PT WEDA BAY NICKEL

ENVIRONMENTAL MONITORING PLAN
Nickel and Cobalt Mining and Processing Project

Central Halmahera and East Halmahera Regency, North Maluku Province, Indonesia

February 2009
FOREWORD

PT Weda Bay Nickel (WBN) is proposing to develop a nickel and cobalt mine and a processing plant in Central Halmahera, North Maluku. WBN is the holder of a Seventh Generation Contract of Work (CoW) for nickel mining in an area currently reduced from 120,500 ha to 54,874 ha in Central Halmahera and East Halmahera, acknowledged by the Government of Indonesia in Presidential Decree No. B.53/PRESS/1/1998 dated 19 January 1998. WBN intends to begin mining activities and processing nickel and cobalt ores, a project that covers all stages of activities including the construction of all the required facilities and infrastructure. This study is aimed at preventing and mitigating potential negative impacts and to optimize the positive impacts.


WBN expresses its appreciation to all parties who have contributed in preparing to this Environmental Monitoring Plan.

Jakarta, February 2009
PT. Weda Bay Nickel

Alain Giraud

President Director
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APPENDIX A  MATRIX SUMMARY OF ENVIRONMENTAL MONITORING PLAN
APPENDIX B  ORGANIZATION CHART OF PT WEDA BAY NICKEL
CHAPTER I
INTRODUCTION

The Environmental Monitoring Plan (RPL) supports monitoring the environmental components impacted by the activities of the Nickel and Cobalt Mining and Processing Project in the regencies of East and Central Halmahera. Monitoring is done for relevant environmental components to be used as indicators: (1) evaluating compliance with laws and regulations relevant for the project, (2) determining conformance with the commitments by WBN, and (3) determining long-term environmental trends.

Principally, the Environmental Monitoring Plans (RPL) can be viewed as:

- A guideline and the basis for environmental monitoring carried out by the Nickel and Cobalt mining and processing project.
- A guideline for the Nickel and Cobalt mining and processing project and related institutions in implementing Environmental Monitoring Plans in the regencies of East Halmahera and Central Halmahera.

1.1 OBJECTIVES AND PURPOSES

1.1.1 Objectives

The objective of environmental monitoring done by WBN is to monitor the mitigation of impacts; these include impacts on the environmental physical-chemical, biological, social, economical, and public health components. WBN is responsible for the prevention and the mitigation of every negative impact caused by the Project. Specifically, the objectives of the Environmental Monitoring Plans are:

- Monitoring environmental components impacted by the activities of the Nickel and Cobalt mining and processing project according to the ANDAL study.
- Demonstrating that Environmental management is successful in mitigating negative impacts and maximizing positive impacts.

1.1.2 Purposes

The Environmental Monitoring Plan (RPL) can be used as a guidance in the process of decision making regarding the environmental monitorings for the activities of WBN, for the government, the proponent (WBN), and the local community:

- For the Proponent (WBN), the RPL guide Environmental Monitoring, thus ensuring that the operational activities will be done with an acknowledgment of the environment. For the proponent, the results
of the Environmental Monitoring Plan will serve as an early warning system if negative environmental change should occur.

- For the government, this may be used as an information source and as a guideline in observation and guidance for the purpose of environmental sustainability in the activity area of Nickel and Cobalt mining and processing project in the regency of East and Central Halmahera.

- For the local community, this may be used as an information source to understand the activities of Nickel and Cobalt mining and processing project, thus eliminating misinterpretations and realizing the mutual cooperation between WBN and the local community.

### 1.2 Environmental Policy

The environmental policy of WBN is included in the company policy. As a company mission, WBN complies with all existing relevant Indonesian laws and regulations in the field of environment, health and safety (EHS) and to participate in community development activities around the mining area. WBN is committed to employ international best practices related to environmental, health and safety management. WBN realizes that, to be successful, environmental management has to be integrated in all stages of mining and processing activities. The following Environmental Policy will apply to the Weda Bay Project:

- Controlling and reducing the environmental impact of the group’s industrial activities.
- Controlling the risks and impact associated with the products sold by the group.
- Promoting a rationale of continuous improvement.
- Factoring the environment into every project stages.
- Strict compliance with regulations.
- Developing self-knowledge to improve and to communicate.
- Anticipating regulatory changes from a sustainable development perspective; and
- Contributing to the development of scientific knowledge.

Successful performance of environmental management will be reflected by the:

- Availability of a work environment for employees that allows one to perform duties without injury risk or work related disease.
• Prevention of pollution.
• Rehabilitation of post mining areas to safe and productive conditions as required by applicable regulations and permits.
• Conservation of biodiversity;
• Compliance with government laws along with company’s commitment.
• Accomplishment of the aspirations from all stakeholders including employees, local communities, government, shareholders, and customers of WBN.
• Utilization of efficient resources, and the
• Sustainable enhancement and repair.

To achieve best management, the company will implement an environmental health and safety management system (EHS-MS) as follows:

• Identify EHS risks related to all job aspects of WBN;
• Determine objectives and targets for all management efforts of significant risks;
• Implement plans, standards and procedures to manage and monitor the risks; and
• Routinely audit, evaluate and report EHS performance;

The organization chart for mining and processing activities of WBN is presented in Appendix A.
CHAPTER II
ENVIRONMENTAL MONITORING PLAN

2.1     **PRE-CONSTRUCTION STAGE**

2.1.1   **Soils**

2.1.1.1 **Soil Erosion**

A. **Source of Impact**
   • Test Pit establishment.

B. **Reference/Indicator of Impacts**
   • Increase of erosion rate.

C. **Monitoring Objectives**
   • To provide data on sediment load
   • To provide information on the efficiency of the sedimentation ponds/dam
   • To provide long term data on erosion in the representative mine area

D. **Monitoring Method**
   • To get data on sediment load and sedimentation ponds/dams efficiency:
      - Monitor the TSS content and flow rate of the inflow water to sedimentation pond.
      - Monitor TSS content and flow rate of the outflow water from sedimentation pond.
      - Collect, prepare, and analyze TSS sample water according to WBN’s protocol in accordance with Indonesian National Standards/SNI (or other appropriate international standards).
   • Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge.

E. **Monitoring Location**
   • One representative permanent monitoring plot at the sedimentation pond.

F. **Monitoring Period and Frequency**
   • TSS and flow rate monitoring every three months during pre-construction stage at the test pit trial area
G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN.

Supervisor

- BAPEDALDA of North Maluku Province.
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

- BAPEDALDA of North Maluku Province.
- Office of Mine and Energy of North Maluku Province.
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.1.2 Surface Water Quality

2.1.2.1 TSS

A. Source of Impact

- Test Pit establishment.

B. Reference/Indicator of Impacts

- Increase of TSS concentration.

C. Monitoring Objectives

- To determine whether the effluent water which flows to watershed may cause changes in TSS concentration.
D. Monitoring Method

- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location

- Discharge from Test Pit Sediment Pond
- Santa Monica Stream (ASM in see Map 1)

F. Monitoring Period and Frequency

- For TSS parameter every three months during pre-construction stage at the test pit trial area

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.1.3 Terrestrial Flora and Fauna

2.1.3.1 Species structure and composition as well as wildlife habitat

A. Source of Impact

- Test Pit establishment.

B. Reference/Indicator of Impacts

- Disturbance to flora and wildlife habitat

C. Monitoring Objectives

- To record flora and fauna species in areas impacted by any land clearing of test pit activities
- To record protected flora and fauna found in the area to be cleared
- To record local plant species and seedlings potential for use in reclamation

D. Monitoring Method

- Conduct survey and make inventory of flora and fauna species in areas to be cleared for test pit.
- Flora and fauna survey is conducted through standard method in forest area to be cleared

E. Monitoring Location

- Area to be cleared for test pit activity at Bukit Limber mining block

F. Monitoring Period and Frequency

- Baseline survey was conducted prior to the test pit trial.

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.1.4 Freshwater Aquatic Biota

2.1.4.1 Abundance of Plankton and Benthos

A. Source of Impact

- Test Pit establishment.

B. Reference/Indicator of Impacts

- Change of aquatic biota abundance.

C. Monitoring Objectives

- To determine whether changes of aquatic biota (mainly benthos) are occurring

D. Monitoring Method

- Establish permanent benthos monitoring site at the Santa Monica Stream.

- Collect, prepare and analyze benthos samples from permanent monitoring plots in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for phytoplankton, zooplankton and benthos analyses.

E. Monitoring Location

- Permanent plankton and benthos monitoring at Santa Monica Stream (BSM in Map 1).

F. Monitoring Period and Frequency

- Once every two years during the pre construction stage

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN
Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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Legend

Road

River

Contract of Work

Village

Transmigration Settlement Unit

Sampling Location

Water Quality and Aquatic Biota

Glossary

(A.) Sagea

(Tg.) Ulie

Ake/River

Tanjung/Cape

(P.) Yef

Pulau/Island

(L.) Sagea

Source

1. Topography Map of Indonesia, scale 1:50,000
2. Aerial Photos, 1993/94. Sheet: Weda (2616-14), Sagea (2616-23), Kulo (2616-42), Ekor (2616-44), Air Sangaji (2616-51), Air Mawas (2615-53)
3. River Location

END
2.1.5 **Socio Economics**

2.1.5.1 **Job Opportunities**

**A. Source of Impact**
- Activities of Survey and Exploration
- Activities of test pit trial

**B. Reference/Indicator of Impacts**
- Number of local and non local employees (outsiders) recruited by WBN
- Number of local contractors engaged in the project

**C. Monitoring Objectives**
- To optimize job opportunities for local communities
- To prioritize skilled local communities as needed by WBN in the employees recruitment
- To reduce local unemployment resides in the COW area

**D. Monitoring Method**
- Monitor the number, percentage and origin of local people employed by WBN by reviewing WBN’s and contractor’s employment records
- Monitor the number, percentage of local contractors engaged in the project

**E. Monitoring Location**
- WBN Project Area.

**F. Monitoring Period and Frequency**
- Once every year during preconstruction period through operating life of the mine

**G. Monitoring Institution**

**Conductor**
- Human Resources Department of WBN

**Supervisor**
- BAPEKALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mines and Energy of East Halmahera Regency.

2.1.5.2 Community Income

A. Source of Impact
• Land Acquisition for mine project.

B. Reference/Indicator of Impacts
• Number of people who receive income/benefit from land acquisition.

C. Monitoring Objectives
• To identify level of community income in project area

D. Monitoring Methods
• Record community income from government statistics (Kecamatan dalam angka)

E. Monitoring Location
• WBN Office
• Office of Villages around project area

F. Monitoring Period and Frequency
• Once every year during preconstruction period through operating life of the mine

G. Monitoring Institution
  Conductor
  • External Relations Department of WBN
Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.1.5.3 Land Ownership

A. Source of Impact

- Land Acquisition for mine project.

B. Reference/Indicator of Impacts

- Change of land ownership and used or occupied by the people in the contract of work area (COW)
- Community unrest due to the issues of land acquisition

C. Monitoring Objectives

- To ensure that land acquisition process is in accordance with applicable laws and regulations on land and vegetation stand compensation

D. Monitoring Method

- Record total area of land released by land owners to WBN for mining activities from BPN office.
• Record the location of the land released by the land owners.
• Prepare land acquisition team legitimated by Decree of North Maluku Governor.

E. Monitoring Location
• Area to be exploited and mined at all mine blocks within project area.

F. Monitoring Period and Frequency
• Once every two years during preconstruction period through operating life of the mine

G. Monitoring Institution

Conductor
• External Relations Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.  
• BAPEDALDA of North Maluku Province  
• Office of Mine and Energy of North Maluku Province  
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
• Office of Mines and Energy of Central Halmahera Regency.  
• Office of Mines and Energy of East Halmahera Regency.
2.1.5.4  Livelihood

A. Source of Impact
   • Land Acquisition for mine project.

B. Reference/Indicator of Impacts
   • Change of Community livelihood as the agriculture land acquired for mine project.

C. Monitoring Objectives
   • To identify the changes in livelihood pattern in local communities.

D. Monitoring Method
   • Data collection about number of local employees that working in WBN and its contractors

E. Monitoring Location
   • Villages around the project area

F. Monitoring Period and Frequency
   • Once every two years during preconstruction period through operating life of the mine

G. Monitoring Institution
   Conductor
   • External Relations Department of WBN

   Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.

   Reporting
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

2.1.5.5 Community Unrest

A. Source of Impact
• Land Acquisition, unmet expectations related to job opportunities

B. Reference/Indicator of Impacts
• Increase in dissatisfaction in the Project by local community

C. Monitoring Objectives
• To detect community tension before it develops into unrest.

D. Monitoring Method
• Record number of formal community complaints to the company through relevant government/institutions offices.

E. Monitoring Location
• Villages around the project area.

F. Monitoring Period and Frequency
• Once every year during preconstruction period through operating life of the mine

G. Monitoring Institution

Conductor
• External Relations Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPE DALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.2 Construction Stage

2.2.1 Air Quality

2.2.1.1 TSP and Dustfall

A. Source of Impact

- Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)

B. Reference/Indicator of Impacts

- Change in TSP concentration in ambient air
- Increment of dustfall

C. Monitoring Objectives

- To identify the long-term trends of air quality in WBN’s project area

D. Monitoring Method

- TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations
- Dust fall is monitored using depositional dust gauges, as per applicable regulations.

E. Monitoring Location

- Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. Monitoring Period and Frequency

- Once every three months during the construction period through operating life of the mine
G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting
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- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.2.2 Noise

2.2.2.1 Noise

A. Source of Impact
- Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)
- Land clearing
- Port construction (dedicated port and barge loading facility)

B. Reference/Indicator of Impacts
- Increase of noise level
C. Monitoring Objectives
   • Identify long-term trends of noise level at WBN project area

D. Monitoring Method
   • Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

E. Monitoring Location
   • Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

Table 1  Air Quality and Noise Sampling Location

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Sampling Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>Lelilef village</td>
<td>KU-1</td>
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</tr>
<tr>
<td>Transkobe Village</td>
<td>KU-2</td>
<td>375942</td>
</tr>
<tr>
<td>Gemaf Village</td>
<td>KU-3</td>
<td>392445</td>
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<tr>
<td>Sagea Village</td>
<td>KU-4</td>
<td>399594</td>
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<tr>
<td>Camp-11</td>
<td>KU-5</td>
<td>381359</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency
   • Once every three months during the construction period through operating life of the mine

G. Monitoring Institution

Conductor
   • Environmental Health and Safety Department of WBN

Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.

Reporting
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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.2.3 Soils

2.2.3.1 Soil Erosion

A. Source of Impact
   - Land clearing for construction of project facilities

B. Reference/Indicator of Impacts
   - Increase of TSS

C. Monitoring Objectives
   - To provide data on sediment load
   - To provide information on the efficiency of the sedimentation trap

D. Monitoring Method
   - To get data on sediment load and sedimentation trap efficiency:
     - Monitor the TSS content in water flowing into sedimentation trap.
     - Monitor TSS content of the outflow water from sedimentation trap.
   - Collect, prepare, and analyze TSS sample water according to WBN’s protocol in accordance with Indonesian National Standards/SNI (or other appropriate international standards).

E. Monitoring Location
   - One representative monitoring plot at the sedimentation trap

F. Monitoring Period and Frequency
   - TSS monitoring once a month during the construction period through operating life of the mine

G. Monitoring Institution

Conductor
   - Environmental Health and Safety Department of WBN

Supervisor
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Office of Mines and Energy of Central Halmahera Regency.


**Reporting**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.2.4 **Hydrology**

2.2.4.1 **Surface Runoff Flow Rate**

**A. Source of Impact**

- Land clearing for construction of project facilities

**B. Reference/Indicator of Impacts**

- Increase of surface water run off rate.

**C. Monitoring Objectives**

- To identify long term trends of water level
- To identify long term trends of flow rate in some important streams within the WBN CoW area

**D. Monitoring Method**

- Monitor water level of the river using automatic water level recording or stage gauge

**E. Monitoring Location**

- Important streams within the WBN COW area (see Map-3 and Table-2):
  - Ake Kobe (AKOBE)
  - Ake Wosea (AWOS)
  - Ake Sake (ASAKE)
Ake Gemaf (AGEM)
- Ake Sagea (ASG-2)

**F. Monitoring Period and Frequency**
- Water level monitoring at the rivers once a month during the construction period through operating life of the mine

**G. Monitoring Institution**

**Conductor**
- Environmental Health and Safety Department of WBN

**Supervisor**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.2.5 **Surface Water Quality**

2.2.5.1 **TSS**

**A. Source of Impact**
- Land clearing for construction of project facilities.
B. Reference/Indicator of Impacts

- Increase of TSS concentration.

C. Monitoring Objectives

- To determine whether the effluent water which flows to watershed may cause changes in TSS concentration.

D. Monitoring Method

- Monitor TSS content in water flowing into sedimentation trap.
- Monitor TSS content in the outflow of sedimentation trap.
- Monitor TSS in important stream within the WBN CoW.
- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).

E. Monitoring Location

- One representative monitoring plot at the sedimentation trap.
- Important streams within the WBN CoW area (see Map-3 and Table-2):
  - Ake Kobe (AKOBE)
  - Ake Wosea (AWOS)
  - Ake Sake (ASAKE)
  - Ake Gemaf (AGEM)
  - Ake Sagea (ASG-2)

Table 2 Stream Gauging Location

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>Ake Kobe</td>
<td>AKOBE</td>
<td>376768</td>
</tr>
<tr>
<td>Ake Wosea</td>
<td>AWOS</td>
<td>383395</td>
</tr>
<tr>
<td>Ake Sake</td>
<td>ASAKE</td>
<td>388124</td>
</tr>
<tr>
<td>Ake Gemaf</td>
<td>AGEM</td>
<td>394634</td>
</tr>
<tr>
<td>Ake Sagea Upstream</td>
<td>ASG-2</td>
<td>396276</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

- TSS monitoring once a month during the construction period through operating life of the mine
- TSS monitoring for important streams every three months during the construction period through operating life of the mine
G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
ENVIRONMENTAL MONITORING PLAN

MAP 3 - STREAM GAUGING LOCATION

Legend

- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit
- Stream Gauge

Sampling Location

Legend

- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit
- Stream Gauge

Sampling Location

Legend

- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit
- Stream Gauge
2.2.6 **Sea Water Quality**

2.2.6.1 **TSS, Turbidity and Oil and Grease**

**A. Source of Impact**
- Port construction (dedicated port and barge loading facility)
- Mobilization of equipment and material.

**B. Reference/Indicator of Impacts**
- Increase of TSS, turbidity and oil & grease concentration.

**C. Monitoring Objectives**
- To determine whether the port construction and mobilization of equipment and material cause changes in TSS, turbidity and oil and grease concentration.

**D. Monitoring Method**
- Collect, prepare and analyze marine water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

**E. Monitoring Location**
- Three locations adjacent to the Port Facility (see Map-4 and Table-3):
  - 500 m to the east of the port (DP-1)
  - 500 m to the west of the port (DP-2)
  - 500 m out to sea of the port (DP-3).

**Table 3  Marine water quality and marine biota sampling location of Dedicated Port**

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>500 m to the east of Port</td>
<td>DP-1</td>
<td>385070</td>
</tr>
<tr>
<td>500 m to the west of Port</td>
<td>DP-2</td>
<td>384470</td>
</tr>
<tr>
<td>500 m out to sea of the Port</td>
<td>DP-3</td>
<td>380171</td>
</tr>
</tbody>
</table>

**F. Monitoring Period and Frequency**
- TSS, turbidity and oil & grease will be monitored every month during construction period through operating life of the mine

**G. Monitoring Institution**

**Conductor**
- Environmental Health and Safety Department of WBN
Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
ENVIRONMENTAL MONITORING PLAN

MAP 4 - MARINE WATER QUALITY SAMPLING LOCATION AT DEDICATED PORT

Legend
- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit
- Water Quality and Aquatic Biota

Sampling Location

Source:
1. Topographic Map of Indonesia, scale 1:50,000
2. Aerial Photos, 1993/94. Sheet: Weda (2616-14), Sagea (2616-23), Kulo (2616-42), Ekor (2616-44), Air Sangaji (2616-51), Air Mawas (2615-53)
2.2.7 Terrestrial Flora and Fauna

2.2.7.1 Species structure and composition of flora and Wildlife habitat quality

A. Source of Impact

- Land clearing for construction of project facilities.

B. Reference/Indicator of Impacts

- Disturbance to biodiversity
- Protected flora and/or fauna might be impacted by the mining activities.

C. Monitoring Objectives

- To record flora and fauna species in areas impacted by land clearing for support facilities
- To record protected flora and fauna found in the area to be cleared
- To record local plant species and seedlings potential for use in reclamation.

D. Monitoring Method

- Conduct a survey and make an inventory of flora and fauna species in areas to be cleared for support facilities.
- Flora and fauna survey is conducted through standard method for survey of flora and fauna in forest area to be cleared.

E. Monitoring Location

- Area to be cleared for support facilities within project area.

F. Monitoring Period and Frequency

- Baseline survey conducted once prior to any land clearing activity

G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN.

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.2.8 Freshwater Aquatic Biota

#### 2.2.8.1 Abundance of Plankton and Benthos

**A. Source of Impact**

• Land clearing for construction of project facilities.

**B. Reference/Indicator of Impacts**

• Change of Aquatic Biota abundance.

**C. Monitoring Objectives**

• To determine whether changes of aquatic biota (mainly benthos) are occurring.

**D. Monitoring Method**

• Monitor aquatic biota (plankton and benthos) abundance at the permanent monitoring sites

• Collect, prepare and analyze plankton and benthos samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for plankton and benthos analyses

**E. Monitoring Location**

• Permanent plankton and benthos monitoring sites at (Map-5 and Table 4):
  
  - Ake Kobe (BKB-1)
  - Ake Wosea (BWS-1)
  - Ake Sake (BSK-1)
- Ake Gemaf (BGF-1)
- Ake Sagea (BSG-1)

Table 4  Freshwater Aquatic Biota Sampling Location During Construction Period

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
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<tbody>
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<td>Easting</td>
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<tr>
<td>Ake Kobe</td>
<td>BKB-1</td>
<td>376768</td>
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<tr>
<td>Ake Wosea</td>
<td>BWS-1</td>
<td>383395</td>
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<td>Ake Sake</td>
<td>BSK-1</td>
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<td>394634</td>
</tr>
<tr>
<td>Ake Sagea Upstream</td>
<td>BSG-2</td>
<td>396276</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

- Every year during the construction period

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
2.2.9 Marine Biota

2.2.9.1 Coral reef fish and coral lifeforms

A. Source of Impact
   - Land clearing
   - Port construction (dedicated port and barge loading facility).

B. Reference/Indicator of Impacts
   - Change in marine coral reef condition.

C. Monitoring Objectives
   - To measure the changes in marine biota (in particular reef fishes and coral condition)

D. Monitoring Method
   - Monitor coral reef fish and coral lifeforms at the permanent monitoring sites
   - Survey of coral reef fish and coral lifeforms is conducted through standard method for survey of coral reef

E. Monitoring Location
   - Three locations adjacent to the Port Facility (see Map-4 and Table-3):
     - 500 m to the east of the port (DP-1)
     - 500 m to the west of the port (DP-2)
     - 500 m out to sea of the port (DP-3)

F. Monitoring Period and Frequency
   - Every two years during construction period.

G. Monitoring Institution
   - Conductor
     - Environmental Health and Safety Department of WBN
   - Supervisor
     - BAPEDALDA of North Maluku Province
     - Office of Mine and Energy of North Maluku Province
     - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
     - Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• BAPEDALDA of North Maluku Province
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• Office of Mines and Energy of East Halmahera Regency.

2.2.10 Socio Economics

2.2.10.1 Job Opportunities

A. Source of Impact
• Construction workforces employment and release.

B. Reference/Indicator of Impacts
• Number of local and non local employees (outsiders) recruited and released by WBN

C. Monitoring Objectives
• To record local recruitment.

D. Monitoring Method
• Monitor the number, percentage and origin of employees of the Project by reviewing WBN’s and contractors’s employment records.

E. Monitoring Location
• Project Area.

F. Monitoring Period and Frequency
• Once a year during the Construction period through operating life of the mine.

G. Monitoring Institution

Conductor
• Human Resources Department of WBN.

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.2.10.2 Business Opportunities

A. Source of Impact
• Mobilization of equipment and material.
• Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)
• Land clearing
• Port construction (dedicated port and barge loading facility).

B. Reference/Indicator of Impacts
• The level of participation of local people, local contractors and general community in various activities related to WBN operation.

C. Monitoring Objectives
• To record the number of entrepreneurs participating in Project development.

D. Monitoring Method
• Collect data regarding number of local entrepreneur that participate in the provision of goods and services.
• Monitor who are entering business, and the success of these
businesses.

• Monitor WBN purchasing and service provision contracts

E. Monitoring Location

• WBN Office
• Office of Industrial and Trade Agency of Central and East Halmahera Regencies.

F. Monitoring Period and Frequency

• Once a year, during Construction period through operating life of the mine.

G. Monitoring Institution

Conductor

• Purchasing Department of WBN
• Site Services Department of WBN.

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.2.10.3 Community Income

A. Source of Impact
- Construction workforces employment and release
- Mobilization of equipment and material.
- Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)

B. Reference/Indicator of Impacts
- Change of community income

C. Monitoring Objectives
- To record changes of community income.

D. Monitoring Method
- Data collection on household income from government statistics (Kecamatan dalam Angka).

E. Monitoring Location
- Villages around the project area.

F. Monitoring Period and Frequency
- Once every year, during Construction period through operating life of the mine.

G. Monitoring Institution

Conductor
- External Relations Department of WBN.

Supervisor
- BAPEDALDA of North Maluku Province.
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting
- BAPEDALDA of North Maluku Province.
2.2.10.4 Livelihood Pattern

A. Source of Impact
   • Construction workforces employment.

B. Reference/Indicator of Impacts
   • Change of livelihood pattern in Community.

C. Monitoring Objectives
   • To identify the changes in livelihood pattern in local communities.

D. Monitoring Method
   • Data collection on household income from government statistics (Kecamatan dalam Angka).
   • Data collection on people occupation from government statistics (Kecamatan dalam Angka).

E. Monitoring Location
   • Villages around the project area.

F. Monitoring Period and Frequency
   • Once a year, during Construction period through operating life of the mine.

G. Monitoring Institution

Conductor
   • External Relations Department of WBN

Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

**2.2.11 Socio Cultural**

**2.2.11.1 Migration (Estimate of population and population density in villages around project area)**

A. **Source of Impact**

• Construction workforces employment.

B. **Reference/Indicator of Impacts**

• Newcomers to the Project Area, other than workforce.
• Increased migration and population growth in villages around project area.

C. **Monitoring Objectives**

• To detect the population increase within villages around the project area.

D. **Monitoring Method**

• Data collection of demography from government statistics (Kecamatan dalam Angka).

E. **Monitoring Location**

• Villages around the project area.

F. **Monitoring Period and Frequency**

• Once a year, during Construction period through operating life of the
mine.

G. Monitoring Institution

Conductor

- External Relations Department of WBN.

Supervisor

- BAPEDALDA of North Maluku Province.
- Office of Mine and Energy of North Maluku Province.
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.2.11.2 Assimilation and Acculturation

A. Source of Impact

- Construction workforces employment and Immigration.

B. Reference/Indicator of Impacts

- Interaction between local community and newcomers.

C. Monitoring Objectives

- To detect community tension before it develops into unrest.
D. Monitoring Method

- Record data on resulting of formal and informal meetings with community member representative and village leaders.

E. Monitoring Location

- Villages around the project area.

F. Monitoring Period and Frequency

- Once a year, during Construction period through operating life of the mine.

G. Monitoring Institution

Conductor

- External Relations Department of WBN.

Supervisor

- Resources, Republic of Indonesia.
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
2.2.11.3 Alteration of social values and norms

A. Source of Impact
   • Construction workforces employment.
   • Interaction between local community and newcomers.

B. Reference/Indicator of Impacts
   • Changes to traditional, cultural values and customs.

C. Monitoring Objectives
   • To detect community tension before it develops into unrest.

D. Monitoring Method
   • Record data on resulting of formal and informal meetings with community member representative and village leaders.

E. Monitoring Location
   • Villages around the project area.

F. Monitoring Period and Frequency
   • Once a year, during Construction period through operating life of the mine.

G. Monitoring Institution
   Conductor
   • External Relations Department of WBN.

   Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
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   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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   • Office of Mines and Energy of East Halmahera Regency.

   Reporting
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   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
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• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.2.11.4 Community Unrest

A. Source of Impact
• Unmet expectations for job and business opportunities.
• Social norms and values of local community not respected by Construction Workforce.

B. Reference/Indicator of Impacts
• Increase in dissatisfaction in the Project by local community.

C. Monitoring Objectives
• To detect community tension before it develops into unrest.

D. Monitoring Method
• Record number of formal community complaints to the company through relevant government/ institutions offices
• Record data on resulting of formal and informal meetings with community member representative and village leaders.

E. Monitoring Location
• Villages around the project area.

F. Monitoring Period and Frequency
• Once a year, during Construction period through operating life of the mine.

G. Monitoring Institution
Conductor
• External Relations Department of WBN.

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

2.2.12 Public Health

2.2.12.1 Prevalence of Diseases and Public Health Services and Sanitation

A. Source of Impact
• Construction workforces employment and Migration

B. Reference/Indicator of Impacts
• Potential increase in prevalence of diseases
• Inadequacy of public health services and degradation of sanitation.

C. Monitoring Objectives
• To identify changes in diseases prevalence in community

D. Monitoring Method
• Collection of secondary data from local health institutions and facilities on the prevalence of disease in the local community

E. Monitoring Location
• Villages around the project area

F. Monitoring Period and Frequency
• Once a year, during Construction period through operating life of the mine
G. Monitoring Institution

Conductor

- External Relations Department of WBN
- Environmental Health and Safety Department of WBN

Supervisor

- BAPEALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

- BAPEALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.3 Operation Stage of Ore Mining

2.3.1 Air Quality

2.3.1.1 TSP and Dustfall

A. Source of Impact

- Removal and placement of overburden, ore mining, and stockpiling in the mine area
- Ore transportation
B. Reference/Indicator of Impacts
   • Change in TSP concentration in ambient air
   • Increment of dustfall
C. Monitoring Objectives
   • To identify the long-term trends of air quality in WBN’s project area
D. Monitoring Method
   • TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations
   • Dustfall is monitored using depositional dust gauges, as per applicable regulations.
E. Monitoring Location
   • Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)
F. Monitoring Period and Frequency
   • Once every three months through operating life of the mine
G. Monitoring Institution
   Conductor
   • Environmental Health and Safety Department of WBN.
   Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.
   Reporting
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.3.2 Noise

2.3.2.1 Noise

A. Source of Impact
   - Ore transportation by trucks.

B. Reference/Indicator of Impacts
   - Increase of noise.

C. Monitoring Objectives
   - To identify long-term trends of noise level at WBN project area.

D. Monitoring Method
   - Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

E. Monitoring Location
   - Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1).

F. Monitoring Period and Frequency
   - Annual Noise Survey to be conducted through operating life of the mine.

G. Monitoring Institution
   - Conductor
     - Environmental Health and Safety Department of WBN.

   - Supervisor
     - BAPEDALDA of North Maluku Province
     - Office of Mine and Energy of North Maluku Province
     - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Environmental Agency *(Badan Lingkungan Hidup)* of East Halmahera Regency.

2.3.3 Morphology and Physiographic

2.3.3.1 Landform

A. Source of Impact
- Removal and placement of overburden, ore mining, and stockpiling in the mine area

B. Reference/Indicator of Impacts
- Change of topography in term of elevation and slope in the mine area related to ore mining and overburden placement

C. Monitoring Objectives
- To provide up-to-date information on the changes in topography and morphology in the active mining areas and overburden placement sites which affect the slope’s stability

D. Monitoring Method
- Monitor physical stability of active mining and overburden placement sites using survey or standard equipment for slope stability monitoring (such as extensometers, prism, and or other equivalent tools) or by visual observation
- Monitor and map changes in topography and morphology by ground survey and satellite images

E. Monitoring Location
- Active mine and overburden placement sites in project area

F. Monitoring Period and Frequency
- Slope stability monitoring: as required in active mine locations and in overburden placement areas and potentially landslide areas.
• Monitoring of changes in topography: once during the mining life until mining and overburden placement is completed at the specified mining area

G. Monitoring Institution

Conductor

• Mine Engineering Department

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
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• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mines and Energy of East Halmahera Regency.

2.3.4 Soils

2.3.4.1 Soil Erosion

A. Source of Impact

• Land clearing for mine area
• Stripping and Piling of topsoil
• Removal and placement of overburden, ore mining, and stockpiling in the mine area
• Progressive Reclamation during mine development

B. Reference/Indicator of Impacts
• Increase of erosion rate.

C. Monitoring Objectives
• To provide data on sediment load
• To provide information on the efficiency of the sedimentation ponds/dam
• To provide long term data on erosion in the representative mine area
• To provide long term data on the performance of reclamation program

D. Monitoring Method
• To get data on sediment load and sedimentation ponds/dams efficiency:
  - Monitor the TSS content and flow rate of the inflow water to sedimentation pond.
  - Monitor TSS content and flow rate of the outflow water from sedimentation pond.
  - Collect, prepare, and analyze TSS in water sample according to WBN’s protocol or in accordance with Indonesian National Standards/SNI (or other appropriate international standards).
• Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge

E. Monitoring Location
• One representative permanent monitoring plot at sedimentation ponds. This location is maintained until post mined period

F. Monitoring Period and Frequency
• TSS monitoring at sedimentation pond once every day during Operations phase.
• Effluent water discharge from sedimentation ponds once every month during Operations phase
• Maintain the permanent plot during the operating life of the mine.

G. Monitoring Institution
   Conductor
   • Environmental Health and Safety Department of WBN.
   • Mine Engineering Department.

   Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.3.5 **Hydrology**

2.3.5.1 **Surface Run Off Flow Rate**

**A. Source of Impact**
- Land clearing for mine area
- Progressive Reclamation during mine development

**B. Reference/Indicator of Impacts**
- Increase of surface water run off rate

**C. Monitoring Objectives**
- To identify long term trends of flow rate in some important streams within the WBN CoW area
- To identify long term trends of effluent water flow rate from the sedimentation ponds

**D. Monitoring Method**
- Monitor water level of the river using automatic water level
E. Monitoring Location

- Important streams within the WBN COW area (see Map-3 and Table-2):
  - Ake Kobe (AKOBE)
  - Ake Wosea (AWOS)
  - Ake Sake (ASAKE)
  - Ake Gemaf (AGEM)
  - Ake Sagea (ASG-2)
- Discharge from sediment ponds adjacent to active mining areas.

F. Monitoring Period and Frequency

- Water level monitoring at the rivers once every three months during Operations phase.
- Effluent water discharge from sedimentation ponds once every months during the operating life of the mine (note: name and location of the ponds may change in the future depend on mining operation progress)

G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN.

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
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Hidup) of Central Halmahera Regency.

- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.3.6 Surface Water Quality

2.3.6.1 TSS

A. Source of Impact

- Slash clearing for mine area
- Stripping and Piling of topsoil
- Removal and placement of overburden, ore mining, and stockpiling in the mine area
- Progressive Reclamation during mine development

B. Reference/Indicator of Impacts

- To comply with applicable regulations on effluent water quality standard of nickel mining activity

C. Monitoring Objectives

- To determine whether the effluent water which flows to watersheds may cause changes in TSS concentration.

D. Monitoring Method

- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location

- Discharge from sediment ponds adjacent to active mining areas.
- Rivers/streams (see Map-6 and Table 5):
  - Ake Jira Upstream (AJIRA-4)
  - Ake Jira Middle (AJIRA-3)
  - Ake Jira Downstream (AJIRA-2)
  - Ake Seloi (ASELOI-1)
  - Ake Kobe (AKOBE)
  - Ake Wosea (AWOS)
  - Ake Gojemli (AGOJ)
  - Ake sake (ASAKE)
- Ake Sesli (ASESLI)
- Ake Gemaf (AGEM)
- Ake Sagea Upstream (ASG-2)
- Ake Sangaji (ASJ-1)

### Table 5  
**Surface Water Quality Monitoring Location**

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<th>Sampling Location Description</th>
<th>Location Code</th>
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</table>

**F. Monitoring Period and Frequency**

- Every day at discharge point from sedimentation ponds during the operating life of the mine.
- Every three months at sampling point during the operating life of the mine: AJIRA-4, AJIRA-3, AJIRA-1, ASELO-1, AKOBE, AWOS, AGOJ, ASAKE, ASESLI, and AGEM.
- Every three months at sampling point: ASG-2 and ASJ-1 during the operating life of the mine.

**G. Monitoring Institution**

**Conductor**

- Environmental Health and Safety Department of WBN

**Supervisor**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

**Reporting**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

### 2.3.6.2 Mg, Fe, Mn and trace metals (Cr\(^{6+}\), Cu, Pb, As, Cd, Co, Ni and Zn)

#### A. Source of Impact
- Removal and placement of overburden, ore mining, and stockpiling in the mine area

#### B. Reference/Indicator of Impacts
- Potential changes in receiving water quality especially major and trace metals

#### C. Monitoring Objectives
- To determine whether water inflow to the rivers/streams is impacting the water quality
- To record long term trends of water quality in rivers/streams within project area

#### D. Monitoring Method
- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

#### E. Monitoring Location
- Discharge from sediment ponds adjacent to active mining areas.
- Rivers/streams (see Map-6 and Table 5):
  - Ake Jira Upstream (AJIRA-4)
  - Ake Jira Middle (AJIRA-3)
  - Ake Jira Downstream (AJIRA-2)
  - Ake Seloi (ASELOI-1)
  - Ake Kobe (AKOBE)
- Ake Wosea (AWOS)
- Ake Gojemli (AGOJ)
- Ake sake (ASAKE)
- Ake Sesli (ASESLI)
- Ake Gemaf (AGEM)
- Ake Sagea Upstream (ASG-2)
- Ake Sangaji (ASJ-1)

F. Monitoring Period and Frequency

- Metals will be monitored every month during the operating life of the mine at discharge from sediment ponds adjacent to active mining areas.
- Metals will be monitored every three months during the operating life of the mine at sampling points: AJIRA-4, AJIRA-3, AJIRA-1, ASELO-1, AKOBE, AWOS, AGOJ, ASAKE, ASESNI, and AGEM.
- Every three months during the operating life of the mine at sampling points ASG-2 and ASJ-1.

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

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- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
- Office of Mines and Energy of East Halmahera Regency

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
ENVIRONMENTAL MONITORING PLAN

MAP 6 - SURFACE WATER QUALITY MONITORING LOCATION
2.3.7 Terrestrial Flora and Fauna

2.3.7.1 Species structure and composition as well as wildlife habitat

A. Source of Impact
   - Land clearing for mine area
   - Progressive Reclamation during mine development

B. Reference/Indicator of Impacts
   - Disturbance to biodiversity
   - Degree of employee and community understanding on the importance of protecting endangered flora and fauna species

C. Monitoring Objectives
   - To record flora and fauna species in areas impacted by any land clearing for mining activities
   - To record protected flora and fauna found in the area to be cleared
   - To record local plant species and seedlings potential for use in reclamation.

D. Monitoring Method
   - Conduct survey and make inventory of plant species in areas to be cleared for mining
   - Conduct survey and make inventory of plant species in one plot reclamation site
   - Survey is conducted through standard transect method in forest area to be cleared

E. Monitoring Location
   - Area to be cleared for mining at all mine blocks within COW
   - One permanent reclamation plot at each non-active mining block

F. Monitoring Period and Frequency
   - Baseline survey conducted once prior to any land clearing activity
   - Flora and fauna survey at reclamation plot once every three years during operating life of the mine

G. Monitoring Institution
   Conductor
   • Environmental Health and Safety Department of WBN
   Supervisor

BAPEDALDA of North Maluku Province

Office of Mine and Energy of North Maluku Province

Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.

Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Office of Mines and Energy of Central Halmahera Regency.


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Office of Mines and Energy of Central Halmahera Regency.


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2.3.8 *Freshwater Aquatic Biota*

2.3.8.1 *Abundance of Plankton and Benthos*

A. **Source of Impact**
   - Stripping and Piling of topsoil
   - Removal and placement of overburden, ore mining, and stockpiling in the mine area
   - Progressive Reclamation during mine development

B. **Reference/Indicator of Impacts**
   - Change of Aquatic Biota abundance

C. **Monitoring Objectives**
   - To determine whether changes of aquatic biota (mainly benthos) are occurring

D. **Monitoring Method**
   - Collect, prepare and analyze plankton and benthos samples from
permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for phytoplankton, zooplankton and benthos collection, identification and analyses.

E. Monitoring Location

- Permanent plankton and benthos monitoring sites at (see Map-7 and Table 6):
  - Ake Jira Upstream (BJR-4)
  - Ake Jira Middle (BJR-3)
  - Ake Jira Downstream (BJR-2)
  - Ake Seloi Upstream (BSL-1)
  - Ake Wosea (BWS-1)
  - Ake Gojemli (BGJ-1)
  - Ake Sake (BSK-1)
  - Ake Gemaf (BGF-1)
  - Ake Sagea Upstream (BSG-2)
  - Ake Sangaji Upstream

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<td>401426</td>
<td>86105</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

- Every year during operating life of the mine

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mines and Energy of East Halmahera Regency
2.3.9 Socio Economics

2.3.9.1 Job Opportunities

A. Source of Impact
   • Employment of operations workforce.

B. Reference/Indicator of Impacts
   • Number of local and non local employees (outsiders) recruited by WBN and contractors

C. Monitoring Objectives
   • To record number of local recruitment by WBN and contractors.

D. Monitoring Method
   • Monitor the number, percentage and origin of employees of the Project by reviewing WBN’s and contractor’s employment records.

E. Monitoring Location
   • Project Area

F. Monitoring Period and Frequency
   • Once a year during the operating life of the mine the

G. Monitoring Institution
   Conductor
   • Human Resources Department of WBN

   Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.

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   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.3.9.2 Business Opportunities

A. Source of Impact
- Project Operation, in particular catering supplies, waste management, maintenance
- Land clearing for mine area
- Progressive Reclamation during mine development

B. Reference/Indicator of Impacts
- The level of participation of local people, local contractors and general community in various activities related to WBN operation.

C. Monitoring Objectives
- To record the number of entrepreneurs participating in Project Operations.

D. Monitoring Method
- Collect data regarding number of local entrepreneur that participate in the provision of goods and services:
  - Number of officially locally owned and operated businesses
  - Types of goods and services provided
  - Value of local economic activities

E. Monitoring Location
- WBN Office
- Office of Industrial and Trade Agency of Central and East Halmahera Regencies

F. Monitoring Period and Frequency
- Once every year, during the operating life of the mine
G. **Monitoring Institution**

**Conductor**
- Purchasing Department of WBN
- Site Services Department of WBN

**Supervisor**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

**Reporting**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

2.3.9.3 **Community Income**

A. **Source of Impact**
- Employment of Operations workforce
- Land clearing for mine area

B. **Reference/Indicator of Impacts**
- Change of community income

C. **Monitoring Objectives**
- To record changes of community income
D. **Monitoring Method**

- Data collection on household income from government statistics (Kecamatan dalam Angka).

E. **Monitoring Location**

- Villages around the project area

F. **Monitoring Period and Frequency**

- Once every year, during operating life of the mine.

G. **Monitoring Institution**

**Conductor**
- External Relations Department of WBN.

**Supervisor**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

**Reporting**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
2.3.9.4 Livelihood Pattern

A. Source of Impact
   • Employment of operations workforce

B. Reference/Indicator of Impacts
   • Change of livelihood pattern in Community

C. Monitoring Objectives
   • To identify the changes in livelihood pattern in local communities

D. Monitoring Method
   • Data collection on household income from government statistics
     (*Kecamatan dalam Angka*).
   • Data collection on people occupation from government statistics
     (*Kecamatan dalam Angka*).
   • If necessary and required conduct survey to collect primary data on
     livelihood pattern in the villages around the project area using
     standard socio-economic and culture survey method

E. Monitoring Location
   • Villages around the project area.

F. Monitoring Period and Frequency
   • Once a year, during operating life of the mine.
   • Once every five years for survey of livelihood pattern during
     operating life of the mine

G. Monitoring Institution

Conductor
   • External Relations Department of WBN

Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (*Badan Pengolola Lingkungan
     Hidup*) of Central Halmahera Regency.
   • Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera
     Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.
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- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.3.10 Socio Cultural

2.3.10.1 Migration (Estimate of population and population density in villages around project area)

A. Source of Impact

- Operations workforces employment
- Project operations

B. Reference/Indicator of Impacts

- Newcomers to the Project Area, other than workforce.
- Increased migration and population growth in villages around project area.

C. Monitoring Objectives

- To detect the population increase within villages around the project area.

D. Monitoring Method

- Data collection of demography from government statistics (Kecamatan dalam Angka).
- If necessary and required conduct survey to collect primary data on demography (mainly migration) in the villages around the project area using standard socio-economic and culture survey method,

E. Monitoring Location

- Villages around the project area

F. Monitoring Period and Frequency

- Once a year, during operating life of the mine.
- Once every five years for demography (migration) primary data
collection during operating life of the mine.

G. Monitoring Institution

Conductor

- External Relations Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.3.10.2 Assimilation and Acculturation

A. Source of Impact

- Employment of operation workforces

B. Reference/Indicator of Impacts

- Interaction between local community and newcomers

C. Monitoring Objectives

- To detect community tension before it develops into unrest.

D. Monitoring Method

- Record data on resulting of formal and informal meetings with community member representative and village leaders.
• If necessary and required conduct survey to collect primary data on aspects of assimilation and acculturation in the villages around the project area using standard socio-economic and culture survey method

E. Monitoring Location

• Villages around the project area

F. Monitoring Period and Frequency

• Once a year, during operating life of the mine.
• Once every five years for assimilation and acculturation primary data collection during operating life of the mine

G. Monitoring Institution

Conductor

• External Relations Department of WBN

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.3.10.3 Alteration of social values and norms

A. Source of Impact
   • Employment of operation workforces
   • Interaction between local community and newcomers

B. Reference/Indicator of Impacts
   • Changes to traditional, cultural values and customs.

C. Monitoring Objectives
   • To detect community tension before it develops into unrest.

D. Monitoring Method
   • Record data on resulting of formal and informal meetings with community member representative and village leaders.
   • If necessary and required conduct survey to collect primary data on aspects of alteration of social values norms in the villages around the project area using standard socio-economic and culture survey method.

E. Monitoring Location
   • Villages around the project area.

F. Monitoring Period and Frequency
   • Once a year, during operating life of the mine.
   • Once every five years for alteration of social values and norms primary data collection during operating life of the mine

G. Monitoring Institution

Conductor
   • External Relations Department of WBN

Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.
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2.3.10.4 Community Unrest

A. Source of Impact

- Unmet expectations for job and business opportunities.
- Social norms and values of local community not respected by Construction Workforce

B. Reference/Indicator of Impacts

- Increase in dissatisfaction in the Project by local community.

C. Monitoring Objectives

- To detect community tension before it develops into unrest

D. Monitoring Method

- Record number of formal community complaints to the company through relevant government/ institutions offices
- Record data on resulting of formal and informal meetings with community member representative and village leaders.

E. Monitoring Location

- Villages around the project area

F. Monitoring Period and Frequency

- Once a year, during operating life of the mine

G. Monitoring Institution

Conductor
- External Relations Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.3.10.5 Quality of Indigenous People Habitat

A. Source of Impact
• Land clearing for mine area

B. Reference/Indicator of Impacts
• Changes in quality of Indigenous People habitat

C. Monitoring Objectives
• To determine stress/changes in livelihood patterns of Indigenous People

D. Monitoring Method
• Data collection based on impromptu/unarranged interaction with Indigenous People during initial survey and clearing.
• If necessary and required conduct survey to collect primary data on Indigenous People livelihood patterns using standard socio-culture survey method.

E. Monitoring Location
• Project Area

F. Monitoring Period and Frequency
• Interactions recorded as/when they occur.
• Survey on Indigenous People livelihood conducted every five years during operating life of the mine

G. Monitoring Institution

Conductor
• External Relations Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
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• Office of Mines and Energy of East Halmahera Regency.

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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.3.11 Public Health

2.3.11.1 Prevalence of Diseases and Public Health Services and Sanitation

A. Source of Impact
• Employment of Operations workforce and migration.

B. Reference/Indicator of Impacts
• Potential increase in prevalence of diseases
• Inadequacy of public health services and degradation of sanitation
C. Monitoring Objectives

- To identify changes in diseases prevalence in community.

D. Monitoring Method

- Collection of secondary data from local health institutions and facilities on the prevalence of disease in the local community.
- If necessary and required conduct survey to collect primary data on public health in the villages around the project area using standard public health survey method.

E. Monitoring Location

- Villages around the project area.

F. Monitoring Period and Frequency

- Secondary data collected once a year during operating life of the mine.
- Public Health Survey conducted every five years during operating life of the mine.

G. Monitoring Institution

Conductor
- External Relations Department of WBN.
- Environmental Health and Safety Department of WBN.

Supervisor
- BAPEDALDA of North Maluku Province.
- Office of Mine and Energy of North Maluku Province.
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province.
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.4 **OPERATION STAGE OF ORE PROCESSING**

2.4.1 **Air Quality**

2.4.1.1 **SO\textsubscript{x} and H\textsubscript{2}S**

A. **Source of Impact**
   - Hydrometalurgical process

B. **Reference/Indicator of Impacts**
   - Changes of SO\textsubscript{x} and H\textsubscript{2}S in ambient air

C. **Monitoring Objectives**
   - Identify long term trends of air quality at the vicinity of nickel processing plant

D. **Monitoring Method**
   - Every six months for stack emissions.
   - Every three months during operation period for ambient air quality

E. **Monitoring Location**
   - Emission at three stacks:
     - Atmospheric Leaching Stack,
     - Secondary Neutralisation Stack,
     - Cobalt Recovery Stack
     - Ambient air quality at sampling locations: KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. **Monitoring Period and Frequency**
   - Once a year for stack emissions.
   - Every 3 months during operation period for ambient air quality

G. **Monitoring Institution**
   **Conductor**
   - Environmental Health and Safety Department of WBN
   **Supervisor**
2.4.2 Surface Water Quality

2.4.2.1 TSS, pH, Hardness, Mg, Fe, Mn and trace metals (Cr⁵⁺, Cu, Pb, As, Cd, Co, Ni and Zn), and SO₄

A. Source of Impact
- Solid residue management (placement of filter cake).

B. Reference Indicator of Impacts
- Potential changes in receiving water quality
- To comply with applicable regulation on effluent water quality standard of nickel mining activity

C. Monitoring Objectives
- To determine whether the effluent water from Residue Storage Facility (RSF) may cause changes to surface water quality
- To record long-term trends of water quality in rivers/streams
D. Monitoring Method

- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location

- Discharge of the Polishing Pond adjacent to the RSF
- Jira River at sampling site AJIRA-4, AJIRA-3 and AJIRA-2 (Map-6 and Table 5)

F. Monitoring Period and Frequency

- Every day for pH and TSS at discharge point of polishing pond
- Every month for Cr\textsuperscript{6+}, Cu, Pb, As, Cd, Co, Ni and Zn at discharge point of polishing pond
- Every three months for complete parameter at Jira River
- All monitorings are conducted during operating life of the mine

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.4.3 Groundwater Quality

2.4.3.1 pH, Mg, Fe, Mn and trace metals (Cr$^{6+}$, Cu, Pb, As, Cd, Co, Ni and Zn), and SO$_4$

A. Source of Impact
- Solid residue management (placement of filter cake)

B. Reference/Indicator of Impacts
- Potential changes in groundwater quality due to infiltration from Residue Storage Facility (RSF).

C. Monitoring Objectives
- To determine whether infiltration from Residue Storage Facility is impacting groundwater quality

D. Monitoring Method
- Establish groundwater quality and piezometer monitoring adjacent to RSF
- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location
- Groundwater and Piezometer monitoring at:
  - 100 m upgradient of RSF
  - 100 m and 500 m downgradient of RSF

F. Monitoring Period and Frequency
- Every month for water level (piezometer) during operating life of the mine.
- Every six months for water quality during operating life of the mine.

G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province

• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

**Reporting**

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.4.4 Seawater Quality

#### 2.4.4.1 TSS, Temperature, Turbidity, Mg, Fe, Mn and trace metals (Cr\textsuperscript{6+}, Cu, Pb, As, Cd, Co, Ni and Zn), and SO\textsubscript{4}

**A. Source of Impact**

• Wastewater management (supernatant discharge).

**B. Reference/Indicator of Impacts**

• Potential changes in sea water quality due to waster water discharge
• To comply with applicable regulation on effluent water quality standard of nickel mining activity

**C. Monitoring Objectives**

• To determine whether the effluent water may cause changes to seawater quality
• To record longterm trends of sea water quality adjacent to plant site

**D. Monitoring Method**

• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

**E. Monitoring Location**
• Effluent water at Processing Plant prior to Outfall
• Three locations adjacent to outfall (see Map-8 and Table 7):
  - 500 m to the west of outfall parallel to the coast (OF-1)
  - 500 m to the east of outfall parallel to the coast (OF-2)
  - 500 m out to the sea perpendicular to the coast (OF-3)
• Two locations at reference sites Map-8 and Table 7:
  - Kobe Plepis (MKP-1)
  - Sagea (MSG-1)
• Two locations at Sagea Lagoon (Map-8 and Table 7):
  - Sagea Lagoon near outlet (ADSG-1)
  - Sagea Lagoon opposite to outlet (ADSG-2)
• Three locations adjacent to the Port Facility (see Map-4 and Table-3):
  - 500 m to the east of the port (DP-1)
  - 500 m to the west of the port (DP-2)
  - 500 m out to sea of the port (DP-3)

Table 7  Seawater Quality Sampling Locations during Operation Period

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td>500 m to the west of outfall parallel to the coast</td>
<td>OF-1</td>
<td>383760</td>
</tr>
<tr>
<td>500 m to the east of outfall parallel to the coast</td>
<td>OF-2</td>
<td>384566</td>
</tr>
<tr>
<td>500 m out to the sea perpendicular to sea coast</td>
<td>OF-3</td>
<td>384524</td>
</tr>
<tr>
<td>Sagea Lagoon water opposite to outlet</td>
<td>ADSG-1</td>
<td>396241</td>
</tr>
<tr>
<td>Sagea Lagoon water outlet</td>
<td>ADSG-2</td>
<td>396368</td>
</tr>
<tr>
<td>Kobe Peplis (Reference site)</td>
<td>MKP-1</td>
<td>378106</td>
</tr>
<tr>
<td>Sagea (Reference site)</td>
<td>MSG-1</td>
<td>399041</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

• Once per day for pH and TSS at sampling point prior to outfall (effluent water)
• Once per month for Cr⁶⁺, Cu, Pb, As, Cd, Co, Ni and Zn at sampling point prior to outfall (effluent water)
• Once every three months for complete parameter at marine and lagoon water quality sampling sites
• All monitorings are conducted during operating life of the mine.
G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
2.4.5 Freshwater Aquatic Biota

2.4.5.1 Abundance of Plankton, Benthos and Nekton.

A. Source of Impact
   - Solid residue management (placement of filter cake).

B. Reference/Indicator of Impacts
   - Change of Aquatic Biota abundance (plankton, benthos and nekton) in Ake Jira

C. Monitoring Objectives
   - To determine whether the effluent water from Residue Storage Facility (RSF) may cause changes to aquatic biota abundance
   - To record longterm trends of aquatic biota dynamics in rivers/streams

D. Monitoring Method
   - Collect, prepare and analyze aquatic biota (plankton, benthos and nekton) samples from permanent monitoring sites (Ake Jira) in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for plankton, benthos and nekton collection, identification and analyses.

E. Monitoring Location
   - Permanent aquatic biota monitoring sites at (see Map-7 and Table 6):
     - Ake Jira Upstream (BJR-4)
     - Ake Jira Middle (BJR-3)
     - Ake Jira Downstream (BJR-2)

F. Monitoring Period and Frequency
   - Once every year during operating life of the mine

G. Monitoring Institution
   **Conductor**
   - Environmental Health and Safety Department of WBN
   **Supervisor**
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   - Environmental Agency (Badan Lingkungan Hidup) of East
Halmahera Regency.


**Reporting**

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.4.6 **Marine Biota**

2.4.6.1 **Abundance of Plankton, Benthos, coral reef fishes and coral life forms**

**A. Source of Impact**

- Wastewater management (supernatant discharge).

**B. Reference/Indicator of Impacts**

- Change in marine biota abundance and condition.

**C. Monitoring Objectives**

- To determine the changes in marine biota (in particular benthos and reef fishes and coral condition)
- To record longterm trends of marine biota condition adjacent to plant site

**D. Monitoring Method**

- Collect, prepare and analyze marine biota (plankton and benthos) samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for marine plankton and benthos collection, identification and analyses.
- Conduct regular survey on coral reef fishes and coral life form at permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for marine coral reef fishes and coral life forms survey, collection, identification and analyses.
E. Monitoring Location

- Plankton and Benthos at sampling locations (see Map-9 and Table 8):
  - 500 m to the west of outfall parallel to the coast (BOF-1)
  - 500 m to the east of outfall parallel to the coast (BOF-2)
  - 500 m out to the sea perpendicular to the coast (BOF-3)
  - Sagea Lagoon near outlet (BLSG-1)
  - Sagea Lagoon opposite to outlet (BLSG-2)
  - Kobe Plepis (BMKP-1) – reference site
  - Sagea (BMSG-1) - reference site

- Coral reef fishes and coral life forms (see Map-9 and Table 8):
  - CR-I (reference site)
  - CR-II
  - CR-III
  - CR-V

**Table 8  Marine biota Sampling Locations during Operation Stage**

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easting</td>
</tr>
<tr>
<td><strong>Plankton and Benthos</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 m to the west of outfall parallel to the coast</td>
<td>BOF-1</td>
<td>383760</td>
</tr>
<tr>
<td>500 m to the east of outfall parallel to the coast</td>
<td>BOF-2</td>
<td>384566</td>
</tr>
<tr>
<td>500 m out to the sea perpendicular to sea coast</td>
<td>BOF-3</td>
<td>384524</td>
</tr>
<tr>
<td>Sagea Lagoon water opposite to outlet</td>
<td>BLSG-1</td>
<td>396241</td>
</tr>
<tr>
<td>Sagea Lagoon water outlet</td>
<td>BLSG-2</td>
<td>396368</td>
</tr>
<tr>
<td>Kobe Peplis (Reference site)</td>
<td>BMKP-1</td>
<td>378160</td>
</tr>
<tr>
<td>Sagea (Reference site)</td>
<td>BMSG-1</td>
<td>399041</td>
</tr>
<tr>
<td><strong>Coral Reef Fishes and Coral Life Form</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small atoll, south of Fritu</td>
<td>CR-I</td>
<td>403049</td>
</tr>
<tr>
<td>River mouth of Sagea Lagoon</td>
<td>CR-II</td>
<td>396416</td>
</tr>
<tr>
<td>Botepu Cape</td>
<td>CR-III</td>
<td>390157</td>
</tr>
<tr>
<td>Ulie Cape/Wosea</td>
<td>CR-IV</td>
<td>384185</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

- Plankton and benthos once every two years during operating life of the mine
- Coral reef fishes and coral life forms once every three years
G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN.

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
ENVIRONMENTAL MONITORING PLAN

MAP 9 - MARINE BIOTA SAMPLING LOCATIONS DURING OPERATION PERIOD

Legend
- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit

Sampling Location
- Plankton and Benthos
- Coral Reef Fishes and Coral Life Form

Source:
1. Topographic Map of Indonesia, scale 1:50,000
2. Aerial Photos, 1993/94. Sheet: Weda (2616-14), Sagea (2616-23), Kulo (2616-42), Ekor (2616-44), Air Sangaji (2616-51), Air Mawas (2615-53)

Revision No: 2
Proofreader: AB
Date Revision: January 10, 2009
Compilation: ZBM
2.5 **OPERATION STAGE OF LIME QUARRY AND PROCESSING**

2.5.1 **Air Quality**

2.5.1.1 **TSP and Dustfall**

A. **Source of Impact**
   - Limestone quarrying
   - Limestone transportation, crushing, and stockpiling

B. **Reference/Indicator of Impacts**
   - Change in TSP concentration in ambient air
   - Increment of dustfall

C. **Monitoring Objectives**
   - To identify the long-term trends of air quality in WBN’s project area

D. **Monitoring Method**
   - TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations
   - Dustfall is monitored using depositional dust gauges, as per applicable regulations.

E. **Monitoring Location**
   - Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. **Monitoring Period and Frequency**
   - Once every three months during operating life of the mine.

G. **Monitoring Institution**

   **Conductor**
   - Environmental Health and Safety Department of WBN

   **Supervisor**
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   - Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.1.2 $SO_2$, $NO_x$, and $CO_2$

A. Source of Impact
• Limestone production

B. Reference/Indicator of Impacts
• Changes in air quality due to gas emissions from limestone processing plant.

C. Monitoring Objectives
• To determine the long term trends in emissions.
• To identify the long-term trends of ambient air quality around limestone processing plant area and vicinity

D. Monitoring Method
• Monitor limestone plant stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.
• Monitor ambient air quality in accordance with GOI protocol or SNI standard.

E. Monitoring Location
• Gas emissions will be monitored at Lime Kiln Stack discharge.
• Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. Monitoring Period and Frequency
• Gas emissions monitored twice a year during operating life of the mine.
• Ambient air monitored every three months during operating life of the mine.

G. Monitoring Institution

Conductor
• Environmental Health and Safety Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
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• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.2 Noise

2.5.2.1 Noise

A. Source of Impact
• Limestone quarrying (blasting)

B. Reference/Indicator of Impacts
• Increase of noise

C. Monitoring Objectives
• Identify long-term trends of noise level at WBN project area
D. **Monitoring Method**

- Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

E. **Monitoring Location**

- Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. **Monitoring Period and Frequency**

- Annual Noise Survey to be conducted during operating life of the mine

G. **Monitoring Institution**

**Conductor**

- Environmental Health and Safety Department of WBN

**Supervisor**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency *(Badan Pengelola Lingkungan Hidup)* of Central Halmahera Regency.
- Environmental Agency *(Badan Lingkungan Hidup)* of East Halmahera Regency.

**Reporting**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency *(Badan Pengelola Lingkungan Hidup)* of Central Halmahera Regency.
- Environmental Agency *(Badan Lingkungan Hidup)* of East Halmahera Regency.
2.5.3 Vibration

2.5.3.1 Vibration

A. Source of Impact

- Limestone quarrying (blasting)

B. Reference/Indicator of Impacts

- Complaint on Vibration
- Structural damage of infrastructures

C. Monitoring Objectives

- To determine the level of nuisance to nearby communities as a result of vibration caused by blasting

D. Monitoring Method

- Vibration level is monitored using equipment in accordance with GOI protocol or SNI standard.

E. Monitoring Location

- One location at the nearest village to represent communities around the project – Gemaf Village

F. Monitoring Period and Frequency

- Annual Vibration Survey to be conducted during operating life of the mine

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.4  Morphology and Physiographic

2.5.4.1 Landform

A. Source of Impact
• Limestone quarrying

B. Reference/Indicator of Impacts
• Change of topography in term of elevation and slope in the limestone mine area related to limestone quarrying

C. Monitoring Objectives
• To provide up-to-date information on the changes in topography and morphology in the limestone quarry site

D. Monitoring Method
• Monitor physical stability of active quarry using survey or standard equipment for slope stability monitoring (such as extensometers, prism, and or other equivalent tools) or by visual observation
• Monitor and map changes in topography and morphology by ground survey and satellite images

E. Monitoring Location
• Active quarry site in the project area

F. Monitoring Period and Frequency
• Slope stability monitoring: as required in active quarry location
• Monitoring of changes in topography: once during the quarry life.

G. Monitoring Institution

Conductor
• Limestone Quarry Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

**Reporting**

• Department of Energy and Mineral Resources, Republic of Indonesia.
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• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.5.5 Soil

#### 2.5.5.1 Soil Erosion

**A. Source of Impact**
- Land clearing for limestone quarry
- Stripping and piling of topsoil

**B. Reference/Indicator of Impacts**
- Increase of erosion rate.

**C. Monitoring Objectives**
- To provide data on sediment load
- To provide information on the efficiency of the sedimentation ponds/dam
- To provide long term data on erosion in the limestone quarry area

**D. Monitoring Method**
- To obtain data on sediment load and sedimentation pond efficiency:
- Monitor the TSS content and flow rate of the inflow water to sedimentation pond.
- Monitor TSS content and flow rate of the outflow water from sedimentation pond.
- Collect, prepare, and analyze TSS sample water according to WBN’s protocol in accordance with Indonesian National Standards/SNI (or other appropriate international standards).
  - Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge

E. Monitoring Location
- One representative permanent monitoring plot at sedimentation pond. This location is maintained until completion of quarry life.

F. Monitoring Period and Frequency
- TSS and flow rate monitoring once a month during Operations phase.
- Maintain the permanent plot during the operating life of the quarry.

G. Monitoring Institution
Conductor
- Environmental Health and Safety Department of WBN
- Mine engineering

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.6 Hydrology

2.5.6.1 Surface Runoff Flow Rate

A. Source of Impact
• Land clearing for limestone quarrying

B. Reference/Indicator of Impacts
• Increase of surface water run off rate

C. Monitoring Objectives
• To identify long term trends of flow rate in some important streams adjacent to limestone quarry site
• To identify long term trends of effluent water flow rate from the sedimentation pond

D. Monitoring Method
• Monitor water level of the river using automatic water level recording or stage gauge

E. Monitoring Location
• One location on the Gemaf River (AGEM) see Map-3 and Table-2
• Discharge from sediment pond adjacent to limestone quarry site

F. Monitoring Period and Frequency
• Water level monitoring at the river once every three months during Operations phase.
• Effluent water discharge from sedimentation ponds once every months during the operating life of the limestone quarry

G. Monitoring Institution

Conductor
• Limestone Quarry Department of WBN
• Environmental Health and Safety Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.5.7 Hydrogeology

#### 2.5.7.1 Groundwater flow pattern

**A. Source of Impact**
- Limestone quarrying.

**B. Reference/Indicator of Impacts**
- Change of groundwater flow pattern

**C. Monitoring Objectives**
- To identify longterm trends of groundwater flow pattern change due to limestone quarrying.

**D. Monitoring Method**
- Manual monitoring of groundwater level using groundwater level monitoring instrument (i.e ‘dipper’).

**E. Monitoring Location**
- Two piezometer bores located down gradient of the limestone quarry.

**F. Monitoring Period and Frequency**
G. Monitoring Institution

Conductor
- Limestone Quarry  Department of WBN
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting
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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.5.8 Surface Water Quality

2.5.8.1 TSS, pH and Hardness

A. Source of Impact
- Limestone quarrying

B. Reference/Indicator of Impacts
- Change of TSS, pH and Hardness due to limestone quarrying
C. Monitoring Objectives
   - To determine whether the effluent water which flows to watershed may cause changes in TSS, pH, and Hardness concentration.

D. Monitoring Method
   - Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location
   - Discharge of the Sediment Pond adjacent to the Limestone Quarry
   - One location on the Gemaf River (AGEM) see Map-3 and Table-2

F. Monitoring Period and Frequency
   - TSS, pH, and Hardness will be monitored every month during the operating life of the limestone quarry
   - One location on the Gemaf River every 3 months during the operating life of the limestone quarry

G. Monitoring Institution

   Conductor
   - Environmental Health and Safety Department of WBN

   Supervisor
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   - Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

   Reporting
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   - Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.9 Terrestrial Flora and Fauna

2.5.9.1 Species structure and composition as well as wildlife habitat

A. Source of Impact
• Land clearing for limestone quarrying
• Limestone quarrying

B. Reference/Indicator of Impacts
• Disturbance to biodiversity

C. Monitoring Objectives
• To record flora and fauna species in areas impacted by any land clearing for limestone quarrying activities
• To record protected flora and fauna found in the area to be cleared

D. Monitoring Method
• Conduct survey and make inventory of flora and fauna species in areas to be cleared for quarrying.
• Flora and fauna survey is conducted through standard method in forest area to be cleared.

E. Monitoring Location
• Area to be cleared as part of quarry development.

F. Monitoring Period and Frequency
• Baseline survey conducted once prior to any land clearing activity

G. Monitoring Institution

Conductor
• Environmental Health and Safety Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
• Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
Office of Mines and Energy of Central Halmahera Regency.

**Reporting**

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
- Office of Mines and Energy of East Halmahera Regency

2.5.10  *Freshwater Aquatic Biota*

2.5.10.1  *Abundance of Plankton and Benthos*

**A. Source of Impact**

- Land clearing for limestone quarrying
- Stripping and Piling of topsoil

**B. Reference/Indicator of Impacts**

- Change of Aquatic Biota abundance

**C. Monitoring Objectives**

- To determine whether changes of aquatic biota (mainly benthos) are occurring

**D. Monitoring Method**

- Collect, prepare and analyze plankton and benthos samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for phytoplankton, zooplankton and benthos collection, identification and analyses.

**E. Monitoring Location**

- Permanent plankton and benthos monitoring sites at:
  - One location on the Gemaf River (BGF-1) see (see Map-7 and Table 6).

**F. Monitoring Period and Frequency**

- Every year during Operations phase.
G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.5.11 Socio Economics

2.5.11.1 Business Opportunities

A. Source of Impact
- Land clearing for limestone quarrying

B. Reference/Indicator of Impacts
- The level of participation of local people, local contractors and general community in limestone quarrying activity

C. Monitoring Objectives
- To record the number of entrepreneurs participating in limestone quarrying activity.
D. Monitoring Method

- Collect data regarding number of local entrepreneur that participate in the provision of goods and services:
  - Number of an officially locally owned and operated
  - Types of goods and services provided and to what entities
  - Value of local economic activities

E. Monitoring Location

- WBN Office
- Office of Industrial and Trade Agency of Central and East Halmahera Regencies

F. Monitoring Period and Frequency

- Once every year, during the operating life of the limestone quarry

G. Monitoring Institution

Conductor

- Purchasing Department of WBN
- Limestone Quarry Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.5.11.2 Community Income

A. Source of Impact
• Land clearing for limestone quarrying

B. Reference/Indicator of Impacts
• Change of community income

C. Monitoring Objectives
• To record changes of community income

D. Monitoring Method
• Data collection on household income from government statistics (Kecamatan dalam Angka).

E. Monitoring Location
• Villages around the project area

F. Monitoring Period and Frequency
• Once every year, during operating life of the mine.

G. Monitoring Institution
Conductor
• External Relations Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.6 **OPERATION STAGE OF SUPPORTING FACILITIES**

2.6.1 **Air Quality**

2.6.1.1 **SOx and H2S**

A. **Source of Impact**
- Sulphate Acid Plant operation

B. **Reference/Indicator of Impacts**
- Changes of SOx and H2S in ambient air.

C. **Monitoring Objectives**
- Identify long term trends of air quality at the vicinity of nickel processing plant

D. **Monitoring Method**
- Monitor sulphuric acid plant stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.
- Monitor ambient air quality in accordance with GOI protocol or SNI standard

E. **Monitoring Location**
- P Sulphuric Acid Plant Stack.
- Ambient air quality at sampling locations: KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. **Monitoring Period and Frequency**
- Stack emissions monitored every six months during operations phase.
- Ambient air quality to be monitored every three months during operation phase

G. **Monitoring Institution**

**Conductor**
- Environmental Health and Safety Department of WBN

**Supervisor**
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

**Reporting**

• Department of Energy and Mineral Resources, Republic of Indonesia.
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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.6.1.2 \( \text{SO}_x \) and \( \text{NO}_x \)

**A. Source of Impact**

• Power Plant

**B. Reference/Indicator of Impacts**

• Changes of \( \text{SO}_x \) and \( \text{NO}_x \) in ambient air

**C. Monitoring Objectives**

• Identify long term trends of air quality at the vicinity of nickel processing plant

**D. Monitoring Method**

• Monitor power plants stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.
• Monitor ambient air quality in accordance with GOI protocol or SNI standard

**E. Monitoring Location**

• Power Plant Stack.
• Ambient air quality at sampling locations: KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)
F. Monitoring Period and Frequency

- Stack emissions monitored every six months during operations phase.
- Ambient air quality to be monitored every three months during operation phase.

G. Monitoring Institution

Conductor
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.6.2 Noise

2.6.2.1 Noise

A. Source of Impact

- Power Plant.

B. Reference/Indicator of Impacts
• Increase of noise.

C. Monitoring Objectives
• Identify long-term trends of noise level at WBN project area

D. Monitoring Method
• Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

E. Monitoring Location
• Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1).

F. Monitoring Period and Frequency
• Annual Noise Survey to be conducted during operating life of the mine

G. Monitoring Institution
Conductor
• Environmental Health and Safety Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.6.3 Hydrology

2.6.3.1 Change of Flow Rate

A. Source of Impact
   • Water supply for WBN activities

B. Reference/Indicator of Impacts
   • Change of flow rate downstream of intake point.

C. Monitoring Objectives
   • To identify long term trends of water level and flowrate

D. Monitoring Method
   • Monitor water level of the river using automatic water level recording or sonar or stage gauge
   • Measure surface water level by stream gauging or weir using AWLR or stage gauge.
   • Measure volume of water off-take to process plant (i.e. total fresh water use).

E. Monitoring Location
   • Downstream of water intake at Kobe River.
   • Kobe River Pump station.

F. Monitoring Period and Frequency
   • Water level monitoring at the rivers ongoing during the operating life of the mine
   • Water level monitoring at the rivers once every three months during the operating life of the mine.
   • Water use to be measured daily

G. Monitoring Institution

Conductor
   • Environmental Health and Safety Department of WBN

Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
2.6.4 Surface Water Quality

2.6.4.1 Oil and Grease

A. Source of Impact
   - Operation of workshop.

B. Reference/Indicator of Impacts
   - Change of oil and grease concentration in receiving water due to workshop effluent
   - To comply with applicable regulation on effluent water quality standard

C. Monitoring Objectives
   - To determine whether the effluent water which flows to watershed may cause changes in oil and grease concentration.

D. Monitoring Method
   - Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards)

E. Monitoring Location
   - Prior to discharge of water from Workshop
   - One location on the Wosea River (AWOS) see Map-3 and Table-2
F. Monitoring Period and Frequency

- Once every month during the operating life of the mine

G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.6.4.2 Nutrients (BOD, COD, NH₃, NO₂, NO₃)

A. Source of Impact

- Non-process waste management

B. Reference/Indicator of Impacts

- Change in nutrient concentrations in downstream surface water.
- To comply with applicable regulation on effluent water quality standard

C. Monitoring Objectives

- To determine changes in nutrient concentrations in downstream
surface water

D. Monitoring Method

• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).

E. Monitoring Location

• Prior to discharge from landfill leachate.
• One location on the Gojemli River (AGOJ) see Map-3 and Table-2

F. Monitoring Period and Frequency

• Once every month during the operating life of the mine.

G. Monitoring Institution

Conductor

• Environmental Health and Safety Department of WBN

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting

• Department of Energy and Mineral Resources, Republic of Indonesia.
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• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.6.5 Groundwater Quality

2.6.5.1 Nutrients (BOD, COD, NH₃, NO₂, NO₃)

A. Source of Impact
   • Non-process waste management

B. Reference/Indicator of Impacts
   • Change in Groundwater Water Quality

C. Monitoring Objectives
   • To determine whether the leachate water infiltration to groundwater may cause changes in Nutrient concentrations

D. Monitoring Method
   • Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location
   • One location down gradient of the Non-process Waste Management Storage location/Landfill.

F. Monitoring Period and Frequency
   • Water quality will be monitored every six months during the operating life of the mine.

G. Monitoring Institution
   Conductor
   • Environmental Health and Safety Department of WBN

   Supervisor
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
   • Office of Mine and Energy of North Maluku Province
   • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
   • Office of Mines and Energy of Central Halmahera Regency.
   • Office of Mines and Energy of East Halmahera Regency.

   Reporting
   • Department of Energy and Mineral Resources, Republic of Indonesia.
   • BAPEDALDA of North Maluku Province
Office of Mine and Energy of North Maluku Province

Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.

Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

Office of Mines and Energy of Central Halmahera Regency.


### 2.6.6 Socio Economics

#### 2.6.6.1 Business Opportunities

**A. Source of Impact**
- Services required by employees residential area

**B. Reference/Indicator of Impacts**
- The level of participation of local people, local contractors and general community related to employee residential activities

**C. Monitoring Objectives**
- To record the number of entrepreneurs participating in Project Operations

**D. Monitoring Method**
- Collect data regarding number of local entrepreneur that participate in the provision of goods and services

**E. Monitoring Location**
- WBN Office
- Office of Industrial and Trade Agency of Central and East Halmahera Regencies.

**F. Monitoring Period and Frequency**
- Once every year, during the operating life of the mine.

**G. Monitoring Institution**

**Conductor**
- External Relations Department of WBN
- External Affairs Department

**Supervisor**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.6.6.2 Community Income

A. Source of Impact
• Services required by employees residential area

B. Reference/Indicator of Impacts
• Change of community income

C. Monitoring Objectives
• To record changes of community income

D. Monitoring Method
• Data collection on household income from government statistics (Kecamatan dalam Angka).

E. Monitoring Location
• Villages around the project area

F. Monitoring Period and Frequency
• Once every year, during operating life of the mine

G. Monitoring Institution

Conductor
• External Relations Department of WBN
Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.7 OPERATION STAGE OF OTHER INFRASTRUCTURE

2.7.1 Air Quality

2.7.2 TSP and Dustfall

A. Source of Impact

- Dedicated port and barge loading facility operation.

B. Reference/Indicator of Impacts

- Change in TSP concentration in ambient air
- Increment of dustfall.

C. Monitoring Objectives

- To identify the long-term trends of air quality in WBN’s project area

D. Monitoring Method

- TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations
• Dustfall is monitored using depositional dust gauges, as per applicable regulations.

E. Monitoring Location
• Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. Monitoring Period and Frequency
• Once every three months during operating life of the mine

G. Monitoring Institution
Conductor
• Environmental Health and Safety Department of WBN
Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.7.3 Noise

2.7.3.1 Noise

A. Source of Impact
   - Dedicated Airport operation
   - Dedicated port and barge loading facility operation

B. Reference/Indicator of Impacts
   - Increase of noise

C. Monitoring Objectives
   - Identify long-term trends of noise level at WBN project area

D. Monitoring Method
   - Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

E. Monitoring Location
   - Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)

F. Monitoring Period and Frequency
   - Annual Noise Survey to be conducted during operating life of the mine

G. Monitoring Institution
   Conductor
   - Environmental Health and Safety Department of WBN
   Supervisor
   - BAPEDALDA of North Maluku Province
   - Office of Mine and Energy of North Maluku Province
   - Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
   - Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting
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• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency

2.7.4 Sea Water Quality

2.7.4.1 TSS, pH, hydrocarbons, Oil and Grease

A. Source of Impact
• Dedicated port and barge loading facility operation

B. Reference/Indicator of Impacts
• Changes in sea water quality, in particular TSS, pH, hydrocarbons, Oil and Grease

C. Monitoring Objectives
• To determine whether the dedicated port and barge loading facility operation may cause changes in pH, TSS, hydrocarbons or oil and grease concentration.

D. Monitoring Method
• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards).

E. Monitoring Location
• Three locations adjacent to the Port Facility (see Map-4 and Table-3):
  – 500 m to the east of the port (DP-1)
  – 500 m to the west of the port (DP-2)
  – 500 m out to sea of the port (DP-3)

F. Monitoring Period and Frequency
• Sea Water Quality will be monitored every three months during operating life of the mine.

G. Monitoring Institution
Conductor
• Environmental Health and Safety Department of WBN
Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.7.5 Marine Biota

2.7.5.1 Abundance of plankton, benthos, coral reef fish and coral life forms

A. Source of Impact

- Dedicated port and barge loading facility operation

B. Reference/Indicator of Impacts

- Changes in abundance of plankton, benthos and the condition of coral.

C. Monitoring Objectives

- To determine the changes in marine biota (in particular benthos and coral condition)
• To record longterm trends of marine biota condition adjacent to plant site.

D. Monitoring Method

• Collect, prepare and analyze marine biota (plankton and benthos) samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for marine plankton and benthos collection, identification and analyses.

• Conduct regular survey on coral reef fish and coral life forms at permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards (or other appropriate international standards) for marine coral reef fishes and coral life forms survey, collection, identification and analyses.

E. Monitoring Location

• Plankton and Benthos at sampling locations (see Map-9 and Table 8):
  - 500 m to the west of outfall parallel to the coast (BOF-1)
  - 500 m to the east of outfall parallel to the coast (BOF-2)
  - 500 m out to the sea perpendicular to the coast (BOF-3)
  - Kobe Plepis (BMKP-1) - reference site
  - Sagea (BMSG-1) - reference site

• Coral reef fishes and coral life forms (see Map-9 and Table 8):
  - CR-I (reference site)
  - CR-II
  - CR-III
  - CR-V

F. Monitoring Period and Frequency

• Plankton and benthos every two years during operating life of the mine

• Coral reef fishes and coral life forms once every three years.

G. Monitoring Institution

Conductor

• Environmental Health and Safety Department of WBN

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

Reporting
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mines and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.7.6 Oceanography

2.7.6.1 Change of current pattern

A. Source of Impact
• Dedicated port and barge loading facility operation

B. Reference/Indicator of Impacts
• Change in beach sedimentation and abrasion pattern

C. Monitoring Objectives
• To determine changes in sedimentation along the shore line adjacent to the Port

D. Monitoring Method
• Evaluation of satellite imagery to determine changes in shoreline morphology or to get secondary data from relevant authority

E. Monitoring Location
• Shoreline to the east and west of the Port Facility.

F. Monitoring Period and Frequency
• Once every two years during the operating life of the mine
G. Monitoring Institution

Conductor

- Port Operation Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

Reporting

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- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.7.6.2 Accessibility

A. Source of Impact

- Dedicated Airport

B. Reference/Indicator of Impacts

- Number of people who utilize the airport

C. Monitoring Objectives

- To determine how the WBN airport has changed the accessibility to and from the Central Halmahera regency.

D. Monitoring Method

- Collect data on people (not directly connected to the Project) who utilize the airport.
E. Monitoring Location

- Dedicated airport.

F. Monitoring Period and Frequency

- Once a year during the Operations phase

G. Monitoring Institution

Conductor

- Airport Operation Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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2.8 COMMUNITY DEVELOPMENT

2.8.1 Provision of Educational Facilities and Services

2.8.1.1 Distribution of provision educational facilities in WBN CoW area

A. Source of Impact

- Increased demands by the local community for educational facilities and services.

B. Reference/Indicator of Impacts

- Requirement and demand of educational facilities and services for local communities.

C. Monitoring Objectives

- To support the government in its efforts to provide adequate educational facilities and services to the community.
- To monitor the provision of necessary educational facilities and services.

D. Monitoring Method

- To review and assess the effectiveness of all the project involved in the education

E. Monitoring Location

- Villages covered by CD programs in Central and East Halmahera Regencies

F. Monitoring Period and Frequency

- Once a year during the implementation of the Community Development Program.

G. Monitoring Institution

Conductor

- External Relations Department of WBN

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

### 2.8.2 Provision of Public Health Service

#### 2.8.2.1 Number of health facility, quality of service, number of patients, and number of paramedics

**A. Source of Impact**

• Local community demand for health services

**B. Reference/Indicator of Impacts**

• Distribution of public health facilities in WBN COW area.

**C. Monitoring Objectives**

• To monitor distribution and effectiveness of health facilities under WBN CD Program
• Comply with IFC Performance standard 4: Community Health, Safety, and Security

**D. Monitoring Method**

• Collect data from local health institutions, review and compare number of health facilities and services to fulfil the minimum community requirement

**E. Monitoring Location**

• Villages covered by CD programs in Central and East Halmahera Regencies
• WBN Clinics, Community Health center

**F. Monitoring Period and Frequency**

• Once a year during the implementation of the Community Development Program
G. Monitoring Institution

Conductor
- External Relations Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.8.3 Fishery and Marine culture

2.8.3.1 Production level on local fishery and aquaculture produce

A. Source of Impact
- Level of fishery knowledge
- Availability of fishing gear
- Low level machinery usage among fisher

B. Reference/Indicator of Impacts
- Fishery and aquaculture productivity in Weda Bay water

C. Monitoring Objectives
- To monitor availability of several important fishery and marine
culture production factor

- To monitor production level of several significant local fishery and marine culture produce

**D. Monitoring Method**

- Collect data, review and compare from relevant fishery department on the fishery production facilities and most important production factors

**E. Monitoring Location**

- Villages covered by CD programs in Central and East Halmahera Regencies

**F. Monitoring Period and Frequency**

- Once a year during the implementation of the Community Development Program.

**G. Monitoring Institution**

**Conductor**

- External Relations Department of WBN

**Supervisor**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.

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- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
2.8.4 Farming and Agriculture Improvement Initiatives

2.8.4.1 Agriculture productivity in WBN’s COW area

A. Source of Impact

- Low agriculture knowledge on valuable commodities among young farmers
- Agriculture production input shortage
- Lack of high quality production input

B. Reference/Indicator of Impacts

- Availability of valuable agricultural commodities in WBN’s COW Area
- Production level of local agricultural commodities (coconut, nutmeg)

C. Monitoring Objectives

- To monitor availability of several important agriculture production factor
- To monitor production level of several significant local agriculture produce

D. Monitoring Method

- Monitor farmer ability to own production facilities such as hand tractors
- Monitor farmer ability to get certain most important production factors such as fertilizer and high quality seed

E. Monitoring Location

- Villages covered by CD programs in Central and East Halmahera Regencies

F. Monitoring Period and Frequency

- Once a year during the implementation of the Community Development Program.

G. Monitoring Institution

Conductor
- External Relations Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.

2.8.5  **Local Business Opportunities**

2.8.5.1  **Number of locally owned and operated businesses and Value of local economic activities**

**A. Source of Impact**

• Level of full and equitable participation of local people in local business opportunities
• Level business skill of local community
• Availability of access to sources of funding and capitals

**B. Reference/Indicator of Impacts**

• The level of participation by the local community in diverse economic activities

**C. Monitoring Objectives**

• To monitor the participation of the local in the economic development in the WBN COW area in Central and East Halmahera Regencies

**D. Monitoring Method**

• Record WBN purchasing and service provision contracts
• Record number of economic facilities operated by locals
Monitor WBN’s Economic and Business Development Initiatives

E. Monitoring Location
- Villages covered by CD programs in Central and East Halmahera Regencies

F. Monitoring Period and Frequency
- Once a year during the implementation of the Community Development Program

G. Monitoring Institution

Conductor
- External Relations Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency *(Badan Pengelola Lingkungan Hidup)* of Central Halmahera Regency.
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- Office of Mine and Energy of North Maluku Province
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- Environmental Agency *(Badan Lingkungan Hidup)* of East Halmahera Regency.
2.9 OTHER MONITORING

2.9.1 Surface and Ground Water Quality

- Non-industrial solid waste: Types and amounts of waste collected, transported, disposed to landfills, and recycled.
- Domestic liquid waste effluent: BOD, COD, TSS, and pH.
- Type and amount of hazardous and toxic wastes (B3)
- Spill: number and amount of spillage

A. Source of Impact

- Effluent discharge from domestic waste water treatment plants.
- Hazardous and toxic wastes (B3) wastes.
- Laboratory waste and outdated/spent chemicals

B. Reference/Indicator of Impacts

- Potential impacts on the environment, particularly surface water and groundwater quality, if solid and liquid wastes are not managed and disposed off properly.

C. Monitoring Objectives

- To quantify the types and amounts of solid waste produced by PT WBN.
- To determine the performance of wastewater treatment plants.
- To ensure correct handling and disposal of hazardous wastes.

D. Monitoring Method

- Measure amount of solid waste produced by counting number of waste trucks entering and discharging waste to landfills.
- Collect, prepare and analyze water samples from all domestic wastewater treatment plant outlets according to PT WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards) and also measure pH, conductivity, and temperature at the time of sampling (in situ).
- Monitor correct implementation of oil, fuel and sulphur spill prevention in accordance with standard operational procedures (SOP).
- Monitor correct implementation of hazardous and toxic wastes handling and disposal (such as used battery, medical waste, slop oils, used grease, laboratory waste, etc) in accordance with standard operational procedures (SOP)

E. Monitoring Location

- Domestic solid waste landfill area
• All domestic waste water treatment plants
• All PT WBN activity locations generating (B3) wastes

F. Monitoring Period and Frequency
• Solid waste: every time solid waste is disposed to the landfills.
• Domestic waste water: every month.
• (B3) waste: every three months.

G. Monitoring Institution
Conductor
• Environmental Health and Safety Department of WBN

Supervisor
• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Office of Mines and Energy of East Halmahera Regency.

Reporting
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• Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
2.9.2 Community Shallow Ground Water Wells Quality

2.9.2.1 TDS, pH, Mg, Fe, Mn and trace metals (Cr\textsuperscript{6+}, Cu, Pb, As, Ba, B, Se, Cd, Hg, Co, Ni and Zn), Cl, and SO\textsubscript{4}

A. Source of Impact

• Several activities in the villages and community that may impact groundwater quality

B. Reference/Indicator of Impacts

• Potential groundwater wells quality changes

C. Monitoring Objectives

• To determine and make sure the groundwater are safe for clean water and raw water for drinking water sources

D. Monitoring Method

• Collect, prepare and analyze the wells water samples according to PT WBN’s protocols in accordance with Indonesian National Standards (or other appropriate international standards) and also measure pH, conductivity, and temperature at the time of sampling (in situ).

E. Monitoring Location

• Representative ground water wells at villages (see Map-10 and Table 9):
  - Sagea Village (SGL)
  - Gemaf Village (GML)
  - Lelilef Sawai Village (SWL)
  - Lelilef Waebulen Village (WBL)
  - Trans Unit (SP3)

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagea Village</td>
<td>SGL</td>
<td>Easting 399466</td>
</tr>
<tr>
<td>Gemaf Village</td>
<td>GML</td>
<td>Easting 392305</td>
</tr>
<tr>
<td>Lelilef Sawai Village</td>
<td>SWL</td>
<td>Easting 381754</td>
</tr>
<tr>
<td>Lelilef Waebulen Village</td>
<td>WBL</td>
<td>Easting 381754</td>
</tr>
<tr>
<td>Transmigration Unit</td>
<td>SP3</td>
<td>Easting 374905</td>
</tr>
</tbody>
</table>

F. Monitoring Period and Frequency

• Once every year during the operating life of the mine
G. Monitoring Institution

Conductor

• Environmental Health and Safety Department of WBN

Supervisor

• Department of Energy and Mineral Resources, Republic of Indonesia.
• BAPEDALDA of North Maluku Province
• Office of Mine and Energy of North Maluku Province
• Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
• Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency

Reporting

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• Office of Mine and Energy of North Maluku Province
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• Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
ENVIRONMENTAL MONITORING PLAN

MAP 10 - COMMUNITY SHALLOW GROUNDWATER WELL MONITORING LOCATIONS

Legend
- Road
- River
- Contract of Work
- Village
- Transmigration Settlement Unit

Sampling Location

Community Well

Source:
1. Topographic Map of Indonesia, scale 1:50,000
2. Aerial Photos, 1993/94. Sheet: Weda (2616-14), Sagea (2616-23), Kulo (2616-42), Ekor (2616-44), Air Sangaji (2616-51), Air Mawas (2615-53)

Glossary
(A.) Sagea
(Tg.) Ulie
Ake/River
Tanjung/Cape
(P.) Yef
Pulau/Island

Environmental Monitoring Plan

January 10, 2009

Revision No: g

Drafter
Proofreader
Compilation
2.9.3 Hydrogeology

2.9.3.1 Groundwater level

A. Source of Impact
   - Facility construction activities
   - Ore Mining activities
   - Limestone quarry

B. Reference/Indicator of Impacts
   - Change of groundwater level

C. Monitoring Objectives
   - To identify longterm trends of groundwater level.

D. Monitoring Method
   - Establish permanent piezometer monitoring wells at each ore deposit
   - Establish permanent piezometer monitoring wells upgradient and down gradient of plant site
   - Manual monitoring of groundwater level using groundwater level monitoring instrument (i.e ‘dipper’).

E. Monitoring Location
   - One at each mining blocks
   - One upgradient plant site and two down gradient plant site

F. Monitoring Period and Frequency
   - Measurement of groundwater level at each mining block to be conducted on a monthly basis one year prior to land clearing and continue until completion of ore mining in particular mine block
   - Measurement of groundwater level at plant site to be conducted on a monthly basis one year prior to construction and continue until closure of the operation

G. Monitoring Institution
   **Conductor**
   - Mine Engineering Department
   - Engineering and Maintenance Division
   - Environmental Health and Safety Department of WBN

   **Supervisor**
2.9.4 Meteorology and Microclimate

2.9.4.1 Air temperature, rainfall, wind speed and direction, relative humidity, and solar radiation

A. Source of Impact
- All activities of WBN in the project area

B. Reference/Indicator of Impacts
- Potential microclimate (temperature and humidity) changes

C. Monitoring Objectives
- To collect long term meteorological and microclimate data this can be used as input for other environmental monitoring and management programs.

D. Monitoring Method
- Conduct continuous monitoring using standard meteorological monitoring equipments

E. Monitoring Location
- Locations of Wosea and Bukit Limber
See Map-11 and Table 10 for the meteorological monitoring station

**Table 10  Meteorological Monitoring Station**

<table>
<thead>
<tr>
<th>Sampling Location Description</th>
<th>Location Code</th>
<th>Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bukit Limber (altitude ≈800 m above sea level)</td>
<td>SM AWS</td>
<td>386387.38 59908.82</td>
</tr>
<tr>
<td>Wosea (altitude ≈3 m above sea level)</td>
<td>Wosea AWS</td>
<td>383607.57 52212.46</td>
</tr>
</tbody>
</table>

**F. Monitoring Period and Frequency**

- Monitoring: continuously.
- Reporting: every three months.
- Throughout the operating life of the mine

**G. Monitoring Institution**

**Conductor**
- Environmental Health and Safety Department of WBN

**Supervisor**
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (*Badan Pengelola Lingkungan Hidup*) of Central Halmahera Regency.
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- Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
2.9.5 Reclamation Progress

- Total area reclaimed in hectare
- Plant species used for reclamation
- Number of seedlings transplanted
- Plant growth performance

A. Source of Impact
- Reclamation of overburden placement area and ex-mined area

B. Reference/Indicator of Impacts
- Reclamation progress from time to time

C. Monitoring Objectives
- To evaluate the success of reclamation program
- To determine survival rate of the transplanted plants
- To determine suitable plant species to be used in reclamation program

D. Monitoring Method
- Take record on:
  - Total area reclaimed
  - Type of plant species used in the reclamation program
  - Total number of seedlings produced and transplanted
  - Map and take photo of the reclaimed area
- Monitor the plant growth performance through:
  - Establishing randomly monitoring plots at reclamation sites for each type of plant species planted
  - Measuring diameter and height of the sampled plants in the monitoring plots
  - Determining the survival rate of reclamation plants
  - Sample and analyze physical and chemical characteristics of soil from reclaimed areas.

E. Monitoring Location
- Representative reclamation area at mine blocks within COW area

F. Monitoring Period and Frequency
- Once a year for:
- Total area reclaimed, type of plant species and total seedlings produced and transplanted
- Reclamation map and photo
- Plant growth performance
- Soil physical and chemical analysis

G. Monitoring Institution

Conductor
- Mine Engineering Department
- Environmental Health and Safety Department of WBN

Supervisor
- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.9.6 Flora and Fauna Biodiversity

- Species diversity, abundance and distribution for major groups such as vegetation, mammals, birds, amphibians, and insects with parameter:
- Vegetation: type, density, dominance, frequency and diversity index.
- Fauna: species, distribution, abundance and diversity index

A. Source of Impact

- Mining activities in the CoW area.

B. Reference/Indicator of Impacts

- Changes in the diversity, abundance and distribution of major flora and fauna groups

C. Monitoring Objectives

- To determine whether changes in biodiversity are occurring within the CoW area

D. Monitoring Method

- Establish permanent biodiversity monitoring plots representing each forest ecosystem type existing in WBN’s CoW area
- Conduct surveys to monitor flora and fauna on permanent plots within WBN Contract of Work area.
- Survey for flora is through standard transect method in the permanent biodiversity monitoring plots
- Fauna survey is conducted using standard procedures that apply for each group of the fauna i.e. mammals, birds, reptiles, amphibians and insects

E. Monitoring Location

- Permanent biodiversity monitoring plots at:
  - One monitoring site at undisturbed mangrove forest
  - One monitoring site in undisturbed lowland alluvial forest
  - One monitoring site in undisturbed lowland ultramafic forest
  - One monitoring site in undisturbed lower montane forest
  - One monitoring site in undisturbed lowland karst forest
  - One monitoring site in reclamation area

F. Monitoring Period and Frequency

- Biodiversity surveys:
  - Regularly once every five years mine for undisturbed forest during the operating life of the mine
  - Once every two years for new reclamation site until first five years and thereafter once every 5 years during the operating life of the mine
G. Monitoring Institution

Conductor

- Environmental Health and Safety Department of WBN
- Mine Engineering Department

Supervisor

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
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- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.

2.9.7 Flora and Fauna in Natural Succession Area

Structure and composition of flora: Vegetation type, density, dominance and diversity index

Fauna: species, distribution, abundance and diversity index

A. Source of Impact

- Overburden removal and placement

B. Reference/Indicator of Impacts

- Progress of natural succession process in reclamation areas

C. Monitoring Objectives
To study the return of terrestrial biota in the natural succession areas

D. **Monitoring Method**

- Establish one permanent monitoring plots in an overburden placement site
- Conduct surveys to monitor the reestablishment of terrestrial flora and fauna communities (structure and composition) naturally in the permanent monitoring plots
- Collect, prepare and analyze soil samples from permanent natural succession monitoring plots in accordance with WBN protocol based on Indonesian National Standards (or other appropriate international standards).
- Prepare map and take photo of natural succession progress in the permanent monitoring plots

E. **Monitoring Location**

- Representative overburden placement sites at mine blocks within COW area

F. **Monitoring Period and Frequency**

- Once every year for the first 5 years and thereafter every five years during life time of the mine

G. **Monitoring Institution**

**Conductor**

- Environmental Health and Safety Department of WBN
- Mine Engineering Department

**Supervisor**

- BAPEDALDA of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.
- Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.
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• Environmental Agency (*Badan Lingkungan Hidup*) of East Halmahera Regency.
• Office of Mines and Energy of Central Halmahera Regency.
• Office of Mines and Energy of East Halmahera Regency.
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http://www.epa.gov/ttn/chief/ap42

http://www.epa.gov/ttn/chief/ap42/ch11
(metallic minerals processing)

http://www.mitrais.com

Appendix A

MATRIX SUMMARY OF ENVIRONMENTAL MONITORING PLAN
### Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

<table>
<thead>
<tr>
<th>Environmental Component/Activity</th>
<th>Monitoring Parameters</th>
<th>Sources of Impacts</th>
<th>Reference/Indicator of Impacts</th>
<th>Monitoring Objectives</th>
<th>Monitoring Methods</th>
<th>Monitoring Location</th>
<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Monitoring Institution</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Pre-Construction Stage</strong></td>
<td></td>
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<td>• Test Pit establishment</td>
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<tr>
<td>• Increase of erosion rate</td>
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<tr>
<td>• To provide data on sediment load</td>
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<tr>
<td>• To provide information on the efficiency of the sedimentation ponds/dams</td>
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<td>• To provide long term data on erosion in the representative mine area</td>
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<td><strong>Surface Water Quality</strong></td>
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<tr>
<td>• Test Pit establishment</td>
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<tr>
<td>• Increase of TSS concentration</td>
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<td>• To determine whether the effluent water which flows to waterbodies may cause changes in TSS concentration</td>
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<tr>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards)</td>
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<td>• Discharge from Test Pit Sediment Pond</td>
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<tr>
<td>• Santa Monica Stream (ASM in see Map 1)</td>
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<td>• For TSS parameter every three months during pre construction stage at the test pit trial area</td>
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<td><strong>Terrestrial Flora and Fauna</strong></td>
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<td>• Test Pit establishment</td>
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<tr>
<td>• Species structure and composition as well as wildlife habitat</td>
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<tr>
<td>• To record flora and fauna species in areas impacted by any land clearing of test pit activities</td>
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<tr>
<td>• To record protected flora and fauna found in the area to be cleared</td>
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<tr>
<td>• To record local plant species and seedlings potential for use in reclamation</td>
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<tr>
<td>• Conduct survey and make inventory of flora and fauna species in areas to be cleared for test pit</td>
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<tr>
<td>• Flora and fauna survey is conducted through standard method in forest area to be cleared</td>
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<tr>
<td>• Area to be cleared for test pit activity at Bukit Limbeng mining block</td>
<td>✗</td>
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<tr>
<td>• Baseline survey was conducted prior to the test pit trial</td>
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<td><strong>Environmental Health and Safety Department of WBN</strong></td>
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**Department of Energy and Mineral Resources, Republic of Indonesia.**

**BAPEDALDA of North Maluku Province.**

**Office of Mine and Energy of North Maluku Province.**

**Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**

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**Office of Mines and Energy of Central Halmahera Regency.**

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### Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

<table>
<thead>
<tr>
<th>Environmental Component/Activity</th>
<th>Monitoring Parameters</th>
<th>Sources of Impacts</th>
<th>Reference/Indicator of Impacts</th>
<th>Monitoring Objectives</th>
<th>Monitoring Methods</th>
<th>Monitoring Location</th>
<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Monitoring Institution</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater Aquatic Biota</td>
<td>Abundance of Plankton and Benthos</td>
<td>• Test Pit establishment</td>
<td>• Change of aquatic biota abundance</td>
<td>• To determine whether changes of aquatic biota (mainly benthos) are occurring</td>
<td>• Permanent plankton and benthos monitoring site at the Santa Monica Stream. Collect, prepare and analyze benthos samples from permanent monitoring plots in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for phytoplankton, zooplankton and benthos analyses.</td>
<td>• Once every two years during the pre construction stage</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province</td>
</tr>
<tr>
<td>Socio Economics</td>
<td>Job Opportunities</td>
<td>• Activities of Survey and Exploration (outsiders) recruited by WBN</td>
<td>• Number of local and non local employees engaged in the project</td>
<td>• To optimize job opportunities for local communities and to prioritize skilled local communities as needed by WBN in the employees recruitment</td>
<td>• Monitor the number, percentage and origin of local people employed by WBN by reviewing WBN and contractor’s employment records</td>
<td>• WBN Project Area</td>
<td>• Once every year during preconstruction period through operating life of the mine</td>
<td>• Human Resources Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
</tr>
<tr>
<td>Community Income</td>
<td>Land acquisition for mine project</td>
<td>• Number of people who receive income/benefit from land acquisition</td>
<td>• To identify level of community income in project area</td>
<td>• Record community income from government statistics (Kecamatan dalam angka)</td>
<td>• WBN Office Office of Villages around project area</td>
<td>• Once every year during preconstruction period through operating life of the mine</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
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<th>Reporting</th>
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<tbody>
<tr>
<td><strong>Land Ownership</strong></td>
<td>• Land Acquisition for mine project</td>
<td>• Change of land ownership and used or occupied by the people in the contract of work area (COW)</td>
<td>• Community unrest due to the issues of land acquisition</td>
<td>• To ensure that land acquisition process is in accordance with applicable laws and regulations on land and vegetation stand compensation</td>
<td>• Record total area of land released by land owners to WBN for mining activities from BPN office</td>
<td>• Record the location of the land released by the land owners</td>
<td>• Prepare land acquisition team legitimated by Decree of North Maluku Governor.</td>
<td>• Area to be exploited and mined at all mine blocks within project area</td>
<td>• Once every two years during preconstruction period through operating life of the mine</td>
<td>• External Relations Department of WBN</td>
</tr>
<tr>
<td><strong>Livelihood</strong></td>
<td>• Land Acquisition for mine project</td>
<td>• Change of Community livelihood as the agriculture land acquired for mine project</td>
<td>• To identify the changes in livelihood pattern in local communities</td>
<td>• Data collection about number of local employees that working in WBN and its contractors</td>
<td>• Villages around the project area</td>
<td>• Once every two years during preconstruction period through operating life of the mine</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province</td>
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<tr>
<td><strong>Community Unrest</strong></td>
<td>• Land Requisition, unmet expectations of lost job opportunities</td>
<td>• Increase in dissatisfaction in the Project by local community.</td>
<td>• To detect community tension before it develops into unrest</td>
<td>• Record number of formal community complaints to the company through relevant government/institutions offices</td>
<td>• Villages around the project area</td>
<td>• Once every year during preconstruction period through operating life of the mine</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Supervising Supervisor</th>
<th>Monitoring Institution or Agency</th>
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<tr>
<td><strong>Air Quality</strong></td>
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<tr>
<td>TSP and dustfall</td>
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<td></td>
<td>Change in TSP concentration in ambient air</td>
<td>To identify the long-term trends of air quality in WBN’s project area</td>
<td>TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations</td>
<td>Dust fall is monitored using depositional dust gauges, as per applicable regulations.</td>
<td>Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)</td>
<td>Once every three months during the construction period through operating life of the mine and KU-4 (see Map -2 and Table-1)</td>
<td>Environmental Health and Safety Department of WBN</td>
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<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</td>
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<tr>
<td><strong>Noise</strong></td>
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<td></td>
<td>Increase of noise level</td>
<td>Identify long-term trends of noise level at WBN project area</td>
<td>Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.</td>
<td>Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)</td>
<td>Once every three months during the construction period through operating life of the mine</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td><strong>Soils</strong></td>
<td>Soil Erosion</td>
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<td>Increase of TSS</td>
<td>To provide data on sediment load</td>
<td>To get data on sediment load and sedimentation trap efficiency</td>
<td>One representative monitoring plot at the sedimentation trap</td>
<td>TSS monitoring once a month during the construction period through operating life of the mine</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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</table>

*Note: TSS = Total Suspended Solids*
### Hydrology

- **Surface Runoff Flow Rate**
  - **Reference/Indicator of Impacts**: Increase of surface water run off rate
  - **Monitoring Objectives**: To identify long term trends of water level
  - **Monitoring Methods**: Monitor water level of the river using automatic water level recording or stage gauge
  - **Important streams within the WBN Cow area**
    - Ake Kobe (AKOBE)
    - Ake Wosea (AWOS)
    - Ake Sake (ASAKE)
    - Ake Gemaf (AGEM)
    - Ake Sagae (ASG-2)
  - **Monitoring Period and Frequency**: Water level monitoring at the rivers once a month during the construction period through operating life of the mine
  - **Conductor**: Environmental Health and Safety Department of WBN
  - **Supervising Institution**: Department of Energy and Mineral Resources, Republic of Indonesia

### Surface Water Quality

- **TSS**
  - **Reference/Indicator of Impacts**: Increase of TSS concentration
  - **Monitoring Objectives**: To determine whether the effluent water which flows may cause changes in TSS concentration.
  - **Monitoring Methods**: Monitor TSS content in water flowing into sedimentation trap.
    - Monitor TSS content in the outflow of sedimentation trap.
    - Monitor TSS in important stream within the WBN Cow.
    - Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).
    - One representative monitoring plot at the sedimentation trap.
    - Important streams within the WBN Cow area (see Map-3 and Table-2).
      - Ake Kobe (AKOBE)
      - Ake Wosea (AWOS)
      - Ake Sake (ASAKE)
      - Ake Gemaf (AGEM)
      - Ake Sagae (ASG-2)
  - **Monitoring Period and Frequency**: TSS monitoring once a month during the construction period through operating life of the mine
  - **Conductor**: Environmental Health and Safety Department of WBN
  - **Supervising Institution**: Department of Energy and Mineral Resources, Republic of Indonesia

### Sea Water Quality

- **TSS, Turbidity and Oil & Grease**
  - **Reference/Indicator of Impacts**: Increase of TSS, turbidity and oil & grease concentration
  - **Monitoring Objectives**: To determine whether the port construction and mobilization of equipment and material cause changes in TSS, turbidity and oil and grease concentration.
  - **Monitoring Methods**: Collect, prepare and analyze marine water samples according to WBN’s protocols in accordance with Indonesian National Standards (if there is no SNI use other appropriate international standards).
    - Three locations adjacent to the Port Facility (see Map-4 and Table-3):
      - 500 m to the east of the port (DP-1)
      - 500 m to the west of the port (DP-2)
      - 500 m out to sea of the port (DP-3)
  - **Monitoring Period and Frequency**: TSS, turbidity and oil & grease will be monitored every month during construction period through operating life of the mine
  - **Conductor**: Environmental Health and Safety Department of WBN
  - **Supervising Institution**: Department of Energy and Mineral Resources, Republic of Indonesia

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**Environmental Resources Management**

MATRIX RPL V1 19 FEB09 -PURI.DOC

Weda Bay Nickel
Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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<th>Supervisor</th>
<th>Reporting</th>
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<tbody>
<tr>
<td>Terrestrial Flora and Fauna</td>
<td>• Species structure and composition of flora  • Wildlife habitat quality</td>
<td>• Land clearing for construction of project facilities</td>
<td>• Disturbance to biodiversity  • Protected flora and/or fauna might be impacted by the mining activities</td>
<td>• To record flora and fauna species in areas impacted by land clearing for support facilities  • To record protected flora and fauna found in the area to be cleared  • To record local plant species and seedlings potential for use in reclamation</td>
<td>• Conduct a survey and make an inventory of flora and fauna species in areas to be cleared for support facilities  • Flora and fauna survey is conducted through standard method for survey of flora and fauna in forest area to be cleared</td>
<td>• Area to be cleared for support facilities within project area</td>
<td>• Baseline survey conducted once prior to any land clearing activity</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia  • BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province  • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency  • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency  • Office of Mines and Energy of Central Halmahera Regency  • Office of Mines and Energy of East Halmahera Regency</td>
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<tr>
<td>Freshwater Aquatic Biota</td>
<td>Abundance of Plankton and Benthos</td>
<td>• Land clearing for construction of project facilities</td>
<td>• Change of Aquatic Biota abundance</td>
<td>• To determine whether changes of aquatic biota (mainly benthos) are occurring</td>
<td>• Monitor aquatic biota (plankton and benthos) abundance at the permanent monitoring sites  • Collect, prepare and analyze plankton and benthos samples from permanent monitoring sites in accordance with WBN's protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for plankton and benthos analyses.</td>
<td>• Permanent plankton and benthos monitoring sites at (Map-5 and Table-4):  • Ake Wosea (BWS-1)  • Ake Wosea (BWS-1)  • Ake Sake (BSK-1)  • Ake Gemal (BGC-1)  • Ake Sagas (BSC-1)</td>
<td>• Every year during the construction period</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia  • BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province  • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency  • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency  • Office of Mines and Energy of Central Halmahera Regency  • Office of Mines and Energy of East Halmahera Regency</td>
</tr>
<tr>
<td>Marine Biota</td>
<td>Coral reef fish and coral lifeforms</td>
<td>• Land clearing for construction (dedicated offshore and barge loading facility)</td>
<td>• Change in marine coral reef condition</td>
<td>• To measure the changes in marine biota (in particular reef fishes and coral condition)</td>
<td>• Monitor coral reef fish and coral lifeforms at the permanent monitoring sites  • Survey of coral reef fish and coral lifeforms is conducted through standard method for survey of coral reef</td>
<td>• Three locations adjacent to the Port Facility (see Map-4 and Table-3):  • 500 m to the east of the port (DP-1)  • 500 m to the west of the port (DP-2)  • 500 m out to sea of the port (DP-3)</td>
<td>• Every two years during construction period</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia  • BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province  • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency  • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency  • Office of Mines and Energy of Central Halmahera Regency  • Office of Mines and Energy of East Halmahera Regency</td>
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WEDA BAY NICKEL
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<tr>
<td>Socio Economics</td>
<td>Job Opportunities</td>
<td>• Construction workforces employment and release</td>
<td>• Number of local and non local employees (outsiders) recruited and released by WBN</td>
<td>• To record local recruitment.</td>
<td>• Monitor the number, percentage and origin of employees of the Project by reviewing WBN’s and contractor’s employment records</td>
<td>• Project Area</td>
<td>• Once a year during the Construction period through operating life of the mine</td>
<td>• Human Resources Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. BAPEDALDA of North Maluku Province</td>
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<tr>
<td>Business Opportunities</td>
<td>Mobilization of equipment and material.</td>
<td>• Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)</td>
<td>• Land clearing</td>
<td>• Port construction (dedicated port and barge loading facility)</td>
<td>• The level of participation of local people, local contractors and general community in various activities related to WBN operation.</td>
<td>• To record the number of entrepreneurs participating in Project development.</td>
<td>• Collect data regarding number of local entrepreneur that participate in the provision of goods and services.</td>
<td>• WBN Office</td>
<td>• Office of Industrial and Trade Agency of Central and East Halmahera Regencies.</td>
</tr>
<tr>
<td>Community Income</td>
<td>Construction workforces employment and release</td>
<td>• Construction of temporary residential facility (construction camp), mine roads, processing facility and RSF (residue storage facility)</td>
<td>• Change of community income.</td>
<td>• To record changes of community income.</td>
<td>• Data collection on household income from government statistics (Kementerian dalam Angka).</td>
<td>• Villages around the project area</td>
<td>• Once every year, during Construction period through operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. BAPEDALDA of North Maluku Province</td>
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</table>
### Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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<th>Reporting</th>
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</thead>
<tbody>
<tr>
<td>Livelihood Pattern</td>
<td>• Construction workforce employment</td>
<td>• Change of livelihood pattern in Community</td>
<td>• To identify changes in livelihood pattern in local communities</td>
<td>• Data collection on household income from government statistics (Kecamatan dalam Angka).</td>
<td>Villages around the project area</td>
<td>Once a year, during Construction period through operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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</table>

| Socio Culture                    | Migration (Estimate of population and density in villages around project area) | • Construction workforce employment | • Newcomers to the Project Area, other than workforce. | • Increased migration and population growth in villages around project area. | • Data collection on demography from government statistics (Kecamatan dalam Angka). | Villages around the project area | Once a year, during Construction period through operating life of the mine. | • External Relations Department of WBN | • Department of Energy and Mineral Resources, Republic of Indonesia. |

| Assimilation and Acculturation    | • Construction workforce employment and Migration. | • Interaction between local community and newcomers. | • To detect community tension before it develops into unrest. | • Record data on resulting of formal and informal meetings with community member representative and village leaders. | Villages around the project area | Once a year, during Construction period through operating life of the mine. | • External Relations Department of WBN | • Department of Energy and Mineral Resources, Republic of Indonesia. | • Department of Energy and Mineral Resources, Republic of Indonesia. |

**Note:** BAPEDALDA refers to the Bureau of Environmental Management and Development of Natural Resources, Republic of Indonesia.
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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<th>Monitoring Methods</th>
<th>Monitoring Location</th>
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<th>Conducting Institution</th>
<th>Supervising Institution</th>
<th>Reporting Institution</th>
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<tbody>
<tr>
<td>Alteration of social values and norms</td>
<td>• Construction workforces employment. • Interaction between local and newcomers</td>
<td>Construction workforces employment.</td>
<td>• Changes to traditional, cultural values and customs.</td>
<td>• To detect community tension before it develops into unrest.</td>
<td>• Record data on resulting of formal and informal meetings with community member representative and village leaders.</td>
<td>Villages around the project area.</td>
<td>Once a year, during construction period through operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
</tr>
<tr>
<td>Community Unrest</td>
<td>• Unmet expectations for job and business opportunities. • Social norms and values of local community not respected by construction workforce.</td>
<td>• Increase in dissatisfaction in the project by local community.</td>
<td>• To detect community tension before it develops into unrest.</td>
<td>• Record number of formal and informal community complaints to the company through relevant government/institutions offices. • Record data on resulting of formal and informal meetings with community member representative and village leaders.</td>
<td>Villages around the project area.</td>
<td>Once a year, during construction period through operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Public Health</td>
<td>• Prevalence of workforces displacement and migration. • Potential increase in prevalence of diseases. • Inadequacy of public health services and degradation of sanitation.</td>
<td>• To identify changes in diseases prevalence in community.</td>
<td>• Collection of secondary data from local health institutions and facilities on the prevalence of disease in the local community.</td>
<td>Villages around the project area.</td>
<td>Once a year, during construction period through operating life of the mine.</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province</td>
<td>• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency. • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency. • Office of Mines and Energy of Central Halmahera Regency. • Office of Mines and Energy of East Halmahera Regency.</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province.</td>
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### C. Operation Stage of Ore Mining
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<th>Supervising</th>
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<tr>
<td><strong>Air Quality</strong></td>
<td>• TSP</td>
<td>• Oreo transportation</td>
<td>• Change in TSP concentration in ambient air</td>
<td>• To identify the long-term trends of air quality in WBN’s project area</td>
<td>• TSP is monitored using Hi-Vol Dust sampler or other equivalent equipment that fulfills the requirement of applicable regulations</td>
<td>• Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)</td>
<td>• Once every three months through operating life of the mine</td>
<td>• Environmental Health and Safety Department of WBN</td>
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<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td></td>
<td>• Dustfall</td>
<td>• Oreo transportation</td>
<td>• Increment of dustfall</td>
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<td>• Dustfall is monitored using depositional dust gauges, as per applicable regulations.</td>
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<tr>
<td><strong>Noise</strong></td>
<td>Noise</td>
<td>• Ore transportation</td>
<td>• Change of noise level at WBN project area</td>
<td>• To identify long-term trends of noise level in WBN project area</td>
<td>• Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard</td>
<td>• Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)</td>
<td>• Annual Noise Survey to be conducted through operating life of the mine</td>
<td>• Environmental Health and Safety Department of WBN</td>
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<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td></td>
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<td>• Ore transportation by trucks</td>
<td>• Increase of noise</td>
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<td>• BAPEDALDA of North Maluku Province</td>
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<tr>
<td></td>
<td></td>
<td>• Ore transportation</td>
<td>• Noise level at WBN project area</td>
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<td>• Office of Mine and Energy of North Maluku Province</td>
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<tr>
<td><strong>Morphology and Physiographic</strong></td>
<td>Landform</td>
<td>• Removal and placement of overburden, ore mining, overburden transportation and stockpiling in the mine area</td>
<td>• Change of topography in term of elevation and slope in the mine area related to ore mining and overburden placement sites which affect the slope’s stability</td>
<td>• To provide up-to-date information on the changes in topography and morphology in the active mining areas and overburden placement sites which affect the slope’s stability</td>
<td>• Monitor physical stability of active mining and overburden placement sites using survey or standard equipment for slope stability monitoring (such as extensometers, prism, and or other equivalent tools) or by visual observation. Monitor and map changes in topography and morphology by ground survey and satellite images.</td>
<td>• Active mine and overburden placement sites in project area</td>
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<td>• Mine Engineering Department</td>
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<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td></td>
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<td>• Removal and placement of overburden, ore mining, overburden transportation and stockpiling in the mine area</td>
<td>• Change of topography in term of elevation and slope in the mine area related to ore mining and overburden placement sites which affect the slope’s stability</td>
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<td>• Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</td>
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<td>• Office of Mines and Energy of East Halmahera Regency.</td>
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<td>Increase of erosion rate</td>
<td>To provide data on sediment load and sedimentation ponds/dams efficiency:</td>
<td>One representative permanent monitoring plot at sedimentation ponds. This location is maintained until post mined period</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td><strong>Hydrology</strong></td>
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<td>Increase of surface water run off rate</td>
<td>To identify long term trends of flow rate in some important streams within the WBN CoW area</td>
<td>Important streams within the WBN CoW area (see Table-3):</td>
<td>Water level monitoring at the rivers every three months during Operations phase.</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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### Monitoring Methods

- **Soils**
  - **Effluent water discharge from sedimentation ponds every month during Operations phase.**
  - **Collect, prepare, and analyze TSS in water sample according to WBN’s protocol or in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards):**
  - **Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge.**

- **Hydrology**
  - **Collect, prepare, and analyze TSS in water sample according to WBN’s protocol or in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards):**
  - **Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge.**

### Important Streams

- **Ake Kobe (ARKOB)**
- **Ake Wesa (AKWES)**
- **Ake Sake (ASAKE)**
- **Ake Gemaf (AGEM)**
- **Ake Suga (AGS)**

### Relevant Institutions

- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of Central Halmahera Regency.**
- **Office of Mines and Energy of East Halmahera Regency.**
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<th>Conductor</th>
<th>Monitoring Institution Reporting</th>
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<tbody>
<tr>
<td>Surface Water Quality</td>
<td>TSS</td>
<td>• To comply with applicable regulations on effluent water quality standard of nickel mining activity</td>
<td>• To determine whether the effluent water which flows to watersheds may cause changes in TSS concentration.</td>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).</td>
<td>To comply with applicable regulations on effluent water quality standard of nickel mining activity. Rivers/streams (see Map-6 and Table 5): - Ake Jira Downstream (AJIRA-2) - Ake Jira Middle (AJIRA-3) - Ake Jira Upstream (AJIRA-4) - Ake Kob (AKOB) - Ake Wosoa (AWOS) - Ake Gejenti (AGEJ) - Ake sake (ASAKE) - Ake Sedi (ASEL) - Ake Gema (AGEM) - Ake Sagea Upstream (ASG-2) - Ake Sangisi (ASlx)</td>
<td>Every day at discharge point from sedimentation ponds during the operating life of the mine. Every three months at sampling point during the operating life of the mine: AJIRA-4, AJIRA-3, AJIRA-1, ASELO-1, AKOB, AWOS, AGEL, ASAKE, ASEL, and AGEM. Every three months at sampling point: ASG-2 and ASE-1 during the operating life of the mine.</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province. • Office of Mine and Energy of North Maluku Province. • Environmental Management Agency (Badan Lingkungan Hidayat) of Central Halmahera Regency. • Environmental Agency (Badan Lingkungan Hidayat) of East Halmahera Regency.</td>
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</table>
### Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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<tr>
<th>Environmental Component/Activity</th>
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<th>Monitoring Institution</th>
<th>Reporting</th>
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</thead>
<tbody>
<tr>
<td>Mg, Fe, Mn and trace metals (Cr, Co, Pb, As, Ga, Cr, Ni and Zn)</td>
<td>• Removal and placement of overburden, ore mining, and stockpiling in the mine area</td>
<td>• Potential changes in receiving water quality especially major and trace metals</td>
<td>• To determine whether water inflow to the rivers/stream is impacting the water quality</td>
<td>• To record long term trends of water quality in rivers/stream within project area</td>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards)</td>
<td>• Discharge from sediment ponds adjacent to active mining areas.</td>
<td>• Metals will be monitored every month the during operating life of the mine at discharge from sediment ponds adjacent to active mining areas.</td>
<td>• Metals will be monitored every three months during the operating life of the mine at sampling point.</td>
<td>• Environment Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Terrestrial Flora and Fauna</td>
<td>Species structure and composition as well as wildlife habitat</td>
<td>• Land clearing for mine area</td>
<td>• Disturbance to biodiversity</td>
<td>• Progressive Reclamation during mine development</td>
<td>• To record flora and fauna species in areas impacted by any land clearing for mining activities</td>
<td>• To record protected flora and fauna found in the area to be cleared</td>
<td>• To record local plant species and seedlings potential for use in reclamation</td>
<td>• Conduct survey and make inventory of plant species in one plot reclamation site</td>
<td>• Survey is conducted through standard transect method in forest area to be cleared</td>
<td>• Environment Health and Safety Department of WBN</td>
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</table>
### Freshwater Aquatic Biota

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<th>Environmental Component/Activity</th>
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</thead>
</table>
| Abundance of Plankton and Benthos | - Stripping and Piling of topsoil  
- Removal and placement of overburden, ore mining, and stockpiling in the mine area  
- Progressive Reclamation during mine development | - Change of Aquatic Biota abundance | - To determine whether changes of aquatic biota (mainly benthos) are occurring | - Collect, prepare and analyze plankton and benthos samples from permanent monitoring sites in accordance with WBN's protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for phytoplankton, zooplankton and benthos collection, identification and analyses. | Permanent plankton and benthos monitoring sites at (see Map-7 and Table 6):  
  - Ake Jira Upstream (BIR-4)  
  - Ake Jira Middle (BIR-3)  
  - Ake Jira Downstream (BIR-2)  
  - Ake Seloi Upstream (BSL-1)  
  - Ake Wossa (BWS-1)  
  - Ake Gejemli (BGJ-1)  
  - Ake Suka (BSK-1)  
  - Ake Gemaf (BGF-1)  
  - Ake Sagoa Upstream (BSG-2)  
  - Ake Sangaji Upstream (ASJ-1) | - Every year during operating life of the mine | - Environmental Health and Safety Department of WBN | - Department of Energy and Mineral Resources, Republic of Indonesia  
- BAPEDALDA of North Maluku Province  
- Office of Mine and Energy of North Maluku Province  
- Environmental Management Agency (Badan Pengelola Lingkungan Hidayat) of Central Halmahera Regency.  
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### Socio Economics

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</table>
| Job Opportunities | - Employment of operations workforce. | - Number of local and non local employees (outsiders) recruited by WBN and contractors | - To record number of local recruitment by WBN and contractors | - Monitor the number, percentage and origin of employees of the Project by reviewing WBN’s and contractor’s employment records. | - Project Area | - Every year during the operating life of the mine | - Human Resources Department of WBN | - Department of Energy and Mineral Resources, Republic of Indonesia  
- BAPEDALDA of North Maluku Province  
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<tr>
<td>Business Opportunities</td>
<td>• Project Operation, in particular catering supplies, waste management, maintenance</td>
<td>• Land clearing for mine area</td>
<td>• Progressive Reclamation during mine development</td>
<td>• The level of participation of local people, local contractors and general community in various activities related to WBN operation.</td>
<td>• To record the number of entrepreneurs participating in Project Operations.</td>
<td>• Collect data regarding number of local entrepreneur that participate in the provision of goods and services: o Number of officially locally owned and operated businesses o Types of goods and services provided o Value of local economic activities</td>
<td>• WBN Office Office of Industrial and Trade Agency of Central and East Halmahera Regencies.</td>
<td>• Once every year, during the operating life of the mine.</td>
<td>• Purchasing Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Community Income</td>
<td>• Employment of Operations workforce</td>
<td>• Land clearing for mine area</td>
<td>• Change of community income</td>
<td>• To record changes of community income</td>
<td>• Data collection on household income from government statistics (Kecamatan dalam Angka).</td>
<td>• Villages around the project area</td>
<td>• Once every year, during operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Livelihood Pattern</td>
<td>• Employment of operations workforce</td>
<td>• Land clearing for mine area</td>
<td>• Change of livelihood pattern in Community</td>
<td>• To identify the changes in livelihood pattern in local communities</td>
<td>• Data collection on household income from government statistics (Kecamatan dalam Angka). • Data collection on people occupation from government statistics (Kecamatan dalam Angka). • If necessary and required conduct survey to collect primary data on livelihood pattern in the villages around the project area using standard socio-economic and culture survey method.</td>
<td>• Villages around the project area</td>
<td>• Once a year, during operating life of the mine. • Once every five years for survey of livelihood pattern in operation life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td>Office of Mines and Energy of East Halmahera Regency</td>
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*Note: The table above outlines the environmental monitoring components, the objectives, and the methods used to monitor these components. It also specifies the monitoring period and frequency, the monitoring location, the monitoring institution, and the conducting department.*
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<tbody>
<tr>
<td>Migration (estimate of population and population density in villages around project area)</td>
<td>Operations workforce</td>
<td>BAPEDALDA of North Maluku Province</td>
<td>External Relations</td>
<td>To detect the population increase within villages around the project area.</td>
<td>Data collection of demography from government statistics (Kecamatan data).</td>
<td>Villages around the project area</td>
<td>Once a year, during operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>To detect the population increase within villages around the project area.</td>
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<td>Office of Mine and Energy of North Maluku Province</td>
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<tr>
<td>Increased migration and population growth in villages around project area.</td>
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<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</td>
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<td>If necessary and required conduct survey to collect primary data on demography (mainly migration) in the villages around the project area using standard socio-economic and culture survey method.</td>
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<td>Monitoring Location</td>
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<tr>
<td>Socio Cultural</td>
<td>Employment of operation workforce</td>
<td>BAPEDALDA of North Maluku Province</td>
<td>External Relations</td>
<td>To detect community tension before it develops into unrest.</td>
<td>Record data on resulting of formal and informal meetings with community members representative and village leaders.</td>
<td>Villages around the project area</td>
<td>Once a year, during operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Interaction between local community and newcomers.</td>
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<td>If necessary and required conduct survey to collect primary data on aspects of assimilation and acculturation in the villages around the project area using standard socio-economic and culture survey method.</td>
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<td>Assimilation and Acculturation</td>
<td>Employment of operation workforce</td>
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<td>Environmental Management Agency</td>
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<tr>
<td>Alteration of social values and norms</td>
<td>Employment of operation workforce</td>
<td>BAPEDALDA of North Maluku Province</td>
<td>Environmental Management Agency</td>
<td>To detect community tension before it develops into unrest.</td>
<td>Record data on resulting of formal and informal meetings with community members representative and village leaders.</td>
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<td>Environmental Management Agency</td>
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<td>Proximation between local community newcomers</td>
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<tr>
<td>Changes to traditional, cultural values and customs.</td>
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<tr>
<td>Community Unrest</td>
<td>• Unmet expectations for job and business opportunities. • Social norms and values of local community not respected by Construction Workforce.</td>
<td>• Increase in dissatisfaction in the Project by local community • To detect community tension before it develops into unrest</td>
<td></td>
<td>• Record number of formal community complaints to the company through relevant government/institutions offices • Record data on resulting of formal and informal meetings with community member representative and village leaders.</td>
<td>• Villages around the project area. • Once a year, during operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td></td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td></td>
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</tr>
<tr>
<td>Quality of Indigenous People</td>
<td>• Land clearing for mine area. • Changes in quality of Indigenous People habitat</td>
<td>• To determine stress/changes in livelihood patterns of Indigenous People.</td>
<td></td>
<td>• Data collection based on impromptu/unarranged interaction with Indigenous People during initial survey and clearing. • If necessary and required conduct survey to collect primary data on Indigenous People livelihood patterns using standard socio-culture survey method</td>
<td>• Project Area. • Interactions recorded as/when they occur. • Survey on Indigenous People livelihood conducted every five years during operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td></td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td></td>
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</tr>
<tr>
<td>Habitat</td>
<td>• Prevalence of Diseases • Employment of Operations workforce and migration.</td>
<td>• Potential increase in prevalence of diseases • Inadequacy of public health services and degradation of sanitation</td>
<td></td>
<td>• To identify changes in diseases prevalence in community.</td>
<td>• Villages around the project area. • Secondary data collected once a year during operating life of the mine. • Public Health Survey conducted every five years during operating life of the mine.</td>
<td>External Relations Department of WBN</td>
<td></td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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</tbody>
</table>

### D. Operation Stage of Ore Processing

- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of Central Halmahera Regency.**
- **Office of Mines and Energy of East Halmahera Regency.**

- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of Central Halmahera Regency.**
- **Office of Mines and Energy of East Halmahera Regency.**
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<th>Conductor</th>
<th>Reporting</th>
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</thead>
<tbody>
<tr>
<td>Air Quality</td>
<td>SOx and H2S</td>
<td>Changes of SOx and H2S in ambient air</td>
<td></td>
<td>Identify long term trends of air quality at the vicinity of nickel processing plant</td>
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<td>Monitor ore processing plant stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard. Monitor ambient air quality in accordance with GOI protocol or SNI standard</td>
<td>Emisson at three stacks:  o Ambient Atmospheric Leaching Stack,  o Secondary Neutralisation Stack,  o Cobalt Recovery Stack</td>
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<tr>
<td>Surface Water Quality</td>
<td>TSS, pH, Hardness, Mg, Fe, Mn and trace metals (Cr\textsuperscript{6+}, Cu, Pb, As, Cd, Co, Ni and Zn), and SCs</td>
<td></td>
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<td>Monitoring changes in receiving water quality</td>
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<td>To comply with applicable regulation on effluent water quality</td>
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<td></td>
<td>To record long term trends of water quality in rivers/streams</td>
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<tr>
<td>Groundwater Quality</td>
<td>pH, Mg, Fe, Mn, and trace metals (Cr\textsuperscript{6+}, Cu, Pb, As, Cd, Co, Ni and Zn), and SCs</td>
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<td>Monitoring changes in groundwater quality due to infiltration from Residue Storage Facility (RSF)</td>
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<td></td>
<td>To determine whether infiltration from Residue Storage Facility (RSF) may cause changes to surface water quality</td>
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<td>To record long term trends of water quality in rivers/streams</td>
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<td>Collect, prepare and analyze water samples according to WBN\textquoteright;s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards)</td>
<td>Discharge of the Polishing Pond adjacent to the RSF</td>
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<td></td>
<td>Every day for pH and TSS at discharge point of polishing pond</td>
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<td></td>
<td></td>
<td>Every month for Cr\textsuperscript{6+}, Cu, Pb, As, Cd, Co, Ni and Zn at discharge point of polishing pond</td>
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<td>Every three months for complete parameter at Jira River</td>
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<td>All monitorings are conducted during operating life of the mine</td>
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</tr>
</thead>
<tbody>
<tr>
<td>Seawater Quality</td>
<td>TSS, Temperature, Turbidity, Mg, Fe, Mn and trace metals (Cr6+, Cu, Pb, As, Cd, Co, Ni and Zn), and SO4</td>
<td>Wastewater management (supernatant discharge)</td>
<td>Potential changes in sea water quality due to wastewater discharge</td>
<td>To determine whether the effluent water may cause changes to seawater quality</td>
<td>Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).</td>
<td>Effluent water at Processing Plant prior to Outfall</td>
<td>Once per day for pH and TSS at sampling point prior to outfall (effluent water)</td>
<td>Environmental Health and Safety Department of WBN</td>
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<td></td>
<td>Three locations adjacent to outfall (see Map-8 and Table 7):</td>
<td>Once per month for Cr6+, Cu, Pb, As, Cd, Co, Ni and Zn at sampling point prior to outfall (effluent water)</td>
<td>Environmental Monitoring Agency (Badan Lingkungan Hidup) of Central Halmahera Regency.</td>
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<td>o 500 m to the west of outfall parallel to the coast (OF-3)</td>
<td>Once every three months for complete parameter at marine and lagoon water quality sampling sites</td>
<td>Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.</td>
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<td>o 500 m to the east of outfall parallel to the coast (OF-2)</td>
<td>All monitorings are conducted during operating life of the mine.</td>
<td>Office of Mines and Energy of East Halmahera Regency.</td>
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<td>o 500 m out to the sea perpendicular to the coast (OF-3)</td>
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<td>Office of Mines and Energy of East Halmahera Regency.</td>
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<td>Two locations at reference sites Map-8 and Table 7:</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td></td>
<td>Two locations at Sagoa Lagoon (Map-8 and Table 7):</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td>o Sagoa Lagoon opposite to outlet (ADSG-2)</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td></td>
<td>Three locations adjacent to the Port Facility (see Map-4 and Table-3):</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td>o 500 m to the east of the port (DP-1)</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td></td>
<td>o 500 m to the west of the port (DP-2)</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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<td>o 500 m out to sea of the port (DP-3)</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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</tbody>
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<th>Monitoring Methods</th>
<th>Permanent aquatic biota monitoring sites at (see Map-7 and Table 6):</th>
</tr>
</thead>
</table>
| Freshwater Aquatic Biota | Abundance of Plankton, Benthos and Nekton. | Solid residue management (placement of filter cake) | Change of Aquatic Biota abundance (plankton, benthos and nekton) in Ake Jira | To determine whether the effluent water from Residue Storage Facility (RSF) may cause changes to aquatic biota abundance | Collect, prepare and analyze aquatic biota (plankton, benthos and nekton) samples from permanent monitoring sites (Ake Jira) in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for plankton, benthos and nekton collection, identification and analyses. | Ake Jira Upstream (BR-4)  
Ake Jira Middle (BR-3)  
Ake Jira Downstream (BR-2) |
| Marine Biota | Abundance of Plankton, Benthos, coral reef fishes and coral life forms | Wastewater management (supernatant discharge) | Change in marine biota abundance and condition. | To determine the changes in marine biota (in particular benthos and reef fishes and coral condition) | Collect, prepare and analyze marine biota (plankton and benthos) samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for marine plankton and benthos identification and analyses. | Plankton and benthos once every two years during operating life of the mine  
Coral reef fishes and coral life forms once every three years |

### Monitoring Period and Frequency
- **Once every year during operating life of the mine**

### Conductor
- **Environmental Health and Safety**

### Monitoring Institution
- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of East Halmahera Regency.**

### Reporting
- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
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- **Office of Mines and Energy of Central Halmahera Regency.**
# Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

## Environmental Monitoring Summary Table

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td>TSP Dustfall</td>
<td>• TSP concentration in ambient air</td>
<td>• Once every three months during operating life of the mine.</td>
<td>• Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-1)</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td><strong>Office of Mine and Energy of North Maluku Province</strong></td>
</tr>
<tr>
<td></td>
<td>Limestone quarrying</td>
<td>• Limestone production</td>
<td>• To determine the long-term trends in emissions.</td>
<td>• Monitor limestone plant stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td><strong>Office of Mine and Energy of North Maluku Province</strong></td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Noise</td>
<td>• Limestone quarrying (blasting)</td>
<td>• Identify long-term trends of noise level at WBN project area</td>
<td>• Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td><strong>Office of Mine and Energy of North Maluku Province</strong></td>
</tr>
</tbody>
</table>

**Notes:**
- TSP: Total Suspended Particles
- GOI: Government of Indonesia
- SNI: National Standard of Indonesia

**Source:**
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<th>Reporting</th>
</tr>
</thead>
</table>
| **Vibration**                   | Vibration             | • Limestone quarrying (blasting) | • Complaint on Vibration  
• Structural damage of infrastructures | • To determine the level of nuisance to nearby communities as a result of vibration caused by blasting.  
• Vibration level is monitored using equipment in accordance with GOI protocol or SNI standard. | • One location at the nearest village to represent communities around the project  
• Gersal Village | • Annual Vibration Survey to be conducted during operating life of the mine | Environmental Health and Safety  
BAPEDALDA of North Maluku Province  
Office of Mine and Energy of North Maluku Province  
Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.  
Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
Office of Mines and Energy of Central Halmahera Regency.  
BAPEDALDA of North Maluku Province  
Office of Mine and Energy of North Maluku Province  
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Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
Office of Mines and Energy of Central Halmahera Regency.  
| **Morphology and Physiographic** | Landform              | • Limestone quarrying | • Change of topography in term of elevation and slope in the limestone mine area related to limestone quarrying | • To provide up-to-date information on the changes in topography and morphology in the limestone quarry site | • Monitor physical stability of active quarry using survey or standard equipment for slope stability monitoring (such as extensometers, prism, and or other equivalent tools) or by visual observation  
• Monitor and map changes in topography and morphology by ground survey and satellite images | • Active quarry site in the project area | Slope stability monitoring as required in active quarry location  
• Monitoring of changes in topography: once during the quarry life. | Limestone Quarry  
BAPEDALDA of North Maluku Province  
Office of Mine and Energy of North Maluku Province  
Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.  
Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
Office of Mines and Energy of Central Halmahera Regency.  
BAPEDALDA of North Maluku Province  
Office of Mine and Energy of North Maluku Province  
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Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
Office of Mines and Energy of Central Halmahera Regency.  
| **Soil**                        | Soil Erosion           | • Land clearing for limestone quarrying  
• Strippling and piling of topsoil | • Increase of erosion rate | • To provide data on sediment load  
• To provide information on the efficiency of the sedimentation ponds/dam  
• To provide long term data on erosion in the limestone quarry area | • To obtain data on sediment load and sedimentation pond efficiency:  
• Monitor the TSS content and flow rate of the inflow water to sedimentation pond.  
• Monitor TSS content and flow rate of the outflow water from sedimentation pond.  
• Collect, prepare, and analyze TSS sample water according to WBN’s protocol in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).  
• Measure flow rate of the sedimentation pond outlet by stream gauging or weir or stage gauge | • One representative permanent monitoring plot at sedimentation pond. This location is maintained until completion of quarry life | TSS and flow rate monitoring once a month during Operations phase.  
• Maintain the permanent plot during the operating life of the quarry. | Environmental Health and Safety  
BAPEDALDA of North Maluku Province  
Office of Mine and Energy of North Maluku Province  
Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.  
Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.  
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<tr>
<td><strong>Hydrology</strong></td>
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<td>Surface Runoff Flow Rate</td>
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<td>Limestone Quarry</td>
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<td>Increase of surface water run off rate</td>
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<td>To identify: long term trends of flow rate in some important streams adjacent to limestone quarry site</td>
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<td>To identify: long term trends of effluent water flow rate from the sedimentation pond</td>
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<td>Monitor water level of the river using automatic water level recording or stage gauge</td>
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<td>One location on the Gemaf River (AGEM) see Map-3 and Table-2</td>
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<td>Discharge from sediment pond adjacent to limestone quarry site</td>
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<td>Effluent water discharge from sedimentation ponds every months during the operating life of the limestone quarry</td>
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<td>Water level monitoring at the river every three months during Operations phase.</td>
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<td><strong>Hydrogeology</strong></td>
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<td>Limestone quarrying</td>
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<td>Change of groundwater flow pattern</td>
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<td>To identify: long-term trends of groundwater flow pattern change due to limestone quarrying.</td>
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<td>Manual monitoring of groundwater level using groundwater level monitoring instrument (a ‘dipper’).</td>
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<td>Two piezometer bore located down gradient of the limestone quarry</td>
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<td>Measurement of groundwater level to be conducted on a six monthly basis for the life of the Limestone Quarry.</td>
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<td><strong>Surface Water Quality</strong></td>
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<td>TSS, pH and Hardness</td>
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<tr>
<td>Change of TSS, pH and Hardness due to limestone quarrying.</td>
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<td>To determine whether the effluent water which flows to watershed may cause changes in TSS, pH, and Hardness concentration.</td>
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<tr>
<td>Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).</td>
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<td>Discharge of the Sediment Pond adjacent to the Limestone Quarry</td>
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<td>One location on the Gemaf River (AGEM) see Map-3 and Table-2</td>
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<tr>
<td>TSS, pH, and Hardness will be monitored every month during the operating life of the limestone quarry</td>
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<td>One location on the Gemaf River every 3 months during the operating life of the limestone quarry</td>
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<td><strong>Environmental Health and Safety</strong></td>
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<td>BAPEDALDA of North Maluku Province</td>
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<td>Office of Mine and Energy of North Maluku Province</td>
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<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</td>
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<td>Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.</td>
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<td>Office of Mines and Energy of Central Halmahera Regency.</td>
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</table>

**Legend:**
- TSS: Total Suspended Solids
- pH: Hydrogen Ion Concentration
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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<th>Reporting</th>
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<tbody>
<tr>
<td>Terrestrial Flora and Fauna</td>
<td>Special structure and composition as well as wildlife habitat</td>
<td>Limestone quarrying</td>
<td>Flora and fauna species in areas impacted by any land clearing for limestone quarrying activities</td>
<td>To record flora and fauna species in areas to be cleared for quarrying. Flora and fauna survey is conducted through standard method in forest area to be cleared.</td>
<td>Area to be cleared as part of quarry development.</td>
<td>Baseline survey conducted once prior to any land clearing activity</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of North Maluku Province</td>
<td>Office of Mines and Energy of North Maluku Province.</td>
</tr>
<tr>
<td>Freshwater Aquatic Biota</td>
<td>Abundance of plankton and benthos</td>
<td>Land clearing for limestone quarrying</td>
<td>Change of aquatic biota abundance</td>
<td>To determine whether changes of aquatic biota (mainly benthos) are occurring</td>
<td>Collect, prepare and analyze plankton and benthos samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards); for phytoplankton, zooplankton and benthos collection, identification and analyses.</td>
<td>Permanent plankton and benthos monitoring sites at; One location on the Coral River (KRF-1) see (see Map-7 and Table 6)</td>
<td>Every year during Operations phase.</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of North Maluku Province</td>
</tr>
<tr>
<td>Socio Economics</td>
<td>Business Opportunities</td>
<td>Land clearing for limestone quarrying</td>
<td>The level of participation of local people, local contractors and general community in limestone quarrying activity</td>
<td>To record the number of entrepreneurs participating in limestone quarrying activity.</td>
<td>Collect data regarding number of local entrepreneur that participate in the provision of goods and services: Number of an officially locally owned and operated business; Types of goods and services provided; Value of local economic activities.</td>
<td>WBN Office Office of Industrial and Trade Agency of Central and East Halmahera Regencies.</td>
<td>Once every year, during the operating life of the limestone quarry</td>
<td>Purchasing Department of WBN Limestone Quarry Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of North Maluku Province</td>
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</tbody>
</table>

*WBN Office* Office of Industrial and Trade Agency of Central and East Halmahera Regencies.
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

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</thead>
<tbody>
<tr>
<td><strong>Community Income</strong></td>
<td>Land clearing for limestone quarrying</td>
<td>Change of community income</td>
<td>To record changes of community income</td>
<td>Villages around the project area</td>
<td>Once every year, during operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province • Office of Mine and Energy of North Maluku Province</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province • Office of Mine and Energy of North Maluku Province</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province • Office of Mine and Energy of North Maluku Province</td>
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<tr>
<td>Environmental Components</td>
<td>Monitoring Parameters</td>
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<td>Conductor</td>
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<tr>
<td><strong>Air Quality</strong></td>
<td>SO$_2$ and HS</td>
<td>• Sulphuric Acid Plant operation</td>
<td>• Changes of SO$_2$ and HS in ambient air</td>
<td>• Identify long term trends of air quality at the vicinity of nickel processing plant</td>
<td>• Monitor sulphuric acid plant stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.</td>
<td>• Monitor ambient air quality in accordance with GOI protocol or SNI standard.</td>
<td>• Sulphuric Acid Plant Stack. • Ambient air quality at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map-2 and Table-1)</td>
<td>• Stack emissions monitored every six months during operations phase. • Ambient air quality to be monitored every three months during operation phase.</td>
<td>• Environmental Health and Safety Department of WBN</td>
</tr>
<tr>
<td><strong>SO$_2$ and NO$_x$</strong></td>
<td>Power Plant</td>
<td>• Changes of SO$_2$ and NO$_x$ in ambient air</td>
<td>• Identify long term trends of air quality at the vicinity of nickel processing plant</td>
<td>• Monitor power plants stack emissions against applicable standards and in accordance with the GOI protocol or SNI standard.</td>
<td>• Monitor ambient air quality in accordance with GOI protocol or SNI standard.</td>
<td>• Power Plant Stack. • Ambient air quality at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map-2 and Table-1)</td>
<td>• Stack emissions monitored every six months during operations phase. • Ambient air quality to be monitored every three months during operation phase.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province. • Office of Mine and Energy of North Maluku Province. • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency. • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency. • Office of Mines and Energy of Central Halmahera Regency. • Office of Mines and Energy of East Halmahera Regency.</td>
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<tr>
<td><strong>Noise</strong></td>
<td>Noise</td>
<td>• Power Plant</td>
<td>• Increase of noise</td>
<td>• Identify long term trends of noise level at WBN project area</td>
<td>• Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.</td>
<td>• Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map-2 and Table-1)</td>
<td>• Annual Noise Survey to be conducted during operating life of the mine</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia. • BAPEDALDA of North Maluku Province. • Office of Mine and Energy of North Maluku Province. • Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency. • Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency. • Office of Mines and Energy of Central Halmahera Regency. • Office of Mines and Energy of East Halmahera Regency.</td>
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</table>

**F. Operation Stage of Supporting Facilities**

- **Air Quality**
  - SO$_2$ and HS: Power Plant Stack, Ambient air quality at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map-2 and Table-1).
  - SO$_2$ and NO$_x$: Power Plant Stack, Ambient air quality at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map-2 and Table-1).

- **Noise**
  - Noise: Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.

**Environmental Monitoring Summary of PT Weda Bay Nickel**

- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province.**
- **Office of Mine and Energy of North Maluku Province.**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of Central Halmahera Regency.**
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<th>Reporting</th>
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<tr>
<td><strong>Hydrology</strong></td>
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<tr>
<td>Change of Flow Rate</td>
<td>• Water supply for WBN activities</td>
<td>• Change of flow rate downstream of intake point</td>
<td>• To identify long term trends of water level and flow rate</td>
<td>• Monitor water level of the river using automatic water level recording or sonar or stage gauge. • Measure surface water level by stream gauging or weir using AWLR or stage gauge. • Measure volume of water off-take to process plant (i.e. total fresh water use).</td>
<td>• Downstream of water intake at Kobe River. Kobe River Pump station.</td>
<td>• Water level monitoring at the rivers ongoing during the operating life of the mine. • Water level monitoring at the rivers once every three months during the operating life of the mine. • Water use to be measured daily</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
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<td><strong>Surface Water Quality</strong></td>
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<tr>
<td>Oil and Grease</td>
<td>• Operation of workshop</td>
<td>• Change of oil and grease concentration in receiving water due to workshop effluent</td>
<td>• To comply with applicable regulation on effluent water quality standard</td>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).</td>
<td>• Prior to discharge of water from Workshop</td>
<td>• One location on the Wosai River (AWOS) see Map-3 and Table-2</td>
<td>• Once every month during the operating life of the mine.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<tr>
<td>Nutrients (BOD, COD, NOx, NO3)</td>
<td>• Non-process waste management</td>
<td>• Change in nutrient concentrations in downstream surface water.</td>
<td>• To comply with applicable regulation on effluent water quality standard</td>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).</td>
<td>• Prior to discharge from landfill leachate. • One location on the Gajam River (AGOJ) see Map-3 and Table-2</td>
<td>• Once every month during the operating life of the mine.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
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<th>Conductor</th>
<th>Superintending</th>
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<tbody>
<tr>
<td>Groundwater Quality</td>
<td>Nutrients (BOD, COD, NH₃, NO₃, NO₂)</td>
<td>Non-process waste management</td>
<td>• Change in Groundwater Water Quality</td>
<td>• To determine whether the leachate water infiltration into groundwater may cause changes in Nutrient concentrations</td>
<td>• Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards).</td>
<td>• One location down gradient of the Non-process Waste Management Storage location/Landfill.</td>
<td>• Water quality will be monitored every six months during the operating life of the mine.</td>
<td>• Environmental Health and Safety Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
</tr>
<tr>
<td>Socio Economics</td>
<td>Services provided by employees residential area</td>
<td>• Business Opportunities</td>
<td>• The level of participation of local people, local contractors and general community related to employee residential activities</td>
<td>• To record the number of entrepreneurs participating in Project Operations.</td>
<td>• Collect data regarding number of local entrepreneur that participate in the provision of goods and services.</td>
<td>• WBN Office</td>
<td>• Once every year, during the operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
</tr>
<tr>
<td>Community Income</td>
<td>Services provided by employees residential area</td>
<td>• Change of community income</td>
<td>• To record changes of community income</td>
<td>• Data collection on household income from government statistics (Konsultasi dalam Angka).</td>
<td>• Villages around the project area</td>
<td>• Once every year, during operating life of the mine.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
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</table>
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

### Environmental Component/Activity

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<th>Noise</th>
<th>Sea Water Quality</th>
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<tbody>
<tr>
<td>TSP</td>
<td>Dustfall</td>
<td>TSS, pH, hydrocarbons, Oil and Grease</td>
</tr>
<tr>
<td>Dedicated port and barge loading facility operation</td>
<td>Dedicated port and barge loading facility operation</td>
<td>Dedicated port and barge loading facility operation</td>
</tr>
<tr>
<td>Change in TSP concentration in ambient air</td>
<td>Increase of noise.</td>
<td>Changes in sea water quality, in Centrticlar TSS, pH, hydrocarbons, Oil and Grease.</td>
</tr>
<tr>
<td>To identify the long-term trends of air quality in WBN’s project area</td>
<td>Identify long-term trends of noise level at WBN project area</td>
<td>To determine whether the dedicated port and barge loading facility operation may cause changes in pH, TSS, hydrocarbons or oil and grease concentration.</td>
</tr>
<tr>
<td>Dustfall is monitored using deposition dust gauges, as per applicable regulations</td>
<td>Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.</td>
<td>Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).</td>
</tr>
<tr>
<td>Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-3)</td>
<td>Villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-3)</td>
<td>Three locations adjacent to the Port Facility (see Map-4 and Table-3): o 500 m to the east of the port (DP-1) o 500 m to the west of the port (DP-2) o 500 m out to sea of the port (DP-3)</td>
</tr>
<tr>
<td>Monitored once every three months during operating life of the mine.</td>
<td>Annual Noise Survey to be conducted during operating life of the mine.</td>
<td>Sea Water Quality will be monitored every three months during operating life of the mine.</td>
</tr>
<tr>
<td>Environmental Health and Safety Department of WBN</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Environmental Health and Safety Department of WBN</td>
</tr>
</tbody>
</table>

### Monitoring Parameters

- TSP
- Dustfall
- Dedicated port and barge loading facility operation
- Change in TSP concentration in ambient air
- Increment of dustfall
- To identify the long-term trends of air quality in WBN’s project area
- Dustfall is monitored using deposition dust gauges, as per applicable regulations.
- Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-3)
- Monitored once every three months during operating life of the mine.
- Environmental Health and Safety Department of WBN

### Sources of Impacts

- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.

### Reference/Indicator of Impacts

- Annual Noise Survey to be conducted during operating life of the mine.

### Monitoring Methods

- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).
- Three locations adjacent to the Port Facility (see Map-4 and Table-3): o 500 m to the east of the port (DP-1) o 500 m to the west of the port (DP-2) o 500 m out to sea of the port (DP-3)

### Monitoring Period and Frequency

- Environmental Health and Safety Department of WBN
- Environmental Health and Safety Department of WBN
- Environmental Health and Safety Department of WBN

### Monitoring Institution


### Reporting

- Office of Mine and Energy of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Office of Mines and Energy of North Maluku Province

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**G. Operation Stage of Other Infrastructure**

<table>
<thead>
<tr>
<th>Air Quality</th>
<th>Noise</th>
<th>Sea Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP</td>
<td>Dustfall</td>
<td>TSS, pH, hydrocarbons, Oil and Grease</td>
</tr>
<tr>
<td>Dedicated port and barge loading facility operation</td>
<td>Dedicated port and barge loading facility operation</td>
<td>Dedicated port and barge loading facility operation</td>
</tr>
<tr>
<td>Change in TSP concentration in ambient air</td>
<td>Increase of noise.</td>
<td>Changes in sea water quality, in Centrticlar TSS, pH, hydrocarbons, Oil and Grease.</td>
</tr>
<tr>
<td>To identify the long-term trends of air quality in WBN’s project area</td>
<td>Identify long-term trends of noise level at WBN project area</td>
<td>To determine whether the dedicated port and barge loading facility operation may cause changes in pH, TSS, hydrocarbons or oil and grease concentration.</td>
</tr>
<tr>
<td>Dustfall is monitored using deposition dust gauges, as per applicable regulations.</td>
<td>Noise level is monitored using sound level meter in accordance with GOI protocol or SNI standard.</td>
<td>Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).</td>
</tr>
<tr>
<td>Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-3)</td>
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<tr>
<td>Monitored once every three months during operating life of the mine.</td>
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</tr>
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<td>Environmental Health and Safety Department of WBN</td>
</tr>
</tbody>
</table>

### Monitoring Parameters

- TSP
- Dustfall
- Dedicated port and barge loading facility operation
- Change in TSP concentration in ambient air
- Increment of dustfall
- To identify the long-term trends of air quality in WBN’s project area
- Dustfall is monitored using deposition dust gauges, as per applicable regulations.
- Ambient air quality at villages adjacent to project activities at sampling locations KU-1, KU-2, KU-3 and KU-4 (see Map -2 and Table-3)
- Monitored once every three months during operating life of the mine.
- Environmental Health and Safety Department of WBN

### Sources of Impacts

- Office of Mine and Energy of North Maluku Province
- Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.

### Reference/Indicator of Impacts

- Annual Noise Survey to be conducted during operating life of the mine.

### Monitoring Methods

- Collect, prepare and analyze water samples according to WBN’s protocols in accordance with Indonesian National Standards/SNI. (if there is no SNI use other appropriate international standards).
- Three locations adjacent to the Port Facility (see Map-4 and Table-3): o 500 m to the east of the port (DP-1) o 500 m to the west of the port (DP-2) o 500 m out to sea of the port (DP-3)

### Monitoring Period and Frequency

- Environmental Health and Safety Department of WBN
- Environmental Health and Safety Department of WBN
- Environmental Health and Safety Department of WBN

### Monitoring Institution


### Reporting

- Office of Mine and Energy of North Maluku Province
- Office of Mine and Energy of North Maluku Province
- Office of Mines and Energy of North Maluku Province
### Marine Biota

- **Abundance of plankton, benthos, coral reef fish, and coral life forms**
- **Dedicated port and barge loading facility operation**
- **Changes in abundance of plankton, benthos, and the condition of coral**
- **To determine the changes in marine biota (plankton and benthos) samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for marine plankton and benthos collection, identification and analyses.**
- **Conduct regular survey on coral reef fish and coral life forms at permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for marine coral reef fishes and coral life forms survey, collection, identification and analyses.**
- **To record longterm trends of marine biota condition adjacent to plant site**
- **Plankton and benthos at sampling locations (see Map-9 and Table-8):**
  - 500 m to the west of outfall (BOF-1)
  - 500 m to the east of outfall parallel to the coast (BOF-2)
  - 500 m out to the sea perpendicular to the coast (BOF-3)
  - Kaleo Plepis (BMK-1) – reference site
  - Sages (BMG-1) – reference site
  - Coral reef fishes and coral life forms (see Map-9 and Table-8):
    - CE-I (reference site)
    - CE-II
    - CE-III
    - CE-V
  - Plankton and benthos every two years during operating life of the mine
  - Coral reef fishes and coral life forms every three years
  - Environmental Health and Safety Department of WBN

### Oceanography

- **Change of current pattern**
- **Dedicated port and barge loading facility operation**
- **Change in beach sedimentation and abrasion pattern**
- **To determine changes in sedimentation along the shore line adjacent to the Port.**
- **Evaluation of satellite imagery to determine changes in shoreline morphology or to get secondary data from relevant authority**
- **Shoreline to the east and west of the Port Facility**
- **Once every two years during the operating life of the mine**
- **Port Operation Department of WBN**

### Monitoring Institution

- **Conductor**: Department of Energy and Mineral Resources, Republic of Indonesia.
- **Supervisor**: BAPEDALDA of North Maluku Province
- **Reporting**: Office of Mine and Energy of North Maluku Province

### Notes

- **Sources of Impacts**: Marine Biota
- **Monitoring Parameters**: Changes in plankton, benthos, and coral life forms
- **Monitoring Methods**: Collection, preparation and analysis of marine biota samples from permanent monitoring sites
- **Monitoring Objectives**: To determine changes in marine biota (plankton and benthos) samples from permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for marine plankton and benthos collection, identification and analyses. Conduct regular survey on coral reef fish and coral life forms at permanent monitoring sites in accordance with WBN’s protocols based on Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) for marine coral reef fishes and coral life forms survey, collection, identification and analyses.
- **Monitoring Location**: Plankton and benthos at sampling locations (see Map-9 and Table-8):
  - 500 m to the west of outfall (BOF-1)
  - 500 m to the east of outfall parallel to the coast (BOF-2)
  - 500 m out to the sea perpendicular to the coast (BOF-3)
  - Kaleo Plepis (BMK-1) – reference site
  - Sages (BMG-1) – reference site
  - Coral reef fishes and coral life forms (see Map-9 and Table-8):
    - CE-I (reference site)
    - CE-II
    - CE-III
    - CE-V
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

<table>
<thead>
<tr>
<th>Environmental Component/Activity</th>
<th>Monitoring Parameters</th>
<th>Sources of Impacts</th>
<th>Reference/Indicator of Impacts</th>
<th>Monitoring Objectives</th>
<th>Monitoring Methods</th>
<th>Monitoring Location</th>
<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Monitoring Institution</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Dedicated Airport</td>
<td>• Number of people who utilize the airport.</td>
<td>To determine how the WBN airport has changed the accessibility to and from the Central Halmahera regency.</td>
<td>Collect data on people who utilize the airport.</td>
<td>Dedicated airport.</td>
<td>• Once a year during the Operations phase.</td>
<td>• Airport Operation Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
<td>• Office of Mine and Energy of North Maluku Province</td>
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<tr>
<td>H. Community Development</td>
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<tr>
<td>Provision of Educational Facilities and Services</td>
<td>Distribution of provision educational facilities in WBN Cow area</td>
<td>• Increased demands by the local community for educational facilities and services.</td>
<td>• Requirement and demand of educational facilities and services for local communities</td>
<td>• To support the government in its efforts to provide adequate educational facilities and services to the community</td>
<td>• To monitor the provision of necessary educational facilities and services</td>
<td>• Villages covered by CD programs in Central and East Halmahera Regencies</td>
<td>• Once a year during the implementation of the Community Development Program.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
<td>• BAPEDALDA of North Maluku Province</td>
</tr>
<tr>
<td>Provision of Public Health Service</td>
<td>Number of health facility, quality of service, number of patients, and number of paramedics</td>
<td>• Local community demand for health services</td>
<td>• Distribution of public health facilities in WBN Cow area</td>
<td>• To monitor distribution and effectiveness of health facilities under WBN CD Program</td>
<td>• Collect data from local health institutions, review and compare number of health facilities and services to fulfill the minimum community requirement</td>
<td>• Villages covered by CD programs in Central and East Halmahera Regencies WBN Clinics, Community Health center</td>
<td>• Once a year during the implementation of the Community Development Program.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<th>Conducting</th>
<th>Monitoring Institution</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishery and Marine culture</td>
<td>Production level on local fishery and aquaculture produce</td>
<td>• Level of fishery knowledge</td>
<td>• Fishery and aquaculture productivity in Weda Bay water</td>
<td>• To monitor availability of several important fishery and marine culture production factor</td>
<td>• To monitor production level of several significant local fishery and marine culture produce</td>
<td>• Collect data, review and compare from relevant fishery department on the fishery production facilities and most important production factors</td>
<td>• Villages covered by CD programs in Central and East Halmahera Regencies</td>
<td>• Once a year during the implementation of the Community Development Program.</td>
<td>• External Relations Department of WBN</td>
<td>• Department of Energy and Mineral Resources, Republic of Indonesia.</td>
</tr>
</tbody>
</table>

| Farming and Agriculture Improvement Initiatives | Agriculture productivity in WBN's COW area | • Low agriculture knowledge on valuable commodities among young farmers | • Agriculture production input shortage | • Lack of high quality production input | • To monitor availability of several important agriculture production factors | • To monitor production level of several significant local agriculture produce | • Collect data, review and compare from relevant agriculture and plantation department to get certain most important production factors such as fertilizer and high quality seed | • Villages covered by CD programs in Central and East Halmahera Regencies | • Once a year during the implementation of the Community Development Program. | • External Relations Department of WBN |

| Local Business Opportunities | • Number of locally owned and operated businesses | • Value of local economic opportunities | • Level business skill of local community | • The level of participation by the local community in diverse economic activities | • To monitor the participation of the local in the economic development in the WBN COW area in Central and East Halmahera Regencies | • Record WBN purchasing and service provision contracts | • Villages covered by CD programs in Central and East Halmahera Regencies | • Once a year during the implementation of the Community Development Program. | • External Relations Department of WBN |

Environmental Resources Management
Matrix RPL VI 194659-PD.docx
Weda Bay Nickel

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## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

<table>
<thead>
<tr>
<th>Environmental Component/Activity</th>
<th>Monitoring Parameters</th>
<th>Sources of Impacts</th>
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<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Monitoring Institution Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface and Ground Water Quality</strong></td>
<td>• Non-industrial solid waste: Types and amounts of waste collected, transported, disposed to landfills, and recycled.</td>
<td></td>
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<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td></td>
<td>• Domestic liquid waste effluent: BOD, COD, TSS, and pH.</td>
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<td><strong>Office of Mine and Energy of North Maluku Province</strong></td>
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<tr>
<td></td>
<td>• Type and amount of hazardous and toxic wastes (B3) spillage</td>
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<td></td>
<td><strong>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Effluent discharge from domestic waste water treatment plants.</td>
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<td><strong>Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.</strong></td>
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<td></td>
<td>• Hazardous and toxic wastes (B3) wastes.</td>
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<td><strong>Office of Mines and Energy of Central Halmahera Regency.</strong></td>
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<td></td>
<td>• Laboratory waste and outdated/open chemicals.</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
</tr>
<tr>
<td></td>
<td>• Potential impacts on the environment, particularly surface water and groundwater quality, if solid and liquid wastes are not managed and disposed off properly.</td>
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<td><strong>Office of Mines and Energy of Central Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• To quantify the types and amounts of solid waste produced by PT WBN.</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• To determine the performance of wastewater treatment plants.</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• To ensure correct handling and disposal of hazardous wastes.</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• Measure amount of solid waste produced by counting number of waste trucks entering and discharging waste to landfills.</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• Collect, prepare and analyze water samples from all domestic wastewater treatment plant outlets according to PT WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) and also measure pH, conductivity, and temperature at the time of sampling (in situ).</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• Monitor correct implementation of oil, fuel, and sulphur spill prevention in accordance with standard operational procedures (SCOP).</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Monitor correct implementation of hazardous and toxic wastes handling and disposal (such as used battery, medical waste, slop oils, used grease, laboratory waste, etc) in accordance with standard operational procedures (SCOP).</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>• Domestic solid waste landfill area</td>
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<td><strong>Environmental Health and Safety Department of WBN.</strong></td>
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<tr>
<td></td>
<td>• All domestic waste water treatment plants</td>
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<td><strong>Department of Energy and Mineral Resources, Republic of Indonesia.</strong></td>
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<tr>
<td></td>
<td>• All PT WBN activity locations generating (B3) wastes</td>
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<td></td>
<td><strong>BAPEDALDA of North Maluku Province</strong></td>
</tr>
<tr>
<td><strong>Community Shallow Ground Water Wells Quality</strong></td>
<td>• TDS, pH, Mg, Fe, Mn, trace metals (Cu, Pb, As, Ba, B, Sr, Cl, Hg, Ni, and Zn), Cl, and SO4</td>
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<td><strong>Office of Mine and Energy of North Maluku Province</strong></td>
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<td></td>
<td>• Several activities in the villages and community that may impact groundwater quality</td>
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<td><strong>Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Potential groundwater wells quality changes</td>
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<td><strong>Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.</strong></td>
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<td></td>
<td>• To determine and make sure the groundwater wells are safe for clean water and raw water for drinking water sources</td>
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<td><strong>Office of Mines and Energy of Central Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Collect, prepare and analyze the wells water samples according to PT WBN’s protocols in accordance with Indonesian National Standards/SNI (if there is no SNI use other appropriate international standards) and also measure pH, conductivity, and temperature at the time of sampling (in situ).</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Representative ground water wells at villages (see Map-11 and Table 10):</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>o Sagora Village (SGL)</td>
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<td></td>
<td>o Gemal Village (GML)</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>o Leleilef Sawai Village (SIV)</td>
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<td>o Leleilef Waebulen Village (WBL)</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<td></td>
<td>o Trans Unit (SU)</td>
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<td><strong>Office of Mines and Energy of East Halmahera Regency.</strong></td>
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<tr>
<td></td>
<td>• Once every year during the operating life of the mine</td>
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# Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

<table>
<thead>
<tr>
<th>Environmental Component/Activity</th>
<th>Monitoring Parameters</th>
<th>Sources of Impacts</th>
<th>Reference/Indicator of Impacts</th>
<th>Monitoring Objectives</th>
<th>Monitoring Methods</th>
<th>Monitoring Location</th>
<th>Monitoring Period and Frequency</th>
<th>Conductor</th>
<th>Monitoring Institution</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogeology</td>
<td>Groundwater level</td>
<td>Facility construction activities</td>
<td>Change of groundwater level</td>
<td>To identify longterm trends of groundwater level.</td>
<td>Establish permanent piezometer monitoring wells at each ore deposit</td>
<td>One at each mining blocks</td>
<td>Measurement of groundwater level at each mining block to be conducted on a monthly basis one year prior to land clearing and continue until completion of ore mining in particular mine block</td>
<td>Mine Engineering Department</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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<td>Ore Mining activities</td>
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<td>Establish permanent piezometer monitoring wells upgradient and down gradient of plant site</td>
<td>One upgradient plant site and two down gradient plant site</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Engineering and Maintenance Division</td>
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<td>Limestone quarry</td>
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<td>Manual monitoring of groundwater level using groundwater level monitoring instrument (i.e ‘dipper’).</td>
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<tr>
<td>Meteorology and Microclimate</td>
<td>Air temperature, rainfall, wind speed and direction, relative humidity, and solar radiation</td>
<td>All activities of WBN in the project area</td>
<td>Potential microclimate (temperature and humidity) changes</td>
<td>To collect long term meteorological and microclimate data this can be used as input for other environmental monitoring and management programs</td>
<td>Conduct continuous monitoring using standard meteorological monitoring equipments.</td>
<td>Locations of Wosea and Bukit Limber</td>
<td>Monitoring, continuously. Reporting: every three months. Throughout the operating life of the mine.</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia.</td>
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## Notes
- The monitoring is conducted on a monthly basis one year prior to land clearing and continues until completion of ore mining in particular mine block.
- Monitoring methods include establishment of permanent piezometer monitoring wells, manual monitoring of groundwater level, and continuous monitoring of meteorological data.
- The reporting frequency is every three months throughout the mine's operating life.
- The monitoring locations are at specific sites within the mine area.
- The monitoring institutions include the Department of Energy and Mineral Resources, and the Environmental Agency of Central Halmahera Regency.
## Matrix of Environmental Monitoring Summary of PT Weda Bay Nickel

### Environmental Component/Activity
- **Reclamation Progress**
- **Flora and Fauna Biodiversity**

### Monitoring Parameters
- **Total area reclaimed in hectare**
- **Plant species used for reclamation**
- **Number of seedlings transplanted**
- **Plant growth performance**
- **Species diversity, abundance and distribution for major groups such as vegetation, mammals, birds, amphibians, and insects with parameter:**
  - Vegetation: type, density, dominance, frequency and diversity indices.
  - Fauna species, distribution, abundance and diversity indices.
- **Mining activities in the CoW area.**
- **Changes in the diversity, abundance and distribution of major flora and fauna groups.**

### Sources of Impacts
- **Total area**
- **Reclamation progress**
- **Flora and Fauna Biodiversity**

### Reference/Indicator of Impacts
- **Reclamation of overburden placement area and ex-mined area**
- **To determine survival rate of the transplanted plants**
- **To determine suitable plant species to be used in reclamation program**
- **To determine whether changes in biodiversity are occurring within major flora and fauna groups.**

### Monitoring Objectives
- **Evaluate the success of reclamation program**
- **To determine survival rate of the transplanted plants**
- **To determine suitable plant species to be used in reclamation program**
- **To determine whether changes in biodiversity are occurring within major flora and fauna groups.**

### Monitoring Methods
- **Take record on:**
  - Total area reclaimed
  - Type of plant species used in the reclamation program
  - Total number of seedlings produced and transplanted
- **Map and take photo of the reclaimed area**
- **Monitor the plant growth performance through:**
  - Establishing randomly monitoring plots at reclamation sites for each type of plant species planted
  - Measuring diameter and height of the sampled plants in the monitoring plots
  - Determining the survival rate of reclamation plants
- **Sample and analyze physical and chemical characteristics of soil from reclaimed areas.**

### Monitoring Location
- **Representative reclamation area at mine blocks within CoW area**
- **Establish permanent biodiversity monitoring plots representing each forest ecosystem type exist in WBN's CoW area.**
- **Conduct surveys to monitor flora and fauna on permanent plots with WBN Contract of Work area.**
- **Survey for flora is through standard transect method in the permanent biodiversity monitoring plots.**
- **Fauna survey is conducted using standard procedures that apply for each group of the fauna i.e. mammals, birds, reptiles, amphibians and insects.**

### Monitoring Period and Frequency
- **Once a year for:**
  - Total area reclaimed, type of plant species and total seedlings produced and transplanted
  - Reclamation map and photo
  - Plant growth performance
  - Soil physical and chemical analysis

### Conductor
- **Mine Engineering Department**
- **Environmental and Safety Department of WBN**

### Monitoring Period
- **Environmental Health and Safety Department of WBN**

### Reporting
- **Department of Energy and Mineral Resources, Republic of Indonesia.**
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
- **Environmental Management Agency (Badan Pengelola Lingkungan Hidup) of Central Halmahera Regency.**
- **Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency.**
- **Office of Mines and Energy of Central Halmahera Regency.**
- **Office of Mines and Energy of East Halmahera Regency.**

### Flora and Fauna Biodiversity

### Mining activities in the CoW area.

### Changes in the diversity, abundance and distribution of major flora and fauna groups.

### To determine whether changes in biodiversity are occurring within the CoW area.

### Permanent biodiversity monitoring plots:
- **Establish permanent biodiversity monitoring plots at:**
  - One monitoring site at undisturbed mangrove forest
  - One monitoring site in undisturbed lowland alluvial forest
  - One monitoring site in undisturbed lowland ultramafic forest
  - One monitoring site in undisturbed lower montane forest
  - One monitoring site in undisturbed lowland karst forest
  - One monitoring site in reclamation area

### Biodiversity surveys:
- **Regularity once every five years mine for undisturbed forest during the operating life of the mine.**
- **Once every two year for new reclamation site until first five years of the operating life of the mine.**

### Environmental Health and Safety Department of WBN

### Mine Engineering Department

### Department of Energy and Mineral Resources, Republic of Indonesia.
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
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- **Office of Mines and Energy of East Halmahera Regency.**

### Department of Energy and Mineral Resources, Republic of Indonesia.
- **BAPEDALDA of North Maluku Province**
- **Office of Mine and Energy of North Maluku Province**
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<tr>
<td>Flora and Fauna in Natural Succession Area</td>
<td>Structure and composition of flora; Vegetation type, density, dominance and diversity index</td>
<td>Overburden removal and placement</td>
<td>Progress of natural succession process in reclamation areas</td>
<td>To study the return of terrestrial biota in the natural succession areas</td>
<td>Establish one permanent monitoring plots in an overburden placement site; Conduct surveys to monitor the reestablishment of terrestrial flora and fauna communities (structure and composition) naturally in the permanent monitoring plots; Collect, prepare and analyze soil samples from permanent natural succession monitoring plots in accordance with WBN protocol based on Indonesian National Standards or other appropriate international standards; Prepare map and take photo of natural succession progress in the permanent monitoring plots</td>
<td>Representative overburden placement sites at mine blocks within COW area</td>
<td>Once every once a year for the first 5 years and thereafter every five years during the mine's life</td>
<td>Environmental Health and Safety Department of WBN</td>
<td>Mine Engineering Department</td>
<td>Department of Energy and Mineral Resources, Republic of Indonesia; BAPEDALDA of North Maluku Province; Office of Mine and Energy of North Maluku Province; Environmental Management Agency (Badan Lingkungan Hidup) of Central Halmahera Regency; Environmental Agency (Badan Lingkungan Hidup) of East Halmahera Regency; Office of Mines and Energy of Central Halmahera Regency; Office of Mines and Energy of East Halmahera Regency</td>
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Appendix B

Organization Chart of PT Weda Bay Nickel