338 ships transporting goods and raw materials for 15,288,000 Tonnes in total. The goods and materials from the port are distributed to industrial factories in IRPC Industrial Park and the nearby area. Majority of the goods are crude oil, oil products, raw materials used in factory manufacturing process, and coal.		**h)** Provide signs and radio communicators for traffic direct officers as well as install warning lights in the the construction zone. i) Do not block traffic lanes with materials used in working onsite while unused materials must be moved out from the construction zone. In addition, number of pipelines to be strung should be calculated for exact number of the point to be installed. j) Limit transporting vehicle speed at 30 km/hr in community and 80 km/hr in general area. k) Install the natural gas pipeline as soon as possible and reinsate the area to its former condition as soon as possible. l) Provide a person to take care of vehicles entering and exiting the construction zone. m) Avoid pipeline stringing/ welding in normal traffic lanes.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
(3) Traffic condition According to the study of traffic condition on 2 main roads in the nearby area of the project zone as Highway no. 3 and Highway no. 36 recorded in B.E. 2553-2555 by Bureau of Highway Safety, Department of Highways , traffic volume based on location of monitoring station can be described as follows; Traffic volume data on Highway no. 3 during B.E. 2553-2555 surveyed by monitoring station - **Highway no. 3** (between Nakhon Rayong municipality Road-Noen Dindaeng junction) Milestone no. 246+000 (B.E. 2553-2555) Taffic condition data on Highway no. 36 between B.E. 2553-2555 were surveyed by traffic volume monitoring station - **Highway no. 36** (between Khao Gare Lare- Pluag Ket) Milestone no. 37+087 (B.E. 2553- 2555) The survey of traffic volume on Highway no. 3 and Highway no. 36 can be summarised as follows;		**(2) Open-cut excavating control for the pipeline alignment in IRPC Industrial Park** a) Provide daily operation plan in terms of date and time to operate the open cut work for the pipeline alignment by identifying the pipe laying routes clearly, and inform the public in advance regarding the plan. b) Effectively operate the construction works at road intersection points as quickly as possible prior to reinstate the area in a short time. c) Provide road diversion or temporary route as an option for pedestrian during operating the construction works. d) Inform road users in advance on the construction plan.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
a) Highway no. 3 **Milestone no. 246+000** Traffic volume during B.E. 2553-2555 was 1,605.01 1,803.46 and 2,008.98 PCU/hr, respectively. Top three vehicles are recorded namely: no. 1 is small trucks (4 wheels) as a percentage of 45.33 44.06 and 40.25, respectively; no. 2 is 7-seater cars as a percentage of 20.04 21.39 and 21.46, respectively; and more than 7-seater cars as a percentage of 9.24 10.17 and 10.82, respectively. **b) Highway no. 36** **Milestone no. 37+087** Traffic volume during B.E. 2553-2555 was 3,894.27 4,213.48 and 4,103.85 PCU/hr, respectively. Top three vehicles are recorded namely: no. 1 is small trucks (4 wheels) as a percentage of 19.26 18.93 and 19.17, respectively; no. 2 is 7-seater cars as as a percentage of 19.77 19.36 and 20.00 , respectively; and no. 3 is more than 7-seater cars as as a percentage of 18.65 18.15 and 18.77 , respectively.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.3 Water use At present, Eastern water resources development and management Public co.ltd. (Eastwater) is developing and manageing raw water distribution system to its clients in east coastal zone of Thailand: Chonburi, Rayong, Chachoensao, Prachinburi, Sra Kaew, and Chantaburi. Raw water sources are Bang Phra reservoir, Nong Kor reservoir, Nong Pla Lhai reservoir, Klon Yai reservoir, Pra Sae reservoir, and Dok Sai reservoir. The raw water pipe networks in east coastal zone interms of water quantity in the reservoirs can be described as follows; - Bang Phra reservoir is in Amphur Sriracha, Chonburi. Its water storage capacity is approx. 117 million m^3. This reservoir is a raw water resource for Chonburi province and Laem Chabung. Current water storage is approx. 54.92 million m^3 (or 47% of total capacity)	**1) Construction phase** **- The project zone and the study area** Water required for main activities within the project zone is for worker consumption and hydrostatic test as following details, In the project zone, water consumption demand for 50 workers/ day is 2.25 m3/day (calculated based on water consumption rate of 45 litres/capita/day, the manual for onsite Waste water treatment plant engineer & manufacturer volume 2 by Pollution Control Department, B.E. 2537). Meanwhile, water demand for hydrostatic test is 450 m3 (based on 2 times testing), which will use water supply from IRPC Industrial Park such that this amount is excluded. Therefore, the water use within the project zone during the construction phase is unlikely to affect community water use in the study area. **2) Operation phase** No activity involved with water use during the operation phase of the project, therefore, it can be counted as non-significant impact.	**Construction phase** **a) Water use and wastewater treatment** (a) Provide clean drinking water and water supply for construction workers sufficiently. (b) Provide sufficient sanitary toilets as well as install onsite wastewater treatment to treat the wastewater to reach acceptable effluent standard prior to discharging to external zone. (c) Take care of the wastewater treatment system based on effective operation. (d) Locate the projet office at least 50 m away from groundwater source to avoid the contamination towards groundwater.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
- Nong Kor reservoir is in Amphur Sriracha, Chonburi. Its water storage capacity is approx. 21.4 million m^3. This reservoir is a raw water resource for Chonburi, Laem Chabung and Pattaya. Current water storage is approx. 11.42 million m^3 (or 53% of total capacity) - Klong Yai reservoir is in Amphur Pluag Daeng, Rayong province. Its water storage capacity is approx. 40.1 million m^3. Current water storage is approx. 21.388 million m^3 (or 53% of total capacity). It is normally co-used as a raw water source with Dok Hrai for Suttahip, Ban Chang and Map Ta Phut, while partiality is supplied to Pattaya.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.4 Electricity use There are 8 districts in Rayong to be supplied the electricity by **5** responsible officials as follows - Rayong Provincial Electricity Authority supplies electricity to Maung district and Ban Khai - Ban Chang Provincial Electricity Authority supplies electricity to Amphur Ban Chang - Glang Provincial Electricity Authority supplies electricity to Amphur Glang, Amphur Wung Chan. - Khao Chamao Electricity Authority supplies electricity to Tambon Map Phut, Amphur Maung Rayong and Amphur Nikom Pattana. - Map Ta Phut Provincial Electricity Authority, Rayong province, has a potential to be developed as the centre of petrochemical industries in Thailand according to Eartern seaboard area development project. The study area is located in Tambon Choeng Noen, Tambon Ban Lang, Tambon Tapong, and partiality of the study area encompasses area in Maung Rayong Municipality where electrictity is supplied to residential and industrial zone.	**1) Construction phase** **- The project zone and the study area** The project will assign the contractor to provide Mobile Generator for the construction activities. It is estimated that it could generate electricity sufficiently based on the demand during this time. Therefore, electricity use in the construction phase is unlikely to affect electricity use in the community. **2) Operation phase** No activity involved with electricity use during the operation phase of the project, therefore, it can be counted as non-significant impact.		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.5 Solid waste management Solid waste management in the study area can be classified based on governance zones of governmental organisations as follows; **1) Tambon Choeng Noen Municipality** At present, Tambon Choeng Noen municipality is giving a service on solid waste collection all over the area of Tambon Choeng Noen (area size 17.5 km2), the collectable waste quantity is approx. 800 Tonnes/ day, averagely.There are 20 workers who are drivers and waste collectors. It has 3 trucks with 10m3 sized capacity, 1 truck with 6 m3 sized capacity, and 1 truck with 14 m3 sized capacity. Each vehicle services averagely 1-2 loads/day. The collected solid waste is disposed by sanitary landfilling operated by private section, Duang Pradit Yota Partnership ltd. located at Moo 7, Tambon Glangm Amphur Glang, Rayong province, 20 km away from Tambon Choeng Noen Administrative Organisation (Source : Tambon Choeng Noen Municipality, March B.E. 2555)	**1) Construction phase** Solid waste generated during the construction phase is managed as follows; a) Municipal solid waste generated by workers is approx. 36 Kg/day (calculated based on solid waste generation rate as 0.8 Kg/day, with a density of 0.3 kg/ litres, and 50 workers for a project) .The contractor will provide collection bins (size 200 litres) for solid waste collection sufficiently. b) Unused materials, i.e. scraps, wood chips, will be collected for reuse in the construction zone or selling to other contractor for futher reuse as land filling/ grading. According to the solid waste management during the construction phase, the contractor will seek for other party to collect and dispose the waste outside the project zone which may affect the local solid waste management, therefore, the construction activities may cause solid waste management in the area negatively (-), however, at low level (-1).	**1) Pre-construction and Construction phase** **a) <u>General solid waste management</u>** (a) Provide trash bags and cans with closure sufficiently aling the construction route to support the waste generated from the construction zone prior to contact relevant organisation to collect and dispose. (b) The contractor must collect the waste generated in the construction zone for sanitary disposal everyday (c) Inform the employees and workers to pay attention to cleanliness in the project zone, and follow the rules strictly (d) Seperate solid waste for reuse and recycling, or selling to recycling waste dealer. (e) Provide area for unused construction scraps/ materials separately. (f) Collect non-recyclable materials for further collection and disposal by local organisation	**Parameters:** - Solid waste types, quantity, weight, sources and management methods - Quantity and Frequency of loads to be collected and disposed **Monitoring location :** Temporary construction office and in the project construction zone **Measuring methods :** - Record types, quantity, and sources of solid waste regularly as well as record the disposal methods and the organisations that collects the waste for disposal. - Record number of loads, and Frequency of service collection trucks **Frequency :** During the construction phase **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2) Ban Lang Tambon Administrative Organisation At present, Ban Lang Tambon Administrative Organisation is giving a service on solid waste collection all over the area of Tambon Ban Lang (area size 30.67 km2) , average collected soloid waste is approx. 4 Tonnes/day. Ban Lang TAO hiresy Pluag Daeng Industry Park Co.,ltd. to collect and dispose the solid waste in this area. The company is located in Tambon Mab Yang Porn, Amphur Pluag Daeng, Rayong province, which is 30 km away from the Ban Lang TAO office. rganisation (Source: Ban Lang Tambon Administrative Organisation, March B.E. 2555)	**- The study area** Construction activities may generate solid waste which may affect local solid waste management by local organisation. Therefore, the construction activities may cause solid waste management in the area negatively (-), however, at low level (-1). **2) Operation phase** No activity involved with activities which may generate solid waste, or affect the local solid waste management, during the operation phase , therefore, there is no activities affect solid waste management during the operation phase in the project zone and the study area (0) counted as no impact (0)	**b) <u>Hazardous waste management</u>** (a) Specify that the contractor would have to follow Ministry of Industry Notification Re: Waste management B.E.2548 which stated that hazardous waste must be segregated from household hazardous waste. For example, lubricant oil, and equipment washing solvents, adsorbents or device used in cleaning spilled oil, and used batteries. The collected hazardous waste must be collected and disposed b authorised organisation approved by Department of Industry, without permission to keep in the construction zone. (b) Provid terms of reference on handling with hazardous waste for the contractor that manifest documents must be kept as an evidence for claiming the final payment from the project developer.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.6 Water drainage system and flood protection According to the map of Royal Thai Survey Department, it was found that the location of study area is 3 -4 m above mdium sea level (MSL), which the slightly sloping down to the sea. The drainage is naturallt flow through the sea. Meanwhile, artificial and natural drainage system in this area are Klong Kar and Klong Kuek Rit. Klong Kar is naturally originated. It is a branch canal from Rayong River. Klong Kar at the study area location is 30 m width, flowing across Tambon Choeng Noen area downwards to Rayong River in the zone of Maung Rayong Municipality. Klong Kuek Rit was made as drainage system by receiving water from Ta Kra Saeng irrigation dam. It parts from Klong Kar upstream flowing downwards through the sea in Tambon Tapong.	**1) Construction phase** **- The project zone** Used water from hydrostatic test is drained to IRPC drainage system. Carrying capacity of the system is calculated based on existing drainage flow comparing with drainage flow after discharging water from the test. The assessment suggested that the drainage system can support the volume of tested water sufficiently, due to total flow (Q_{total}) generated is less than the flow when water is fully drained in the drainage ditch (Q_{full}). Therefore, it is predicted that effluent from the test could bring about neative impact on drainage system carrying capacity (-) as low level of impact (1).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	- The study area The pipe alignment area is located underdround, in the project zone, where soil protection system is provided to avoid soil erosion which may affect water drainage and flooding, therefore, the construction activities are unlikely to affect water drainage (0) with no impact (0). **2) Operation phase** After the construction phase, area reinstatement will be conducted coupled with no activities during the operation phase may cause water drainage and flood control, or make the runoff flow increasing, therefore, the activities during the operation phase are unlikely to affect water drainage and flood control in the project zone and the study area (0) with no impact (0).		

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.7 Disaster protection and mitigation Description of local disaster protection and mitigation office in the study area can be summarised as follow **(1) Choeng Noen Tambon Administrative Organisation** Choeng Noen Tambon Administrative Organisation is responsible for an area of 20 km2 in terms of community safety. At present, there are 10 firemen, 1 disaster protection officer, and 120 civil defence volunteers (as in B.E. 2554). Fire equipment& device control available are consisting of 1 fire truck with capacity of 12,000 litres, 2 fire truck with capacity of 5,000 litres, 1 fire truck with water and foam system with capacity of 12,000 litres, 1 portable water pump, and 1 set of self contained breathing apparatus (SCBA). In addition, Choeng Noen Tambon Administrative Organisation can coordinate for support healp from nearby fire control stations i.e. Nakhon Rayong Municipality, Tapong Tambon Administrative Organisation and IRPC Industrial Park that can access Tambon Choeng Noen within 20 minutes (Source : Tambon Choeng Noen Municipality, March B.E. 2555)		**1) Construction phase** **a) Contaminated oil storage and management** Provide adsornebts for cleaning the low amount of spilled fuel oil and lubricant **b) Safety management** (a) Provide the fence surrounding the project construction office to control 1 entrace-exit available. (b) Provide security staff at the entrance for safety conrol. (c) The contractor's workers must have their I.D. cards on them during the working time. (d) Visitors are requested to exchange I.D. card before accessing the project zone. (e) Install portable fire extinguishers in the project office at accessible and visible points. (f) Control workers behaviours to avoid any problem in the community nearbythe construction zone (g) Specify punishment measures in case there is anyone who breaks the rules.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
(2) Ban Lang Tambon Administrative Organisation Ban Lang Tambon Administrative Organisation is responsible for an area of 30.67 km2. At present, there are 2 portable water pumps, 5 fire extinguishers, and 202 civil defence volunteers (as in B.E. 2554). In addition, Ban Lang Tambon Administrative Organisation can coordinate for support help from nearby fire control stations i.e. Choeng Noen Tambon Administrative Organisation and IRPC industrial zone that can access Tambon Ban Lang within 15 minutes (Source: Ban Lang Tambon Administrative Organisation, March B.E. 2555)			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
(3) IRPC industrial Park IRPC Public Co., Ltd. is a central coordinator or emergency control centre. It is a key centre in being informed any activities related to disaster protection and mitigation in the industrial zone. It also can support help to nearby area with facilities and equipment as 1 fire truck (10 wheels) with firewater carrying capacity of 6,000 litres (Foam carrying capacity of 4,000 litres),1 fire truck (10 wheels) with firewater carrying capacity of 6,000 litres (Foam carrying capacity of 5,000 litres), 1 fire truck (10 wheels) with firewater carrying capacity of 6,000 litres (Foam carrying capacity of 9,000 litres), 1 general fire truck with ladders (10 wheels) with firewater carrying capacity of 2,838 litres (Foam carrying capacity of 2,838 litres, 1 fire truck (10 wheels) with firewater carrying capacity of 1,000 litres (Foam carrying capacity of 3,000 litres), 1 fire truck (10 wheels) with firewater carrying capacity of 2,000 litres (Foam carrying capacity of 3,500 litres). In addition, IRPC Industrial Park can coordinate for support help from the nearest fire station i.e. Choeng Noen TAO that can access IRPC within 10 minutes, and other station as Nakhon Rayong Municipality, Tapong Tambon Administrative Organisation, Maung Map Ta Phut Municipality, Tambon Ban Pae Municipality, and Tambon Glang.			

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
4.8 Occupational health and safety	**1) Construction phase** Occupational health and safety measures during the construction phase are considered based on impacts from construction activities i.e. noise, accidents, and fire control as following details **(1) Noise** Loud noise is consider an impact that affect the workers in construction phase. According to the assessment, pipe lowering is the activity which significantly affect the workers. The pipe lowering by pipe jacking and pipe drilling that may generate sound level higher than the standard (the standard : 8 hr working continuously, 90 dBA at 15 m distance). If the workers exposes the noise in a long hours without protection, they may encounter hearing loss problem; either temporarily or permanently.	**a) Fire protection and control :** **Pre-construction phase** (a) The contractor must submit occupational health and safety and environment plan and emergency control plan for approval from IRPC Public Co., Ltd. prior to implementing as working instruction that everyone must follow strictly. (b) Natural gas transmission pipeline design must be based on Location Class according to ASME B3 1 . 8 which considerd population density as a guideline. Pipeline used in this project is designed according to Location Class 4 category. **b) Incident protection and control:** **Construction phase** (a) Inform the plan and contact IRPC for approval on commencing the construction works, as well as coordinated with relevant organisations prior to the operation. (b) Follow procedures specified by IRPC industrial zone strictly. (c) Contact with safety department of industrial factories where construction works are operated.	**Construction phase** **Parameters:** Records on accidents, illness, injuries at work **Monitoring location :** the construction zone **Measuring methods :** - Provide qualified safety officer who has been trained as professional safety officer or high-level technical safety officer to inspect safety in construction works, analyse accident records, and obstacles which lead to the failure reoccurrence protection measures. - Record and summarise accident statistics, cause and solution of damages on workers health by indicating required description i.e. causes, consequences, and solution **Frequency :** Monthly, during the Construction phase **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	However, significance of impacts from construction activities depends on Intensity, Frequency, Duration, Nature of Noise, and individuals. In order to mitigate the impact towards the workers, the project will assign the contractor to consider using the machines which generate lesser loud noise as well as conduct regularly maintenance. In terms of workers, according to Regulation (Standards - 29 CFR) Noise Exposure Computation-1910.95 APP A, it is allowed that they can expose noise at 115 dBA for 1 hour. However, from the sound level assessment in the working zone, workers will be allowed to take a break as well as working as rota. They will work continuously no longer than 2 hr, with using PPE such as ear plugs, ear muffs. Concerning noise impacts on surrounding area residents during the construction zone, the project has specified working period as between 08.00-17.00 hr to mitigate the risk of noise annoyance in community zone.	(d) Implement suggestions, specifications or consensus summary towards the construction activities gained from relevant organisations in providing work instruction and construction plan applicable with current construction activities. **c) Measures on occupational health and safety** (a) The contractor must follow specification according to safety management plan of IRPC Public Co., Ltd. strictly during the construction phase. (b) ArrangeOccupational health and safety training for workers, prior to the construction. Safety awareness should be emphasised along with working rules. (c) Arrange training workshop for the tasks which may need operational skills for workers before starting the construction works. (d) Manage construction workers to use personal protective equipment (PPE) at works appropriately i.e. by using helmet, safety shoes, and ear plugs. Particularly in welding works, additional PPE may be required such as goggles, welding helmets, light filter glasses, and gloves, etc.	**Operation phase** **Parameters:** - Accident records, gas leakages and causes of emergency - Record of illness, injuries at works, general health condition of workers **Monitoring location :** The project zone **Measuring methods :** - Record the accidents, emergency gas leaks incident, as well as inspect causes; provide solution methods and protection measures; provide physical examination programme for workers. **Frequency :** - Record the occurrence of accident , gas leaks, and emergency cases along with investigate causes and solution measures, health impact regularly during the year of the operation phase - Record worker illness and injuries at works regularly during the year of the operation phase - Annually: physical examination for workers, Hearing loss test for risk group, during the operationphase. - Annually provide emergency response plan record according to specification provided by IRPC Public Co., Ltd. during the operation phase **Responsible official:** IRPC Public Co., Ltd.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	If the contractor can follow the provided measures strictly, the impact is estimated to be low (-1) **(2) Accidents** Accidents which may occur during the construction phase is caused from careless operation, therefore, it is essential that accident protection measures must be provided for the construction operation. This is possible according to the details demonstrated in Chapter 2 on Occupational health as safety. Such guideline will be used in providing initial criteria for selecting the contractor in order that the contractor can follow the protocol strictly. Therefore, probality of sever incident is considered to be low.	(e) The contractor must provide a good maintenance on machine and equipment. In case unusual working condition may be detected, the maintenance works must be conducted as soon as possible. (f) Arrange workplace appropriately by dividing area for all taks obviously. (g) Install warning signs or signals in area with risks of danger. (h) The contractor must provide first aid kit sufficiently in the construction area **d) Safety measures during the process of Tie-In with Sale Tap Valve** (a) IRPC Public Co., Ltd. will have to arrange training on welding techniques according to working procedure for contractor's workers to ensure that they have sufficient skills in real practice (b) Contractor's workers who is going to work as welding technician will have to have relevant experience before. (c) IRPC Public Co., Ltd. will have to provide control officer to direct the task operation during the whole working hours.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	(3) Fire protection Activity which may cause fire is welding work and electric short circuit from electric equipment.If the project and the contrcactor agree to provide safety protection measures for construction tasks, coupled with regularly conducting effective inspection regarding the provided plan, probalbility of this risk is considered low. In terms of support help, the project can request for support help from external organisations in case of emergency very quickly, therefore, the impact is considered low (-1)	(d) Provide 1 set of gas detecto in the working station for leakage inspection. (e) Provide 2 sets of Dry Chemical Fire Extinguisher (Dry ABC, 15 Pounds/Set) reserved in the working station at all working time. (f) Specify Hazardous Area at the welding point with caution on none of Ignition Source or any action which may cause ignition/ fire during the working operation. (g) Provide information chart stating that there are men at work on pipeline installation so that passing drivers can be more careful. (h) Contact local relevant organisations: disaster protection and mitigation office; informing the construction plan so that they can be aware that support help may be required in case of emergency.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	2) Operation phase As community safety is the first priority when operating natural gas pipeline transporting system, all procedures must be inspected strictly since area preparation, materials selection, transportation, welding, coating, pipe lowering, and maintenance to ensure that all systems are safe based on international standards. The natural gas pipeline used in this project is designed based on USA international engineering standard, and manufactured from reliable factory, all joints are tested by X-Ray, as well as strength test nased on international standards i.e. hydrostatic test with pressure of 1.5 folds of normal operated pressure, while the pipe corrosion is 24-hr protected by Cathodic Protection. Regarding such characteristics of the pipelines, it could be ensured that safety level is high for the project operation. In case unusual incident may occur, SCADA can control on-off valves 24 hy via computer system in case of emergency.	**e) Safety measures during welding check by X-Ray** (a) Provide expert to conduct the weldings by Gamma Ray (b) Provide closure the welding check zone with warning signs as danger zone. (c) Provide Work permit system in the zone where welding is inspected by gamma ray (d) Direct working team in wearing protective clothes and equipment i.e gloves, helmets, maska, safety shoes, etc. (e) The working team should inspect and badge themselves with Film Badge before starting the tasks (f) Radioactive warning sign must be presented at welding inspection zone. (g) Strictly practice with care following the regulation stated in Notification no. 4 regarding the Atomic for Peace Act B.E.2508	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
	In addition, IRPC Public Co., Ltd. has provided natural gas pipeline maintenance annual plan based on ASME B 31 G and ASME B 31.8 including NACE RP-0169 standard which specify that corrosion and electric pressure must be inspected, etc. Also, pipeline markers posts are installed every 100 m distance to inform the gas pipe route. Referring to the control measures provided, it can be ensured that the operation wil be conducted based on safety measure, therefore, it can be estimated that impact on occupational health and safety may not occur (0)	**f) Protection measures in case of Domino Effect occurence** (a) Design standard, pipeline distance, and pipeline lowering - Natural gas transmission pipeline design must be based on Location Class according to ASME B3 1 . 8 which considerd population density as a guideline. Pipeline used in this project is designed according to Location Class 4 category. - Underdground pipe route is specified to be at at least 1.5 m lower than original ground surface. - The design should provide immediate cut-off valves for closing the route where leaks found to decrease the probability of Domino Effect incident.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- The pipeline installation in case pipe lowering paralled with other pipeline network.The installation of the pipeline is conducted based on the standard of ASME B 31.8 which state that the buried pipe route shall have to be located at lease 6 inches or 0.15 m away from public utilities/ facilities. Meanwhile, distance between the pipeline route (horizontally) must be at least 2m between the pipe surfaces of both lines (natural gas pipe line vs tapwater pipe line). (b) Implement suggestions, specifications or consensus summary towards the construction activities gained from relevant organisations in providing work instruction and construction plan applicable with current construction activities.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		Operation phase **1) Occupational health and safety training** Arrange iccupational health and safety training for workers appropriately for workers who handling on tasks related to natural gas on these following topics - Safety rules and working procedure in the boundary of gas transmission pipeline - The use of personal protective equipment - Procedure to conduct in case of emergency - First aids, etc. **2) Gas leakage and fire control** (1) Regularly inspect, surveil, and maintain the gas transmission system as follows; - Survey the area where natural gas transmission pipeline are laid to comply with ASME B31.8 standard as 1 time annually. - Survey warning signs/ charts to comply with ASME B 31.8 standard annually, coupled with site survey. - Survey the leakages of gas ransmission pipeline to comply with ASME B31.8 standard, 1 time annually.	**Operation phase** **Parameters :** Gas leakage incidents and emergency occurence **Monitoring station:** The operation zone of natural transporting pipeline **Measuring methods :** Record gas leakages, emergency incident, as well as identify causes of the incidents, provide mitigation measures for impacts which may affect workers and nearby communities. **Frequency :** Annually during the operation phase **Budget :** - Included in annual operational budget - The whole natural pipeline route of the project - Practice emergency response plan in the responsible area of pipeline system operation region office with local relavant organisations (pipeline system operation region office is responsible in emergency control in the project zone) at least 1 time/ year, during the operation phase

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Survey and observe subsidence of natural gas transmission pipeline, and erosion of covering soil in the area with soft soil, brooks,or slope to comply with ASME B 31.8 as 1 time annually. - Check electric pressue used in cathodic protection process to comply with NACE RP 0169 standard, 2 times annually - Check the pipe corrosion at high risk points i.e. joints, high velocity of gas flow, and pipeline corrosion based on ASME B31.8 as 1 time aannually. - Check electric pressure used in cathodic protection of natural gas transmission pipeline every 1 m distance to find out where the electric pressure is lower than a standard of NACE RP 0169 every 5 years (only at significant area) - Check the condition of pipe Coating every 5 years, or when there is any change of environment, or when Pipe to Soil Potential is lower than the standard level. - Check electricity distribution system by Rectifier supplying to Cathodic Protection measuring electricity parameters as electric potential and electric power every month (12 times annually).	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Check corrorion state inside the pipline, deviation of the pipeline, distortion, scratches, thickness, creases, and other mechanical damages every 5 years. (2) Control the working operation to be based on occupational health and safety and environment policy as well as working procedures in gas transmission pipe zone. (3) Take care of pipeline markers posts that all texts and information are clearly visible. (4) Contact area owner where pipes are laid well as contact organisations in charged with public facilities/utilities in the nearby area to inform the project construction plan in advance. (5) Arrange Work Permit system in the zone of gas transmission pipeline system before the operation.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		3) Readiness and operation preparation in case of gas leakages **Gas leakages** (1) Provide emergency control and response plan as a code of practice when gas leakage incident occurs. (2) After the construction, emergency response plan of this project will be shifted from IRPC's to PTT's after the ownership of the project has been transferred from IRPC PCL to PTT PCL. (3) Perform emergency response plan at least 1 time annually. (4) Arrange time to revied, improve, and evaluate the effectiveness of emergency response plan occasionally so that the practice can be performed effectively. (5) Provide contact phone numbers of important organisations in case of emergency i.e. police station, disaster mitigation office, hospitals, etc. (6) Install dry chemical extinguisher at Metering and Regulation Station (MRS) in Rayong CHP of IRPC Public Co., Ltd. (7) Provide well-trained officer to conduct duty in case of gas leakages. (8) Provide public insurance for the protection of life and properties which may be affected from project operation.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		4) Protection measures of accident which may be caused by third party and terrorism (1) Arrange 24 hr security at metering and regulation station (MRS) at Rayong CHP plany of IRPC Public Co., Ltd. (2) Inspect and maintain gas leakage protection equipment, PPE, and fire control equipment at MRS regularly. (3) Check the condition of pipeline markers posting or visible signs, and contact telephone number in case of emergency. (4) Inform and request for cooperation from relevant organisations, community and enterprises in the nearby zone to notice unwanted behaviour of third person(s) which may interrupt or cause the damages of the pipeline system. In addition, if any organisation may conduct construction, improve, or othe action related to public unitlities system, i.e. maintenance works of roads, water supply, landlines, in the zone of the natural gas pipes, it is require to inform the project, while project coordinator must be provided.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		5) Occupational health and safety for workers (1) Request workers to use PPE appropriately upon their tasks. (2) Request workers to check device and equipment before working operation (3) While maintainin the leaking pipeline, **codes of practice are as follow** - Arrange work permit system in the welding area and welding check by X-ray zone - Request workers to use PPE such as gloves, helmets, safety shoues, etc. - Close off the welding area as well as provide warning sign of danger in such area - Measure gas at the working station by Gas Detector the whole time - Close off the welding check area, unauthorised persons are not allowed to access the zone. - Provide radiation warning sign, in area where X-rays is used for welding check, with warning texts as follows;  - The welding inspector must check and put on Film badge before conduct the welding check	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		(4) Provide annual physical examination for employees annually. (5) In case pipe maintenance works are conducted in area with soft soil, open cut operation must be controlled to do with caution and erosion protection measures to ensure safety for workers, i.e. installing Sheet Pile around the open cut area, or may consider decreasing the slope of the excavation wall appropriately.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
5. values on quality of life **5.1 Socioeconomics** Although the natural gas transmission pipeline project for combined heat and power generation in Maung Rayong is located in the IRPC Industrial Park, coupled with the study area encompasses the distance of 500 m away fron the pipeline centre (the majority located in IRPC Industrial Park and the partiality is located external zone as vacant zone), the project has given priority to public participation by conducting the survey on socioeconomics in the study area including informing the project description and updates to the public with following objectives - To survey the figure of socioeconomics condition of community in Rayong, through secondary data, however, the community in the study area is focused - To study social characteristics in the study area to build more understanding via social participation process - To survey perception on information, news, and updates as well as public opinions towards the project operation	**1. Sociality, Public relations, and complaints hearing** Although there are only few factories with no residential zone in the study area, the project development may cause impact on inconvenience and annoyance because of working-by-the-road activitiy that could obstruct entrance-exit of the IRPC industrial zone. The impact may include dust and noise from the construction. Based on previous experience, there has been found that contractors tended to ignore taking care of the construction zone such that nearby communities had been affected from construction activities.	**Construction phase** **1) Public relations** **(1) Pre-construction phase** - Public relations was performed to explain the project background and deliver relevant information to the target groups to build more understanding and hear their opinions. Meanwhile, questions were answered by the staff form IRPC Public Co., Ltd. Information to be delivered includes * Rationale of the project and its options * Summary of such options and supporting reasons * To hear community opinions and conceens - Present the constructionmethods, period of activity, and imoact protection and mitigation measures - Give away project information document, leaflets, or newsletter to the public. The information involves knowledge about natural gas, transmission pipeline system, and safety measures for community and those who reside in the zone of the pipe routes.	**Construction phase** **Public relations and complaints hearing, assessing opinions shared by community leaders** **Indicators :** Public opinions towards the project development on natural gas transmission pipeline system **Target groups :** Governmental organisations institutions/ organisations and relevant factories/ enterprises in the zone of 500 m away from the pipe line centre, encompassing the IRPC industrial zone.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
- To assess socioeconomics impact which may occur fro the project operation, and to provide protection and mitigation measures in case negative impacts may occur	Referring to the study of socioeconomics and public opinion towards the project development by using questionnaire asking respondents at household level, community leader level, and enterprise level, it suggests that most of them agree with the project development. Meanwhile, partiality of them are anxious about the impacts which may occur during the construction phase as noise, dust, traffic obstruction, etc. The community may be affected from such impacts only during the construction phase.	- Arrange meeting target group to break the ice between them, the groups include community leaders, community committee, and enterprises representatives.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
2) Study methods The study of socioeconomics and public attitudes on the project development in the study area involves data collection on generic condition of socioeconomics and public attitudes in the study area. Obtained data will be used as a direction in providing mitigation measures on impacts which may affect quality of lif of the population in the study area. Sources of the socioeconomics data are as follows; **Secondary Source**: data are from documents, recorded data, or any media which opened to the public by relevant organisations in the study area. This could help gaining data which relates to existing environment in the area. The data were collected from Choeng Noen Tambon Administrative Organisation and Ban Lang Tambon Administrative Organisation. The data collected are compried of socioecnomics of the communities in the study area which includes politics, population, education, religion, and economic structure. **Primary Source:** field survey was conducted as in-depth interviewing representative from relevant organisations and heads of local organisations on socioeconomics issues in the study area, existing environmental impact, attitudes and opinions towards the project development.	However, during the project operation, urgent issues may need to be solved, particularly, annoyance in community nearby the pipeline zone. As such, it is essential that Environmental and socioeconomic impact mitigation plan is required so that impact could be compromised to be at the lowest level. In addition, complaints hearing process has been provided that the citizen can use as way to inform the annoyance which may be caused from the project operation, and wish IRPC and the contractor to take action appropriately to mitigate the impact. This could help the project to operate its works smoothly and could ensure the community concerns. There are also opportunity that community can take part in auditing safety in the construction which shows that the project team is concerned on community safety.	**(2)Construction phase** The construction phase may casue impacts on local occupation, local mental health, and environment i.e. dust, noise, traffic, and safety. Therefore, public relations plan for construction phase is provided to take care of community in case annoyance from the construction may occur, as follows - Provide hotline phone number that anyone can ask for information updates and submit complaints related to construction operation. - Establish public relations team to visit community, or land owner in the nearby zone, that are affected from the project activities so that the team can follow up for surveillance as well as to hear the complaints during the ocnstrcution phase. - Support community activities including thatof governmental organisations, schools, and social enterprises occasionally and appropriately.	**Measuring methods :** 1) Assess perception on news, information, understanding about the project, impacts which may occur and mitigation measures; opinions and suggestions, complaints among the target groups in the study area encompassing the distance of 500 m away from the pipeline centre. 2) Deliver information and update on natural gas and safety, build more understanding, and confidence towards the project and its organisations via available communication system/ various types of media, i.e. leaflets. The information may include general knowledge about natural gas, pipeline marker posts, communication pathway between the project and community.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
3) Results of the survey and socioeconomics basic data collection - Area predicted to be affected from the project operation encompasses area located in the distance of 500 m away fron the pipeline centre in IRPC Industrial Park mainly, while partially located external zone across the vacant area awaiting for land use activity. The zone is in Choeng Noen TAO and Ban Lang TAO in Amphur Maung, Rayong. The opinion survey from relevant organisations explored basic description of the organisation, anxiety, opinions, and suggestions.The interviews were conducted with representatives of governmental organisation on 25-26 April B.E. 2555. The result suggested that public relations on the project information should be delivered to school, communities surrounding the project zone on the impacts which may cause from the project operation. Risks insurance should be provide for the community. They area also concerned on wastewater and gas leakages problem while noise and traffic may cause from construction activities.		**2) Community impact protection and mitigation** - Inform the citizen in advance on the construction plan before any operation in the area, particularly, theconstruction date and time. - Provide monitoring team to inspect the area condition after the construction phase. Consider to hire local people to mitigate in conflicts which may occur when many immigrating workers are hired. The recruitment may be announced via community leaders who are willing to assist seeking qualified human resource who are suitable for the project. - Control unwanted behaviour which may cause by works closely to avoid annoyance which may happen in the nearby community in the construction zone - Follow other environmental impact protection and mitigation measures strictly. **3) Complaints hearing (Figure 3)** **(1) Generic complaints** - Complaints can be delivered to project officers: which include construction unit team; engineers; public relations and environment team; the contractor: via face to face, telephone, note, letter, fax., e-mail. The complaint makers are requested tol leave contact address, details on issues to complain, and suggestion for the project to take into consideration.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Complaint collector will transfer the complaints to complaint hearing centre at field onsite office (at the project location) or at IRPC Public co., ltd. office where the complaints are processed for further action by assigned officer. After the investigation of the problem, the officer will arrange time to meet the complaint maker to meet onsite where problem occurs (if any) and cooperate in assessing the situation. The complaint maker will be asked to see the complaint form and sign her/his name as an evidence. The observation will be recorded and investigated by the officer, identify type of the complaint onto the form (the generic complaints will be initially inspected within 3 days after informed) - The project team, comprises of project representatives or project responsible official and contractor, conducts meeting to consider the complaints, investigate causes of the problem, and assign related section to take action. - The project construction head direct the operation to solve the problem. Record the command and relevant details in the complaint form and note the date. - Assigned person takes action and record the result in the complaint form after the operation has been completed.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Assigned person invites the complaint maker to follow up the result of problem solution prior to seeking for agreement from the complaint maker by signing the form. If agreement is not achieved, the issue will be considered againg in the board meeting for further investigation and solution. - The construction unit head informs the result of the accepted operation which fixed problem related to the complaint, to the project meeting. The complaint centre officer collects the recorded complaint form as an evidence for monthly assessment. **b) Urgent complaints** - Complaints can be delivered to project officers: which include construction unit team; engineers; public relations and environment team; the contractor: via face to face, telephone, note, letter, fax., e-mail. The complaint makers are requested tol leave contact address, details on issues to complain, and suggestion for the project to take into consideration.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Complaint collector immediately (within 1 hour) transfer the complaints to complaint hearing centre at field onsite office (at the project location) or at IRPC Public co., ltd. office where the complaints are reported to construction unit head and contact the complaint maker within 1 hour to arrange field meeting onsite where problem occurs and cooperate in assessing the situation (depending on availability of the complaint maker). The complaint maker will be asked to see the complaint form and sign her/his name as an evidence. The observation will be recorded and investigated by the officer, and identify type of the complaint onto the form. - The project construction head assigned involved person to solve the problem within 24 hours. If the contractor could not solve the problem on his own, and the project has to conduct this operation, the expense can be clained later on from the contractor. Then the head assign the complaint centre to inform the operation to the complaint maker within 24 hours, and invite the complaint maker to visit and inspect the result of the operation.	

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		- Assigned person records the result of operation in the complaint form after the operation has been completed and invite the complaint maker to be acknowledged, and sign the form. If agreement is not achieved, the issue will be considered again in the board meeting for further investigation and solution. - The construction unit head informs the result of the approved operation, by the complaint maker, which fixed problem related to the complaint, to the project meeting. The complaint centre officer collects the recorded complaint form as an evidence for monthly assessment. **Operation phase** 1) Provide complaint hearing system that affected people can use as a way to communicate with the project developer so that required action can be taken as soon as possible.	**Operation phase** **Parameters :** Public opinions towards the project development on natural gas transmission pipeline operation **Targeted group :** Governmental organisations, instiurions/ organisations and related enterprises located in the coverage zone within 500 m away from the central point of the pipeline route.

Table 3-1 (Con't) Summary of existing environment, environmental impact assessment, environmental impact protection, mitigation and monitoring measure

Environmental components and values	Significant environmental impacts	Protection and mitigation measures	Monitoring measures
		2) Arrange public relations and deilver "emergency response maual for community" as well as contact telephone numbers in case of emergency related to natural gas transmission system to relevant organisations and those who are interested in. This can be performed via communication system i.e. in person, website, leaflets, poster, community leaders, etc. 3) Build good relationship with community by taking part in community activities and support them occasionally regarding appropriateness of the context i.e. community traditional/ festival activities, and financial contribution in sports, education, public health, and public benefits.	**Measuring methods :** Assess perception on news, information, understanding about the project, impacts which may occur and mitigation measures; opinions and suggestions, complaints among the target groups in the study area encompassing the distance of 500 m away from the pipeline centre. **Frequency :** First year of operating and every 5 year
5.2 Aesthetics and tourisms None of historic place is found in area surrounding the project zone. Nevertheless, tourist attraction in Rayong province are such as King Thak Sin's shrine, Wat Bpa Pradoo, Pra Chedi Glang Nam (Middle water pagoda), city shrine, Sri Maung Park, Samed island, etc.	**Construction phaseและOperation phase** The construction activities will be operated in IRPC Industrial Park where no tourist attraction and historic places are found in the study area, therefore, the project is unlikely to affect aesthetics and tourisms (0)		

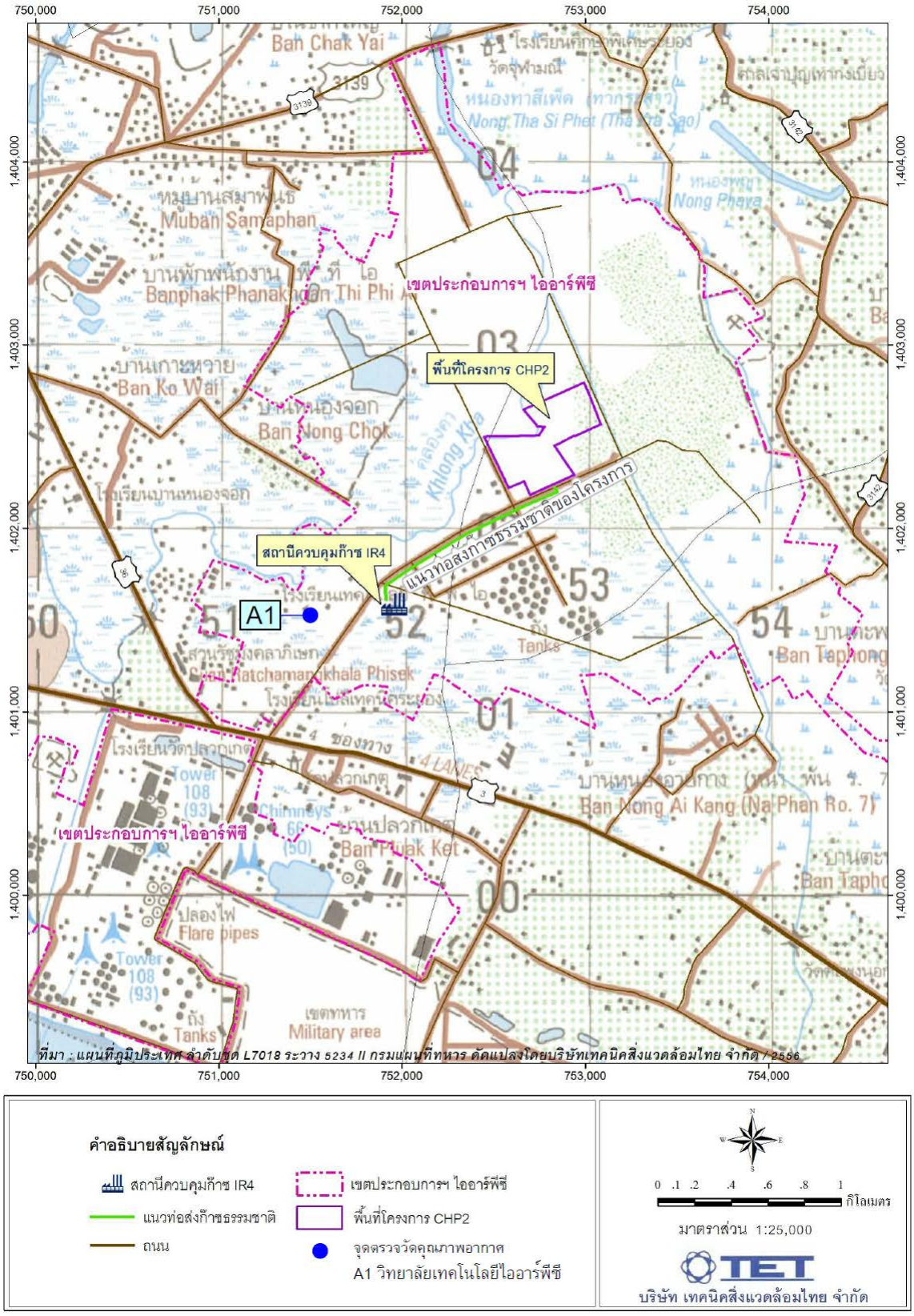

Figure 1 Ambient Air Quality Station

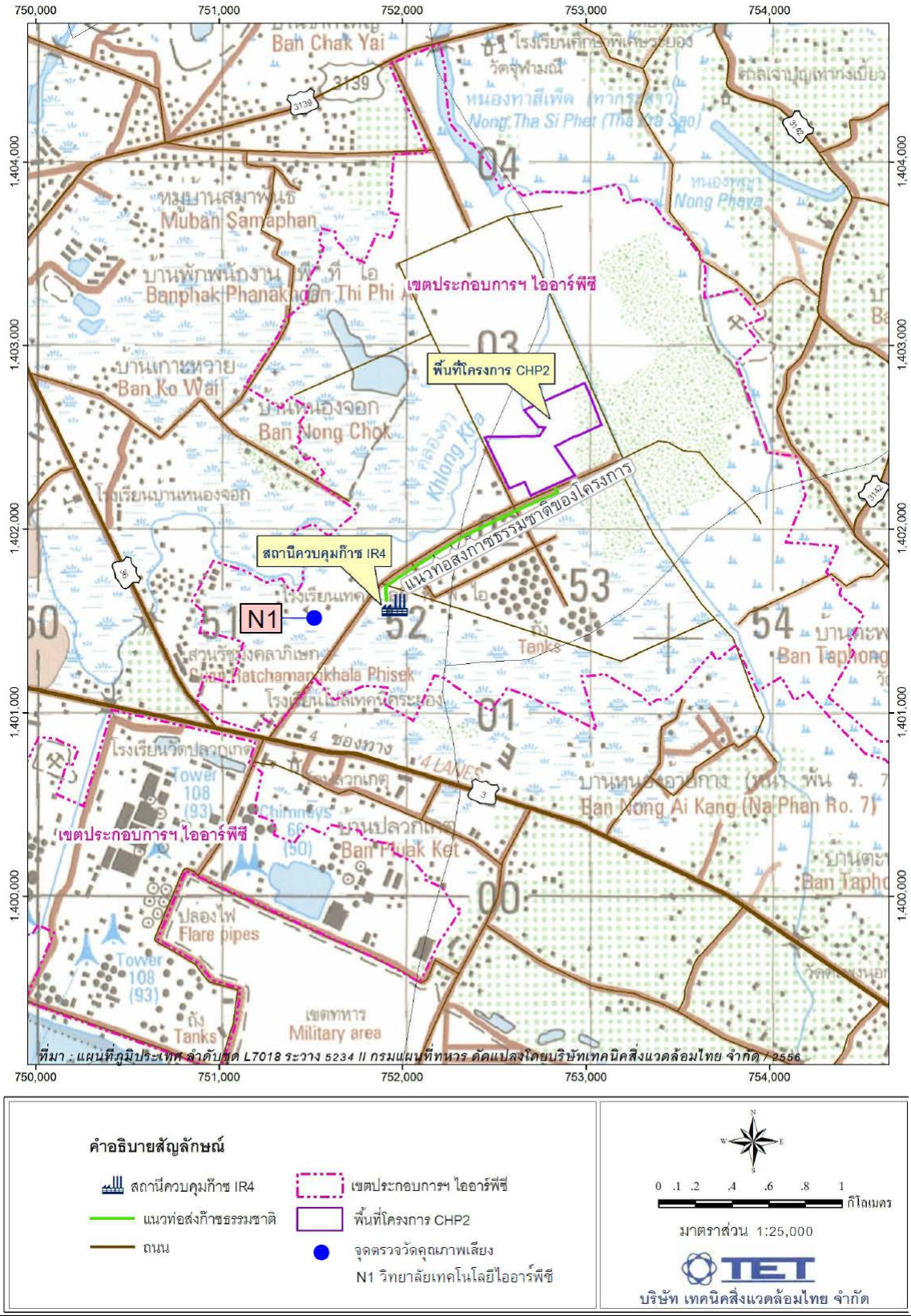

Figure 2 Noise Level Station

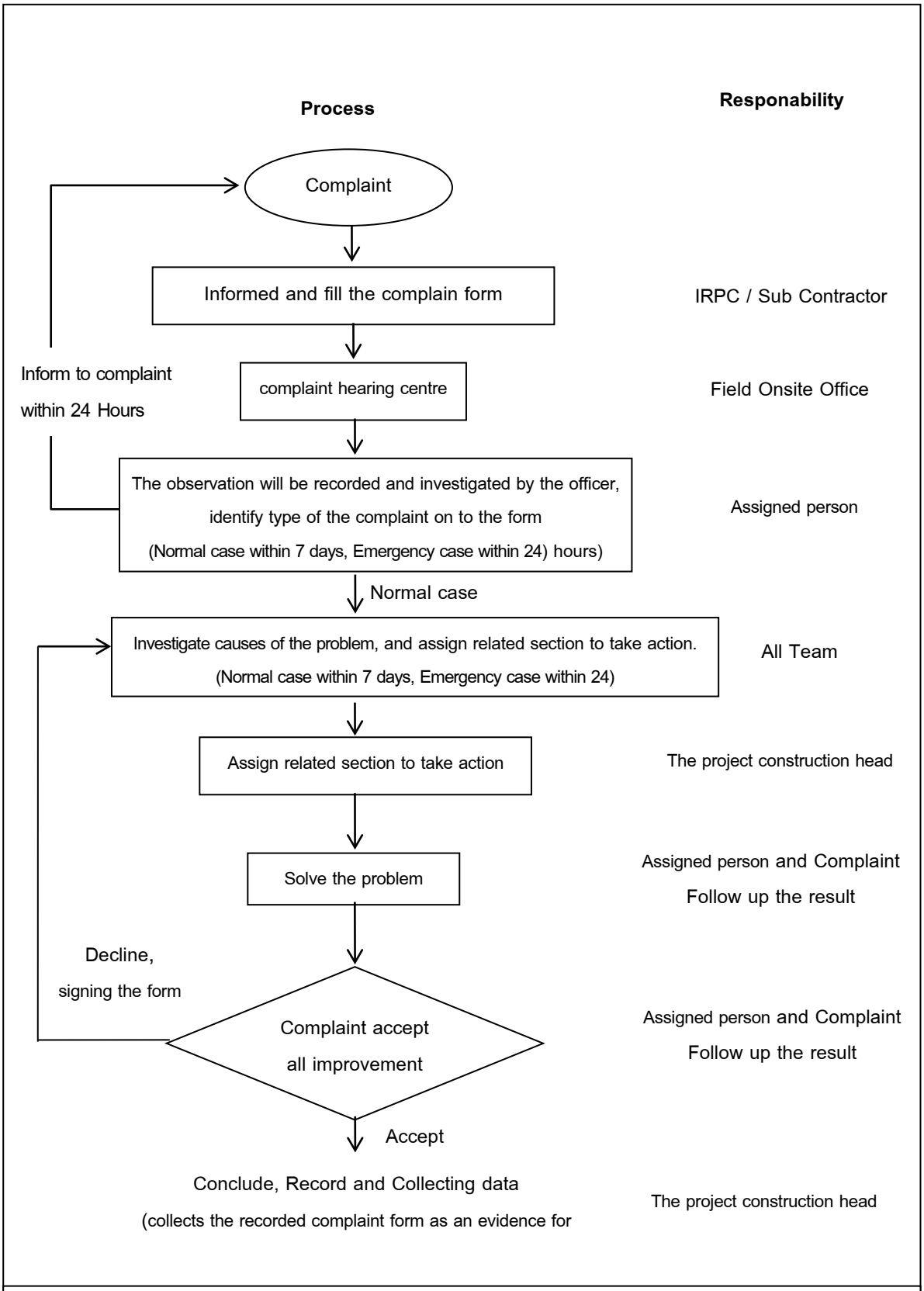

Figure 3 Operation procedures for compliant receiving and responding