ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY FOR BETANO REFINERY PROJECT IN TIMOR-LESTE

31 March – 8 April 2016
OUTLINE OF PRESENTATION

• EIA Objectives
• Methodology
• Project Information
• Existing Environmental Condition
• Environmental and Social Impact Assessment and Mitigation Measure
  ➢ Pre-Construction Phase
  ➢ Construction Phase
  ➢ Operation Phase
  ➢ Deactivation Phase
EIA OBJECTIVES

To prepare environmental management plan (EMP) to minimize environmental impact during pre-construction, construction, operation and deactivation phase based on comprehensive environmental impact assessment covering Physical Environment, Biological Environment, Socio-economic Environment, and Cultural and Visual Environment.
METHODOLOGY

• Study the existing environmental conditions around the project area
• Review the project features
• Identify and quantify the potential negative impacts and positive impact from the proposed project with respect to the environment (physical, biological, economic, social, and cultural)
• Propose prevention, mitigation, and monitoring measures
The project comprises of two (2) components:

1. Component 1 for the Betano Refinery, Nova Betano and the Water Supply System, all located in Betano Area, and

2. Component 2 is the Condensate Pipeline to transport the refinery products from Betano Refinery to Suai Supply Base.
BETANO REFINERY
PROJECT INFORMATION

• **Location:** Betano Village, Same Sub-district, Manufahi District

• **Area:** 230 hectares between the new proposed highway and the southern coastal line

• **Capacity of the refinery:** 30,000 barrels of condensate per day

• **Product:** Diesel, Heavy and Light Naphtha, Gasoline & LPG

• **Project objective:** Domestic supply-demand and exportation of remaining products
Study Area: 5 km radius around the refinery
REFINERY
AUXILIARY FACILITIES
WASTE WATER TREATMENT SYSTEM
DRAINAGE SYSTEM
WAVE PROTECTION STRUCTURE
EXISTING LAND USE

1 Mixed Deciduous Forest and Palm ≈ 73%

3 Beach Forest ≈ 5%

2 Teak and Perennial Plant ≈ 18%

4 Mixed Deciduous Forest and Palm
NOVA BETANO
PROJECT INFORMATION

- **Location**: Approximately 5 km to the north of Betano village and adjacent to the Caraulun River (to the west)
- **Area**: Cover 1,190 Ha of land where Nova Betano is separated into two areas, Nova Betano West and Nova Betano East, by north-south road from Same towards the southern shoreline.
- **Project objective**: To establish Petroleum Administration City, resettlement site of relocated households from refinery construction and residence for staff of refinery
Study Area: 5 km radius around the site
STAGING PLAN
SUSTAINABLE AND GREEN DEVELOPMENT
EXISTING LAND USE

1 Mixed Deciduous Forest ≈ 70%
2 Teak and perennial plant
3 Irrigation
4 Field crop ≈ 3.6%
5 Residential area ≈ 0.5%
WATER SUPPLY SYSTEM
PROJECT INFORMATION

• **Location:** Weir is located about 10 km. to the northeast of the refinery

• **Length of water pipeline:** Approximately 10 km. (Ø 250-280 mm)

• **Capacity:** 40,000 cu.m for weir

• **Project objective:** To provide the raw water feedstock which will be used to produce the reverse osmosis (RO) water for other general uses such as Boiler Feed water, Demineralized water, Potable water etc.
Study Area: 5 km radius around the site and 50 m strips on both sides of water supply pipeline route
WATER SUPPLY SYSTEM FOR BETANO REFINERY PLANT

1. Proposed Site Office
2. Access Road
3. Weir and Component
4. Emergency Spillway
5. Closure Dam
6. Water Pipeline

Water Tank 500 m³

WATER STORAGE POND

REFINERY AREA

WEIR LOCATION
WATER SUPPLY SYSTEM
WATER PIPELINE
WATER TANK
WATER STORAGE POND
EXISTING LAND USE

1 Mixed Deciduous Forest, and Palm ≈ 96%

2 Riparian Forest ≈ 4%
EXISTING ENVIRONMENTAL CONDITION

• Physical Environment
• Biological Environment
• Socio-economic Environment
• Cultural and Visual Environment
The study areas display a typical tropical monsoonal climate. There are 2 seasons, wet season; start from December to July and dry season from August to November. The average temperature range is 23.8-28.1 °C. The relative humidity range is 73.3-85.6 %. The average wind speed range is 0.5-1.3 m/sec. The average annual rainfall is 1,494 mm/year.

AMBIENT AIR QUALITY

• Most of Study area is residential, food crop, and un-developing area.

• The primary air pollutants is Particulate Matter (PM) or dust which cause by vehicular traffic.

• PM10 is approximately 25-27 ug/m³ less than the 24-hr average of WHO and NEPM guidelines, and U.S. EPA. standard, which 50 and 150 ug/m³, respectively.

• Other air pollutions, i.e. NOₓ, SOₓ are less than the limit of reporting.

• Most of Study area is residential, food crop, and un-developing area.

• The primary source of noise is vehicular traffic.

• $L_{Aeq}$ is range of 45.5-62.4 dB

<table>
<thead>
<tr>
<th>Station</th>
<th>Direction</th>
<th>Vehicles</th>
<th>Traffic condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC1A</td>
<td>Same to Betano</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Passenger car</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Light truck</td>
<td></td>
</tr>
<tr>
<td>TC1B</td>
<td>Betano to Selihasan</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Bicycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Light truck</td>
<td></td>
</tr>
</tbody>
</table>
COASTAL WATER QUALITY FOR BETANO REFINERY PROJECT

- The concentrations of dissolved oxygen (6.11-6.62 mg/L) are in range of Indonesia Marine Water Quality Standards (2004).
- pH levels (7.9-8.1) are in range of National Recommended Water Quality Criteria (US EPA, 2009).
- Heavy metal together with organic contamination are within Indonesia Marine Water Quality Standards (2004) and National Recommended Water Quality Criteria (US EPA, 2009).
- Coastal water quality is suitable for coastal ecosystem.

The concentrations of dissolved oxygen (5.87-6.64 mg/L) are within Indonesia Marine Water Quality Standards (2004).

pH levels (8.0-8.1) are in range of National Recommended Water Quality Criteria (US EPA, 2009).

Heavy metal together with organic contamination are below Indonesia Marine Water Quality Standards (2004) and National Recommended Water Quality Criteria (US EPA, 2009).

Marine water quality is suitable for marine ecosystem.

The water quality of the rivers is within the standards and can be used as freshwater preservation, livestock and irrigation.
GROUNDWATER QUALITY

Betano Refinery Project  NOVA Betano Project  Water Supply System Project

The water is suitable for domestic use and agriculture
**TERRESTRIAL ECOLOGY**

<table>
<thead>
<tr>
<th>Class</th>
<th>Betano Refinery</th>
<th>NOVA Betano</th>
<th>Water Supply System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>74</td>
<td>88</td>
<td>48</td>
</tr>
<tr>
<td>Wildlife</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammals</td>
<td>7</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Birds</td>
<td>21</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>Reptiles</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Amphibians</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36</strong></td>
<td><strong>42</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

*Rosewood (Pterocarpus indicus)*  
*Timor Friarbird (Philemon inornatus)*  
*Streaky-breasted Honeyeater (Meliphaga reticulate)*
SOCIO-ECONOMIC SURVEY FOR BETANO REFINERY PROJECT

Manufahi District

Betano Village

Selihasan sub-village

Bematan sub-village

Opinion

- Agree
  - Job opportunity for local people
  - Community and country development

Suggestion

- Present project affected area to local people
- Local people participation in each step of EIS study
# SOCIO-ECONOMIC SURVEY FOR NOVA BETANO PROJECT

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>• Job opportunity from the project for local people</td>
</tr>
<tr>
<td></td>
<td>• Country development</td>
</tr>
<tr>
<td></td>
<td>• Job opportunity</td>
</tr>
<tr>
<td></td>
<td>• Not need to resettle PAPs to live together in only one area, please arrange community which has different culture separately</td>
</tr>
</tbody>
</table>
### SOCIO-ECONOMIC SURVEY FOR WATER SUPPLY SYSTEM PROJECT

#### Opinion

<table>
<thead>
<tr>
<th>Kakeulaletek sub-village</th>
<th>Maha Clusin sub-village</th>
<th>Selihasan sub-village</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Job opportunity for local people</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Country development</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Suggestion

- Availability for transportation via Dam Crest during project operation
- Water supply for community
- Job opportunity for local people
CULTURAL AND VISUAL ENVIRONMENT

Cemetery in Selihasan sub-village

Betano Name in Selihasan sub-village

Huiloco Cemetery in Maha Clusin sub-village

Portuguese Port in Betano village
PRE-CONSTRUCTION PHASE

Potential Impacts

• Land acquisition
• Fugitive dust from land preparation
• Waste from site clearance

Mitigation Measures

• Fair compensation
• Spray water
• Reuse for communities and agricultural activities
CONSTRUCTION PHASE

Potential Impacts

• Fugitive dust

• Traffic Problem and risks

• Gaseous emission from project vehicles and machinery

Mitigation Measures

• Spray water

• Cover truck transporting construction material with tarpaulin sheet

• Limit speed at 40 km/hr

• Installation of safety signs

• Avoid transportation in rush hours

• Routine maintenance of vehicles
CONSTRUCTION PHASE

Potential Impact

• Increase of noise level from construction activities

Mitigation Measures

• Regularly monitor ambient noise levels
• Conduct routine maintenance of machinery
• Set schedule for activities with high noise level only during day time
CONSTRUCTION PHASE

Potential Impact

• Community Health, Safety and Security

Mitigation Measures

• Provision of personal protective equipment for workers
• Installation of warning and prohibition signs
• Give priority to local employment during the construction period
• Grievance Redress Mechanism
CONSTRUCTION PHASE

Potential Impact

• Soil erosion/landslide
• Increased storm water, run-off

Mitigation Measures

• Limit excavated area and cut slope designed, and backfilling should be finished before opening the next section
• Using less time for construction near the water source
• Avoid construction during heavy rain
• Prohibition of discharge of waste to water sources
CONSTRUCTION PHASE

Potential Impact

• Agricultural area disturbance
• Vegetation and wildlife disturbance
• Blocking local road

Mitigation Measures

• Obtain permission for cutting trees from the relevant agencies
• Use efficient equipment to reduce noise level, dust and fume
• Inform construction plan to landowners 3-6 months in advance
• Provide temporary detour for local people
CONSTRUCTION PHASE

Potential Impact
• Increase solid waste

Mitigation Measures
• Prohibition of discharge of waste to water sources
• Monitor groundwater quality at the nearest well to the project area twice a year
• Provision of waste disposal site, and sewage treatment within the construction site
# CONSTRUCTION PHASE

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Socio-economic</td>
<td>• Give priority to local employment during the construction period</td>
</tr>
<tr>
<td></td>
<td>• Inform construction schedule to villagers</td>
</tr>
<tr>
<td></td>
<td>• Grievance Redress Mechanism</td>
</tr>
</tbody>
</table>
## OPERATION PHASE

### Potential Impact
- Increase gaseous emission from combustion of Betano Refinery Project

### Mitigation Measures
- Control the emission not to exceed the standard
- Install the Continuous Emission Monitoring System (CEMS)
- Properly maintain the operation of air pollution control systems
- Regularly record the shutdown period and duration of flare operation
- Monitor ambient air quality at sensitive receptor and emission stack twice a year
AERMOD has been used for prediction of air quality impact for refinery

Study area: 10 x 10 km²

Parameters: NOx, SOx, and PM

All results within applicable standard (i.e. US. EPA., WHO, IFC)
Example for AERMOD Result

WORLD BANK GROUP standard for PM10 avg. 24 hours = 150 mg/m³
OPERATION PHASE

Example for AERMOD Result

IFC standard for SO$_2$ avg. 24 hours = 125 mg/m$^3$
Example for AERMOD Result

WHO standard for NO₂ avg. 1 hour = 200 mg/m³
## OPERATION PHASE

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Generation of wastewater from <strong>Betano Refinery</strong> Project</td>
<td>• Provide wastewater treatment system and control water quality to meet the standard</td>
</tr>
<tr>
<td></td>
<td>• Regularly maintain wastewater treatment system</td>
</tr>
<tr>
<td></td>
<td>• Monitor coastal water twice a year</td>
</tr>
</tbody>
</table>
OPERATION PHASE

Potential Impact

• Generation of wastewater and solid waste from NOVA Betano Project

Mitigation Measures

• All sewerage to be contained within the municipal sewer systems
• Provide proper waste management system
• Provision of water supply, waste disposal, and sewage treatment system within the area
OPERATION PHASE

Potential Impact

- Increase of noise level in existing communities due to project operation of Betano Refinery

Mitigation Measures

- Design the process building to reduce noise level
- Personal protective equipment
- Plant Operating Maintenance and Calibration Manuals, Procedures and Schedules
OPERATION PHASE

Potential Impact

• Impact on occupation health and safety from excessive noise, flammable and explosive hazards of Betano Refinery
• Public Health

Mitigation Measures

• Establish the committee for occupational health/safety
• Provide first aid system and fire extinguishers
• Regularly inspect and maintain the pollution control system
• Provide PPE
• Annual health check up for workers
OPERATION PHASE

Potential Impact

• The adverse impact might be generated by the Betano Refinery operation intense of noise and gas emission
• Community Health, Safety and Security
• Socio-economic

Mitigation Measures

• Corporate Social Responsibilities (CSR)
• Grievance Redress Mechanism
OPERATION PHASE

Potential Impact

• Transport obstruction from water supply system project

Mitigation Measures

• Provision of transportation route via weir crest (motorbike)
• Provide new local road to village (small truck)
• Support water to nearby communities and upgrade existing local road to weir site
OPERATION PHASE

Potential Impact

• Major hazard might cause impact to community i.e. fire and explosion of Betano Refinery

Mitigation Measures

• Propose emergency plan
• Provide equipment and fire security system
• Installation of gas detection system and emergency valve
• Provide fire extinguishers
DEACTIVATION PHASE

Betano Refinery Project

• The majority activities will be demolition and removal structure including remediation.
• Impacts and mitigation measures of deactivation phase are as same as those of construction phase.

NOVA Betano and Water Supply System Project

• There would be no deactivation phase
CONDENSATE PIPELINE
• **Location:** From Betano Refinery (Betano Village, Same Sub-district, Manufahi District) along southern shoreline to tank farm at Camenaãã Village, Suai Sub-district, Covalima District.

• **Length of condensate pipeline:** 78 km.
  - Light Naphtha, Heavy Naphtha and Diesel ø 8 inches
  - Condensate ø 12 inches.

• **Project objective:** Transportation of condensate
CONDENSATE PIPELINE

Study Area: 50 m strips on both sides of pipeline route
CONDENSATE PIPELINE
EXISTING ENVIRONMENTAL CONDITION

• Physical Environment
• Biological Environment
• Socio-economic Environment
• Cultural and Visual Environment
CLIMATE & METEOROLOGICAL

- The study areas display a typical tropical monsoonal climate.
- There are 2 seasons, wet season; start from December to July and dry season from August to November.
- The average temperature range of 23.8-28.1 °C.
- The relative humidity range of 43.9-85.6 %
- The average wind speed range of 0.3-1.3 m/sec.
- The average annual rainfall range of 1072-1494 mm/year.

AMBIENT AIR QUALITY

• Some section is residential, food crop, and un-developing area.

• The primary air pollutants is Particulate Matter (PM) or dust which cause by vehicular traffic.

• PM10 is approximately 25-40 ug/m$^3$ less than the 24-hr average of WHO and NEPM guidelines, and U.S. EPA. standard, which 50 and 150 ug/m$^3$, respectively.

• Other air pollutions, i.e. NO$_x$, SO$_x$ are less than the limit of reporting.

• Most of Study area is residential, food crop, and un-developing area.

• The primary source of noise is vehicular traffic.

• $L_{Aeq}$ is range of 45.5-64.9 dB

KM1-KM26

1. Raiketan R.
2. STA.8+627
3. Foura R.
4. Loumea R.
5. Mola R.
6. STA.25+819

Fatukao
KM41-KM54

Betano Polytechnic

Settlement area of power plant
The water quality of the three rivers is within the standards and can be used as freshwater preservation, livestock and irrigation.
### SURFACE WATER QUALITY

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (°C)</td>
<td>29.5</td>
<td>30.2</td>
<td>34</td>
<td>US EPA/2009 82/2001 Class I,II</td>
</tr>
<tr>
<td>pH</td>
<td>8.06</td>
<td>8.11</td>
<td>8.18</td>
<td>6.5-9    6-9</td>
</tr>
<tr>
<td>DO (mg/L)</td>
<td>7.19</td>
<td>7.03</td>
<td>6.47</td>
<td>3.5      ≥ 4</td>
</tr>
</tbody>
</table>

The water quality of the three rivers is within the standards and can be used as freshwater preservation, livestock and irrigation.
## GROUNDWATER QUALITY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>GW2</th>
<th>Standard of WHO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>µS/cm</td>
<td>1,452</td>
<td>250</td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>6.77</td>
<td>6.5-8.5</td>
</tr>
<tr>
<td>Salinity</td>
<td>ppt</td>
<td>0.7</td>
<td>-</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>g/l</td>
<td>1.30</td>
<td>-</td>
</tr>
</tbody>
</table>

The water is suitable for consumer such as, washing and agriculture.
### TERRESTRIAL ECOLOGY

<table>
<thead>
<tr>
<th>Class</th>
<th>Condensate Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>92</td>
</tr>
<tr>
<td>Wildlife</td>
<td></td>
</tr>
<tr>
<td>Mammals</td>
<td>9</td>
</tr>
<tr>
<td>Birds</td>
<td>28</td>
</tr>
<tr>
<td>Reptiles</td>
<td>5</td>
</tr>
<tr>
<td>Amphibians</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
</tr>
</tbody>
</table>

- Rosewood (*Pterocarpus indicus*)
- Timor Friarbird (*Philemon inornatus*)
- Streaky-breasted Honeyeater (*Meliphaga reticulate*)
TRAFFIC SURVEY

Access Road to Betano Refinery

Access Road to Condensate Pipeline
### Result of traffic counting at access road

<table>
<thead>
<tr>
<th>Station</th>
<th>Direction</th>
<th>Vehicles</th>
<th>Traffic condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC1A</td>
<td>Same to Betano</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Passenger car</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Light truck</td>
<td></td>
</tr>
<tr>
<td>TC1B</td>
<td>Betano to Selihasan</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Bicycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Light truck</td>
<td></td>
</tr>
<tr>
<td>TC2A</td>
<td>Zumalai to Ainaro</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Bicycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Light truck</td>
<td></td>
</tr>
<tr>
<td>TC2B</td>
<td>Ainaro to Suai</td>
<td>1) Motorcycle</td>
<td>Very good traffic flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Light truck</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Bicycle</td>
<td></td>
</tr>
</tbody>
</table>
Opinion

- Agree
  • Community development (economic, benefit)
  • Country development

Suggestion

• Appropriate compensation and same compensation rate
• Inform project construction plan to chief of village and local people prior to construction
• Concern sacred place
• Job opportunity for local people
# SOCIO-ECONOMIC SURVEY

## Cova Lima District

- **Opinion**: Agree
  - Community benefit and country development
  - Job opportunity

## Suai Sub-district

- **Opinion**: Agree
  - Community benefit and country development
  - Job opportunity

## Zumalai Sub-district

- **Opinion**: Agree
  - Community benefit and country development
  - Job opportunity

## Suggestion

- Spray water at construction area to mitigate dust
- Closely contact with chief of village during project construction period
- Project should respect to local culture
- Appropriate mitigation measures for project impact
## SOCIO-ECONOMIC SURVEY

<table>
<thead>
<tr>
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<tr>
<td>Agree</td>
<td>• Job opportunity from the project for local people</td>
</tr>
<tr>
<td></td>
<td>• Community benefit and country development</td>
</tr>
<tr>
<td></td>
<td>• Job opportunity</td>
</tr>
<tr>
<td></td>
<td>• Water supply system for community from river</td>
</tr>
<tr>
<td></td>
<td>• Closely contact with chief of village during project construction period</td>
</tr>
</tbody>
</table>

Raimea, Tashilin, Zulo village

Beco village

Labarai village
CULTURAL AND VISUAL ENVIRONMENT

Cemetery in Bobe sub-village (km. 35-50)
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fugitive dust from land preparation</td>
<td>• Spray water</td>
</tr>
<tr>
<td>• Land acquisition</td>
<td>• Pay the compensation in fair price</td>
</tr>
<tr>
<td>• Waste from site clearance</td>
<td>• Reuse for communities and agricultural activities</td>
</tr>
</tbody>
</table>
CONSTRUCTION PHASE

Potential Impact

• Fugitive dust

Mitigation Measures

• Cover truck transporting construction material with tarpaulin sheet
• Limit speed 40 km/hr
• Routine maintenance of vehicles
• Avoid transportation in rush hours
## CONSTRUCTION PHASE

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Noise pollution and annoyance</td>
<td>• Inform local communities</td>
</tr>
<tr>
<td>• Traffic problem and risks</td>
<td>• Limit work 06.00 a.m.-06.00 p.m.</td>
</tr>
<tr>
<td></td>
<td>• Provide temporary by-pass</td>
</tr>
<tr>
<td></td>
<td>• Put up indication and warning sign</td>
</tr>
<tr>
<td></td>
<td>• Avoid transportation in rush hours</td>
</tr>
</tbody>
</table>
CONSTRUCTION PHASE

Potential Impact

• Soil erosion/landslide

• Solid waste

Mitigation Measures

• Backfilling must be done immediately after pipe laying

• Using less time for construction near the water source

• Avoid construction during heavy rain

• Prohibition of discharge of waste to water sources
## CONSTRUCTION PHASE

### Potential Impact

- Agricultural area disturbance
- Vegetation and wildlife disturbance

### Mitigation Measures

- Obtain permission for cutting trees from the relevant agencies
- Use efficient equipment to reduce noise level, dust and fume
- Inform construction plan to landowners 3-6 months in advance
# Construction Phase

## Potential Impact

- Disturbance of Historic and Scared Sites

## Mitigation Measures

- Avoid the residential areas, historic and scared places, education institute and government offices
- Consult with local leaders and relevant local agencies before construction
- Stop the construction and inform concerned authority for proper management if historic object is found
# OPERATION PHASE

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline Leakage Risk</td>
<td>• Have welding inspection by expert</td>
</tr>
<tr>
<td></td>
<td>• Regularly maintain pipeline twice a year</td>
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<tr>
<td></td>
<td>• Provide SCADA system</td>
</tr>
<tr>
<td></td>
<td>• Organize emergency practices</td>
</tr>
<tr>
<td></td>
<td>• Leakage inspection once a year in compliance with the ASME B31.8 standard</td>
</tr>
</tbody>
</table>
OPERATION PHASE

Potential Impact

• Public health and safety for local resident

Mitigation Measures

• Support and participate in communities’ activities
• Distribute Emergency manual to people
• Build up knowledge, understanding and confidence on pipeline system
• Provide first aid kits in project concerned sub-villages
DEACTIVATION PHASE

There would be no deactivation phase.
THANK YOU
For Your Attention