

## TABLE OF CONTENT

<b>PREFACE</b>	
<b>TABLE OF CONTENT</b> .....	<b>i</b>
<b>LIST OF TABLE</b> .....	<b>iv</b>
<b>LIST OF PICTURE</b> .....	<b>vii</b>

### CHAPTER I INTRODUCTION

1.1. BACKGROUND .....	I-1
1.2. PURPOSE AND BENEFIT .....	I-2
1.2.1. Project Purpose .....	I-2
1.2.2. Project Benefit .....	I-2
1.3. RULES AND REGULATIONS .....	I-3
1.3.1. Law .....	I-3
1.3.2. Governmental Regulation .....	I-6
1.3.3. Presidential Regulation .....	I-8
1.3.4. Ministerial Regulation .....	I-9
1.3.5. Presidential Decree .....	I-10
1.3.6. Ministerial Decree .....	I-11
1.3.7. Decree of The Chief of Environmental Control Agency .....	I-13
1.3.8. Decree of The Governor of West Java .....	I-14
1.3.9. Regional Regulation .....	I-15

### CHAPTER II BUSINESS PLAN

2.1. IDENTITY OF INITIATOR AND DRAFTER OF ENVIRONMENTAL ANALYSIS IMPACT .....	II-1
2.1.1. Identity of Initiator .....	II-1
2.1.2. Identity of Environmental Analysis Impact Drafter .....	II-1
2.1.3. Structure of Assesment Team .....	II-1
2.2. SCOPE OF ASSESSED ACTIVITY PLAN AND ALTERNATIVE OF BUSINESS AND/OR ACTIVITY PLAN COMPONENTS .....	II-2
2.2.1. Activity Status .....	II-2
2.2.2. Compliance of Business/Activity Plan with the Spatial Layout of Indramayu Regency, West Java Province Activity Plan of PLTU Indramayu 2 x 1.000 MW .....	II-2
2.2.3. Other Activities Around The PLTU Indramayu 2 x 1.000 MW Project Site .....	II-6
2.2.4. Resources Availability .....	II-6
2.2.5. Development Plan Spatial Layout of PLTU Indramayu 2 x 1.000 MW .....	II-7
2.2.6. Electricity Production Process .....	II-11
2.2.7. Business Plan and/or Impact Causation Activity .....	II-13
A. Pre Construction .....	II-13
B. Construction .....	II-14
C. Operational Stage .....	II-25

### BAB III ENVIRONMENTAL BASELINE

3.1. CHEMICAL GEOPHYSIC COMPONENTS .....	III-1
3.1.1. Climate .....	III-1
3.1.1.1. Temperature .....	III-3
3.1.1.2. Relative Moisture .....	III-3

3.1.1.3. Wind Speed .....	III-3
3.1.1.4. Sun Radiation Intensity .....	III-6
3.1.1.5. Evaporation .....	III-6
3.1.1.6. Rainfall .....	III-6
3.1.1.7. Global Warming .....	III-7
3.1.2. Air Quality and Noise .....	III-11
3.1.2.1. Air Quality .....	III-11
3.1.2.2. Noise .....	III-11
3.1.3. Water Quality .....	III-15
3.1.3.1. Sea Water Quality .....	III-15
3.1.3.2. River Water Quality .....	III-16
3.1.3.3. Resident's Well Water Quality .....	III-18
3.1.3.4. Sea Sediment Quality.....	III-22
3.1.4. Physiographic .....	III-23
3.1.4.1. Physiographic.....	III-23
3.1.4.2. Stratigraphic .....	III-24
3.1.4.3. Hydrology .....	III-25
3.1.4.4. Disaster .....	III-36
3.1.5. Hydrooceanography .....	III-39
3.1.5.1. Batimetri .....	III-39
3.1.5.2. Oceanography Parameter .....	III-40
3.1.6. Land Use and Transportation .....	III-47
3.1.6.1. Land Use .....	III-47
3.1.6.2. Transportatoin .....	III-53
3.2. BIOLOGICAL COMPONENTS .....	III-58
3.2.1. Flora .....	III-58
3.2.1.1. Condition of Vegetation Within The Location of PLTU Indramayu 2 x 1.000 MW .....	III-58
3.2.1.2. Vegetation outside/around the Site of PLTU Indramayu 2 x 1.000 MW.....	III-60
3.2.2. Fauna .....	III-61
3.2.3. Water Life Forms .....	III-64
3.2.3.1. Ocean Life Forms .....	III-64
3.2.3.2. Plain Water Life Forms .....	III-67
3.3. COMPONENTS OF SOCIO-ECONOMIC AND CULTURE .....	III-69
3.3.1. Population .....	III-70
3.3.1.1. Number, Development and Structure of Population .....	III-70
3.3.1.2. Population According to Religion and Education .....	III-72
3.3.1.3. Manpower .....	III-73
3.3.2. Socio-Economic .....	III-74
3.3.2.1. Livelihoods .....	III-74
3.3.2.2. Sources of Livelihood .....	III-78
3.3.3. Social-Cultural Aspect .....	III-86
3.3.3.1. Communities Around the Prospective Area of PLTU Indramayu 2 x 1.000 MW .....	III-86
3.3.3.2. Social Institutions .....	III-88
3.3.3.3. Perception of the Communities .....	III-88
3.4. COMMUNITY'S HEALTH COMPONENT .....	III-90
3.4.1. Health Resources .....	III-98
3.4.2. Condition of Environment Sanitation .....	III-99

## BAB IV SCOPE OF STUDY

4.1. EVALUATED SIGNIFICANT IMPACT .....	IV-1
4.1.1. Potential Impact .....	IV-1

4.1.2. Hypothetical Significant Impact .....	IV-7
4.2. SCOPE OF STUDY AREA AND EVALUATION TIME LIMIT .....	IV-12
4.2.1. Project Limit .....	IV-12
4.2.2. Administrative Limit.....	IV-12
4.2.3. Ecological Limit .....	IV-12
4.2.4. Social Limit .....	IV-13

## **BAB V SIGNIFICANT IMPACT PREDICTION**

5.1. PRECONSTRUCTION STAGE .....	V-1
5.1.1. Land Acquisition .....	V-1
5.2. CONSTRUCTION STAGE .....	V-2
5.2.1. Labor Recruitment and Personnel Mobilisation .....	V-2
5.2.2. Equipment and Material Mobilisation Activities .....	V-4
5.2.3. Land Preparation Activity .....	V-7
5.2.4. Facility and Infrastructure Development .....	V-12
5.3. OPERATIONAL STAGE .....	V-15
5.3.1. Labor Recruitment .....	V-15
5.3.2. Coal Discharge Activity (Jetty) .....	V-16
5.3.3. Operation of Coal Handling System .....	V-17
5.3.4. Operation of Generator .....	V-17
5.3.5. Operation of Cooling Unit .....	V-26
5.3.6. Operation of Water Treatment and Liquid Waste Treatment .....	V-30
5.3.7. Operation of Coal Ash Storage .....	V-32

## **BAB VI EVALUATION OF SIGNIFICANT IMPACT**

6.1. EVALUATION ON SIGNIFICANT IMPACT .....	VI-1
6.1.1. Preconstruction Stage .....	VI-1
6.1.2. Construction Stage .....	VI-1
6.1.2.1. Labor Recruitment and Personnel Mobilisation .....	VI-1
6.1.2.2. Equipment and Material Mobilisation .....	VI-2
6.1.2.3. Land Preparation .....	VI-3
6.1.2.4. Facility and Infrastructure Development .....	VI-3
6.1.3. Operational Stage .....	VI-4
6.2. EVALUATION AS THE BASIS FOR MANAGEMENT .....	VI-5
6.2.1. Development of PLTU Indramayu 2 x 1.000 MW .....	VI-6
6.2.1.1. Air Quality .....	VI-6
6.2.1.2. Sea Water Quality .....	VI-8
6.2.1.3. Flood .....	VI-9
6.2.1.4. Increasing Community's Level of Income .....	VI-10
6.2.1.5. Land Traffic Problem .....	VI-11
6.2.1.6. Community Restlessness .....	VI-11
6.2.1.7. Jetty Development Plan .....	VI-12
6.2.2. Jetty Development .....	VI-13
6.2.2.1. Sea Water Quality .....	VI-13
6.2.2.2. Increasing Community Prosperity .....	VI-14
6.2.3. Environmental Impact on Project .....	VI-14
6.2.3.1. Increasing Abrasion and Accretion .....	VI-14
6.2.3.2. Global Warming .....	VI-15

<b>BIBLIOGRAPHY</b> .....	DP-1
---------------------------	------

## **ATTACHMENT**

## LIST OF TABLE

Table 2.1.	Coal Spesification .....	II-6
Table 2.2.	Land Use Estimation for PLTU Indramayu 2 x 1.000 MW .....	II-8
Table 2.3.	Construction Equipment Type and Required Amount in The PLTU Indramayu 2 x 1.000 MW Development Project.....	II-15
Table 2.4.	Boiler characteristic of PLTU Indramayu 2 x 1.000 MW .....	II-17
Table 2.5.	Description on Design of PLTU Indramayu 2 X 1.000 MW .....	II-28
Table 2.6.	Plant Type for Re-Planting .....	II-35
Table 3.1.	RECAPITULATION OF CLIMATE ELEMENTS ON PROSPECTIVE PROJECT AREA OF PLTU INDRAMAYU 2 X 1.000 MW (2001-2010) .....	III-2
Table 3.2.	WIND SPEED OCCURRENCE RATIO (%) (2006-2010 PERIOD) .....	III-4
Table 3.3.	RESUME OF DOMINANT MONTHLY WIND SPEED AND DIRECTION (2006-2010 PERIOD) .....	III-4
Table 3.4.	MONTHLY RAINFALL IN STUDY AREA (mm) 2001-2010 PERIOD .....	III-9
Table 3.5.	MONTHLY RAIN DAY IN STUDY AREA 2001-2010 PERIOD .....	III-9
Table 3.6.	RECAPITULATION OF RAINFALL AND CLIMATE TYPE IN STUDY AREA .....	III-10
Table 3.7.	AIR QUALITY MEASUREMENT RESULT .....	III-12
Table 3.8.	NOISE MEASUREMENT RESULT .....	III-13
Table 3.9.	SEA WATER QUALITY AROUND PROSPECTIVE AREA FOR THE PLTU INDRAMAYU 2 X 1.000 MW .....	III-15
Table 3.10.	RIVER WATER QUALITY AROUND THE PROSPECTIVE PROJECT SITE OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-16
Table 3.11.	WELL WATER QUALITY AROUND THE PROSPECTIVE PROJECT SITE OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-18
Table 3.12.	SEA SEDIMENT QUALITY AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-22
Table 3.13.	SEDIMENT CRITERIA FROM EPA REGIONAL V (mg/KG DRY WEIGHT) .....	III-23
Table 3.14.	CARRIED SEDIMENT AND RIVER DEBIT MEASUREMENT RESULT AROUND THE PROSPECTIVE PROJECT SITE AREA OF PLTU INDRAMAYU 2 X 1.000 MW.....	III-29
Table 3.15.	HALF-MONTHLY AVERAGE DEBIT (1999 -2008) OF SALAM-DARMA DAM THAT FLOWS INTO BUGIS IRRIGATION CHANNEL .....	III-30
Table 3.16.	MODIFIED MERCALLI SCALE .....	III-37
Table 3.17.	FETCH LENGTH IN INDRAMAYU BEACH .....	III-44
Table 3.18.	CONSTITUENT VALUE OF TIDAL WAVE GENERATOR FORCE IN INDRAMAYU BEACH .....	III-45
Table 3.19.	IMPORTANT TIDAL REFERENCE IN INDRAMAYU BEACH .....	III-45
Table 3.20.	LAND USE IN SUKRA DISTRICT YEAR 2008 .....	III-48
Table 3.21.	SPATIAL USE PLAN OF INDRAMAYU REGENCY .....	III-49
Table 3.22.	AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY IN JL. RAYA SUMUR ADEM NORTHERN COAST ROAD .....	III-55
Table 3.23.	AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY IN JL. RAYA PATROL NORTHERN COAST ROAD .....	III-55
Table 3.24.	AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY IN JL. PLTU SUMUR ADEM .....	III-55
Table 3.25.	AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW IN SUB-DISTRICT OF SUKRA (SATURDAY) .....	III-56
Table 3.26.	AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW (SUNDAY) .....	III-56
Table 3.27.	AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW (MONDAY) .....	III-57
Table 3.28.	AMOUNT OF PASSENGER CAR UNIT PER HOUR ON THE ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW DURING MONDAY .....	III-57



Table 3.29. INVENTORY OF FLORA VARIETY IN THE SITE OF PLTU INDRAMAYU 2 x 1.000 MW .....	III-58
Table 3.30. INVENTORY OF NATURAL CROP VARIETY IN THE SITE OF PLTU INDRAMAYU 2 x 1.000 MW .....	III-59
Table 3.31. NUMBER OF FAUNA VARIETY IN THE RESEARCH AREA .....	III-61
Table 3.32. RELATIVE COMPOSITION AND POPULATION OF FAUNA IN THE RESEARCH AREA .....	III-61
Table 3.33. OCEANIC PLANKTON VARIETY AROUND THE PROSPECTIVE SITE FOR PLTU INDRAMAYU 2 X 1.000 MW .....	III-65
Table 3.34. OCEAN BENTHOS VARIETY AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-66
Table 3.35. VARIETY OF PLANKTON IN THE RIVER AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-67
Table 3.36. VARIETY OF BANTHOS IN THE RIVER AREA AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW .....	III-69
Table 3.37. POPULATION OF INDRAMAYU REGENCY 2005 - 2008 .....	III-70
Table 3.38. POPULATION OF PATROL AND SUKRA SUB-DISTRICT 2005 - 2008 .....	III-70
Table 3.39. POPULATION MUBER IN VILLAGES THAT BECOMES PROJECT LOCATION ACCORDING TO GENDER IN PATROL AND SUKRA SUB-DISTRICT, 2009 .....	III-71
Table 3.40. NUMBER OF POPULATION ACCORDING TO EDUCATIONAL LEVEL IN THE VILLAGE OF PROJECT SITE IN PATROL AND SUKRA SUB-DISTRICT 2009 .....	III-72
Table 3.41. POPULATION IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO RELIGION IN SUKRA AND PATROL SUB-DISTRICT 2009 .....	III-73
Table 3.42. POPULATION IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO JOB IN SUKRA AND PATROL SUB-DISTRICT 2009 .....	III-75
Table 3.43. MAIN LIVELIHOOD OF RESIDENTS IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO JOB IN SUKRA AND PATROL SUB-DISTRICT 2009 .....	III-77
Table 3.44. AMOUNT OF OWNERSHIP OF TECHNICAL IRRIGATION RICE FIELD (m2) IN THE SUB-DISTRICT OF SUKRA AND PATROL 2009 .....	III-77
Table 3.45. AMOUNT OF OWNERSHIP OF HALF-TECHNICAL IRRIGATION RICE FIELD (m2) IN THE SUB-DISTRICT OF SUKRA AND PATROL 2009 .....	III-78
Table 3.46. RISKS PERCEIVED BY THE COMMUNITIES .....	III-89
Table 3.47. BENEFITS PERCEIVED BY THE COMMUNITIES .....	III-89
Table 3.48. EXPECTATIONS REGARDING THE DEVELOPMENT OF PLTU INDRAMAYU 2 x 1.000 MW .....	III-89
Table 3.49. TYPES OF HOUSE FLOOR .....	III-91
Table 3.50. WATER SOURCES FOR BATHING AND WASHING .....	III-91
Table 3.51. CLARITY OF WATER ACCORDING TO COMMUNITY .....	III-92
Table 3.52. WATER QUALITY-ODOR LEVEL .....	III-93
Table 3.53. WATER TASTE .....	III-93
Table 3.54. DIRTY WATER/WASTEWATER DISPOSAL .....	III-95
Table 3.55. RUBBISH DISPOSAL .....	III-96
Table 3.56. MAIN DISEASES IN THE COMMUNITIES IN SUKRA DISTRICT .....	III-97
Table 3.57. MAIN DISEASES IN THE COMMUNITY OF PATROL DISTRICT .....	III-98
Table 3.58. COMMUNITY HEALTH FACILITIES IN SUKRA DISTRICT .....	III-98
Table 3.59. WATER SOURCES FOR DRINKING/COOKING IN THE DRY SEASON .....	III-99
Table 3.60. WATER SOURCES FOR DRINKING/COOKING IN THE RAINY SEASON .....	III-99
Table 3.61. WATER SOURCE FOR BATHING/WASHING IN THE DRY SEASON .....	III-99
Table 3.62. WATER SOURCE FOR BATHING/WASHING IN THE RAINY SEASON .....	III-100
Table 3.63. TOILETS AND BATHROOMS .....	III-100
Table 3.64. WASHING FACILITIES .....	III-100
Table 3.65. TOILETS .....	III-101
Table 4.1. Matrix of Potential Impact Identification on Preconstruction, Construction and Operational Stage .....	IV-1
Table 5.1. Amount of Vehicle During Construction Stage .....	V-4

Table 5.2.	Emission Factor .....	V-5
Table 5.3.	Emission Factor of SO <sub>2</sub> , NO <sub>2</sub> Pollutant Gas (M <sub>3</sub> n/Hour) .....	V-7
Table 5.4.	Prediction on Increasing Air Pollution Caused By The Construction of Facility and Infrastructure .....	V-7
Table 5.5.	Intensity of Noise from Construction Heavy Equipment .....	V-8
Table 5.6.	Prediction of Change in Opening Surface and Land Maturity .....	V-16
Table 5.7.	Specification of Unit 1 and 2 of PLTU Indramayu 2 X 1000 MW .....	V-18
Table 5.8.	Spesification of PLTU Jawa Barat (side-to-side) .....	V-18
Table 5.9.	Emission Standard .....	V-18
Table 5.10.	Increasing SO <sub>2</sub> Concentration from The Operating of PLTU Indramayu Unit 1, 2 and PLTU Jawa Barat.....	V-20
Table 5.11.	Increasing NO <sub>2</sub> Concentration from The Operating of PLTU Indramayu Unit 1, 2 and PLTU Jawa Barat .....	V-20
Table 5.12.	Increasing PM <sub>10</sub> Concentration from The Operating of PLTU Indramayu Unit 1, 2 and PLTU Jawa Barat by Using Electrical Ash Catcher (Esp) .....	V-20
Table 5.13.	Cooling Unit Spesification of PLTU Indramayu 2 X 1000 MW .....	V-26
Table 5.14.	Used Spesification and Condition in The Model of PLTU Indramayu 1 and 2 .....	V-27
Table 5.15.	Sea Water Condition .....	V-27
Table 5.16.	Model Case for Heat Distribution Prediction .....	V-28
Table 5.17.	Heat Distribution Level Model Result .....	V-28
Table 5.18.	Waste Water Standard .....	V-31
Table 5.19.	Liquid Waste Standards (Desalinisation) .....	V-31
Table 5.20.	Liquid Waste (FGD System) (Wet Scrubber Air) .....	V-31
Table 5.21.	Waste Water Standards (Coal Stockpile) .....	V-31
Table 5.22.	Matrix of Signnificant Impact Evaluation on Preconstruction, Construction, and Operational Stage of PLTU Indramayu 2 x 1.000 MW Development .....	V-34

## LIST OF PICTURE

FIGURE 2-1.	MAP OF ACTIVITY SITE FOR PLTU INDRAMAYU 2 X 1.000 MW DEVELOPMENT PLAN.....	II-3
FIGURE 2.2.	MAP OF SPATIAL LAYOUT PLAN OF INDRAMAYU REGENCY .....	II-4
FIGURE 2-3.	ACTIVITY SITE OF PLTU INDRAMAYU 2 X 1.000 MW DEVELOPMENT PLAN, IN MEKARSARI VILLAGE, PATROL SUB-DISTRICT, INDRAMAYU REGENCY, WEST JAVA PROVINCE .....	II-5
FIGURE 2.4.	LAYOUT MAP OF PLTU INDRAMAYU 2 X 1.000 MW .....	II-8
FIGURE 2.5 .	LAY OUT OF U PLTU INDRAMAYU .....	II-9
FIGURE 2.6.	LAND ALLOCATION ESTIMATION FOR PLTU INDRAMAYU 2 X 1.000 MW .....	II-10
FIGURE 2.7.	PROCESS OF COAL CONVERSION TO ELECTRICITY .....	II-12
FIGURE 2.8.	JETTY GENERAL LAYOUT .....	II-19
FIGURE 2.9.	STACK SCHEME OF PLTU INDRAMAYU .....	II-20
FIGURE 2.10.	WATER UTILIZATION CHART .....	II-22
FIGURE 2.11.	COAL ASH DEPOSIT SCHEMATIC SYSTEM .....	II-23
FIGURE 2.12.	DEPOSIT POND AND DRAINAGE SYSTEM .....	II-24
FIGURE 2.13.	CONSTRUCTION SCHEDULE OF PLTU INDRAMAYU 2 X 1.000 MW .....	II-25
FIGURE 2.14.	COAL HANDLING SYSTEM .....	II-28
FIGURE 2.15.	WASTE WATER TREATMENT PLANT SCHEME .....	II-37
FIGURE 3-1.	WINDROSE .....	III-5
FIGURE 3-2.	MAP OF AIR QUALITY AND NOISE SAMPLING .....	III-14
FIGURE 3-3.	MAP OF SEA WATER QUALITY SAMPLING .....	III-20
FIGURE 3-4.	MAP OF SURFACE WATER QUALITY, WELL WATER, AND WATER DEBIT SAMPLING .....	III-21
FIGURE 3-5.	FLAT TERRAIN MORPHOLOGY OF STUDY AREA .....	III-23
FIGURE 3-6.	REGIONAL GEOLOGICAL MAP OF STUDY AREA AND ITS SURROUNDING, (HALF OF INDRAMAYU REGIONAL GEOLOGICAL MAP SHEET 1309-04, BY D. SUDANA AND A. ACHDAN AND HALF OF PAMANUKAN SHEET, SHEET NO. 1209-06, BY H.Z. ABIDIN AND SUTRISNO), SCALE 1 : 100.000, PUBLISHED BY CENTER OF GEOLOGY STUDY, BANDUNG) .....	III-25
FIGURE 3-7.	CLAY, GRAYISH BROWN, MASSIVE, IMPERMEABLE, DOMINATING STUDY AREA.....	III-25
FIGURE 3-8.	RIVER BASIN DISTRIBUTION AND SIZE IN INDRAMAYU REGENCY.....	III-27
FIGURE 3-9.	IRRIGATION MAP IN INDRAMAYU REGENCY .....	III-28
FIGURE 3-10.	WELL, GENERALLY NOT SUPPRESSED IN THE BEACH SEDIMENT ACQUIFER SYSTEM .....	III-31
FIGURE 3-11.	REGIONAL HYDROGEOLOGICAL MAP OF STUDY AREA .....	III-32
FIGURE 3-12.	GROUND WATER AND ACQUIFER PRODUCTIVITY MAP IN INDRAMAYU REGENCY .....	III-33
FIGURE 3-13.	GROUND WATER POTENTIAL MAP OF INDRAMAYU REGENCY .....	III-34
FIGURE 3-14.	FLOOD DISASTER POTENTIAL DISTRIBUTION MAP IN INDRAMAYU REGENCY .....	III-35
FIGURE 3-15.	INDONESIAN EARTHQUAKE INTENSITY DISTRIBUTION AND RISK MAP. ....	III-39
FIGURE 3-16.	BATIMETRI MAP OF INDRAMAYU BEACH .....	III-40
FIGURE 3-17.	WIND SPEED AND DIRECTION DISTRIBUTION (2006-2010 PERIOD) ....	III-41
FIGURE 3.18.	WAVE HIND CASTING AREA .....	III-42
FIGURE 3.19.	FETCH LINE IN INDRAMAYU BEACH .....	III-43
FIGURE 3-20.	TIDAL WAVE MEASUREMENT RESULT OF INDRAMAYU BEACH .....	III-44
FIGURE 3.21.	CURRENT DISTRIBUTION, DIRECTION, AND SPEED .....	III-46
FIGURE 3-22.	TIDE CURRENT PATTERN .....	III-47
FIGURE 3-23.	SPATIAL USE PLAN .....	III-51
FIGURE 3-24.	MAINSTAY AREA PLANNING .....	III-52
FIGURE 3-25.	MAP OF TRANSPORTATION SAMPLING .....	III-54

FIGURE 3-26.	VEGETATION IN PROSPECTIVE AREA OF PLTU INDRAMAYU 2 x 1.000 MW. ....	III-58
FIGURE 3-27.	BEACH CONDITION IN THE PROSPECTIVE SITE OF PLTU INDRAMAYU 2 x 1.000 MW DURING OBSERVATION.....	III-60
FIGURE 3-28.	HALF-BRICK HOUSE-PLASTERED FLOOR (a), BAMBOO HOUSE-EARTHEN FLOOR (b) .....	III-91
FIGURE 3-29.	COMMUNITY WATER SOURCE-DRILLED WELL (LEFT) AND MANUALLY-DUG WELL (RIGHT) .....	III-92
FIGURE 3-30.	COMMUNITY WATER SOURCE-A POND .....	III-93
FIGURE 3-31.	CLOSET IN THE RIVER (LEFT), CLOSET IN A WATER CHANNEL (RIGHT) .....	III-94
FIGURE 3-32.	SEPTIC TANK NEAR DRILLED WELL .....	III-94
FIGURE 3-33.	DIRTY WATER/WASTEWATER DISPOSAL .....	III-95
FIGURE 3-34.	IRRIGATION CHANNEL FILLED WITH RUBBISH .....	III-95
FIGURE 3-35.	COMMUNITY WASTE DISPOSAL SITE .....	III-96
FIGURE 3-36.	POULTRY HOUSE (A); DUCK HOUSE (B) .....	III-97
FIGURE 3-37.	GOAT HOUSE .....	III-97
FIGURE 4.1.	POTENTIAL IMPACT IDENTIFICATION DURING PRECONSTRUCTION STAGE .....	IV-3
FIGURE 4.2.	POTENTIAL IMPACT IDENTIFICATION DURING CONSTRUCTION STAGE .....	IV-4
FIGURE 4.3.	POTENTIAL IMPACT IDENTIFICATION DURING OPERATIONAL STAGE... ..	IV-5
FIGURE 4.4.	FLOW CHART OF SCOPING PROCESS .....	IV-6
Figure 4-5.	MAP OF THE BORDER OF STUDY AREA .....	IV-14
FIGURE 5.1.	MOBILISATION COURSE FOR EQUIPMENT AND MATERIAL .....	V-4
FIGURE 5.2.	SCHEME OF NOISE DISTRIBUTION IN PROJECT SITE .....	V-8
FIGURE 5.3.	ISOPLETH OF NOISE DISTRIBUTION AREA .....	V-9
FIGURE 5.4.	ISOPLETH OF INCREASING SO <sub>2</sub> POLLUTANT GAS CONCENTRATION DISTRIBUTION AREA .....	V-21
FIGURE 5.5.	ISOPLETH OF INCREASING NO <sub>2</sub> POLLUTANT GAS CONCENTRATION DISTRIBUTION AREA .....	V-22
FIGURE 5.6.	ISOPLETH OF INCREASING PM <sub>10</sub> CONCENTRATION DISTRIBUTION AREA .....	V-23
FIGURE 5.7.	ISOPLETH MAP OF SO <sub>2</sub> (A), NO <sub>2</sub> (B) PLUME, OPERATION OF ... PLTU 1 + 2 and PLTU JAWA BARAT, DOMINATED BY NORTH WIND DIRECTION, WIND SPEED 1,5 M/SEC .....	V-24
FIGURE 5.8.	ISOPLETH MAP OF PM <sub>10</sub> PLUME, OPERATION OF PLTU 1 + 2 and PLTU JAWA BARAT, DOMINATED BY NORTH WIND DIRECTION, WIND SPEED 1,5 M/SEC .....	V-24
FIGURE 5.9.	RESULT OF OPERATIONAL MODEL OF PLTU INDRAMAYU 2 X 1000 MW AND PLTU JAWA BARAT WITH CURRENT SPEED OF 0.25M/S HEADING SOUTH EAST .....	V-29
FIGURE 5.10.	RESULT OF OPERATIONAL MODEL OF PLTU INDRAMAYU 2 X 1000 MW AND PLTU JAWA BARAT WITH CURRENT SPEED OF 0.25M/S HEADING SOUTH EAST .....	V-29

# CHAPTER I INTRODUCTION

## 1.1. LATAR BELAKANG

Development in Indonesia that is being actively implemented at this time aims at improving the welfare and quality of life of the people. Implementation of development on one hand is facing the issue of large population with high growth rates thus requiring better infrastructure. On the other hand, availability of natural resources is not increasing and is limited. Development activities and the increasing number of people can lead to increased pressure on natural resources.

Utilization of natural resources to improve the welfare and quality of life of the people must be accompanied by efforts to conserve the environment harmoniously in a balanced manner to support sustainable development. The development should be implemented in an integrated and comprehensive policy, taking into account the needs of the present and future generations. The important thing that should be observed in the integrated and total development is the environment. Therefore, the development intended must be environmentally sound and sustainable.

New installations of power plants, at present, are urgent and necessary to supply the increasing national electricity demand, especially in Java and Bali. Therefore PT. PLN (Persero) accelerates the construction of coal-fired power plant, including the plant in Indramayu, West Java Province which is expected to be completed in 2017. The reason for the use of coal is due to the increasing oil fuel prices, and abundant and relatively inexpensive Indonesian coal reserve is an alternative to a diversified development of electrical energy.

The construction of the Steam Power Plant which has a capacity of 2 x 1000 megawatts (MW) is planned to be built in the North Coast of Indramayu region, in Mekarsari, Patrol and Patrol Lor Villages, Patrol District, as well as Sumuradem Village Sukra District, Indramayu Regency. The electricity produced by the new power plant will be 8.4% and is going to be distributed directly through the Java - Bali interconnection system.

The aim of this study is to implement of sustainable development and wise and controlled utilization of natural resources. This study is needed in the planning of construction activities PLTU Indramayu 2 x 1000 MW in order to estimate the impact on the environment, both beneficial and adverse impacts.

Article 15 of Law No. 23 of 1997 states that every activity which is expected to produce significant impacts on the environment must be accompanied by an Environmental Impact Analysis Study. Implementation of the Environmental Impact Analysis is stipulated in Government

Regulation No. 27 of 1999 and further in Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business and / or Activities that Must be Equipped by Environmental Impact Analysis dictating that the activities of planned construction of power plant with a capacity of over 100 MW shall be equipped with an Environmental Impact Analysis study.

## **1.2. OBJECTIVES AND BENEFITS**

In general, the objectives and benefits of PLTU Indramayu 2 x 1000 MW with the capacity of 2 x 1000 MW are to meet the needs of power supply which is very urgent and will be used for the construction sector in Java and Bali.

### **1.2.1. Project Objectives**

In line with the condition of the electrical system of the Java Bali today, the growth rate of electrical energy needs at this time is very demanding because of a very significant increase, while the ability of the existing plants has begun to decline. Therefore, PT. PLN is in a desperate need to build new power plants fueled by coal with the capacity of 2 x 1000 MW in order to meet the demand and maintain the reliability of electricity supply. PLTU Indramayu 2 x 1000 MW will be located in Mekarsari Village, Patrol Village and Patrol Lor Village, Patrol District, as well as Sumuradem Village Sukra District, Indramayu Regency, West Java Province.

### **1.2.2. Project Benefits**

The benefits of PLTU Indramayu 2 x 1000 MW project include its use for the government, the initiator, and the public.

#### **A. Benefits for the Government**

The benefits of the planned construction of PLTU Indramayu 2 x 1000 MW for the Government are:

- a. To overcome the shortage of electricity in Java in particular and Indonesia in general as a "crash program".
- b. To increase the supply of electricity in Java.
- c. To optimize the use of resources to generate electricity through PLTU Indramayu 2 x 1000 MW along with its facilities for public social, economic and cultural interests.
- d. To implement the government's policy with regard to diversification of energy resources in the efforts to conserve oil and increase the use of alternative energy resources.
- e. To increase government revenue through the central and local tax revenues, user charges, and non-tax revenues.

#### **B. Benefits for the Initiator**

The benefits of PLTU Indramayu 2 x 1000 MW project for the Initiator are:

- a. To promote the reliability of electrical systems and improve the availability of electricity in the transmission network of Java Island.
- b. To provide an economical source of electricity to stimulate economic growth.
- c. To implement Government policy regarding the diversification of energy for fuel savings and increase alternative energy sources.

### **C. Benefits for the People**

The benefits of the construction of PLTU Indramayu 2 x 1000 MW for the People are:

- a. To enjoy development benefits through evolving technological transformation of the availability of electricity.
- b. To gain sources of electricity that will stimulate economic activity.
- c. Availability of professional and businesses / services opportunities that will result in positive impacts on development, particularly in Indramayu.

### **1.3. LEGISLATIONS**

In the framework of the goal of sustainable development and Environmental Impact Analysis of PLTU Indramayu 2 x 1000 MW, the legislations as follows will be made references:

#### **1.3.1. Law**

- 1) Law of the Republic of Indonesia No. 1 of 1970 concerning Occupational Safety.  
Reason : As a reference in the construction of power plant with regard to the management of occupational safety impact.
- 2) Law No. 7 of 1981 concerning Compulsory Personnel Reporting.  
Reason : As a reference in the recruitment of workers for PLTU Indramayu 2 x 1000 MW.
- 3) Law of the Republic of Indonesia No. 5 of 1984 concerning Industry.  
Reason : As a reference in the construction of power plant with regard to industrial activities which will be built.
- 4) Law No. 1 of 1990 concerning Occupational Safety  
Reason : As a reference in the construction of power plant with regard to its Implementation which must meet safety requirements.
- 5) Law No. 5 of 1990 concerning Conservation of Natural Resources and Ecosystems.

Reason : As a reference in the planning / conservation of natural resources related to impact management.

- 6) Law of the Republic of Indonesia No. 35 of 1991 concerning River.

Reason : As a reference in the construction of the power plant with regard to the impact on the management of the river around the construction.

- 7) Law No. 3 of 1992, concerning Worker Social Security

Reason : As a reference in the construction of power plant with regard to Social Security membership. Companies that employ workers should include them in the Social Security program

- 8) Law of the Republic of Indonesia No. 14 of 1992 concerning Traffic and Road Transportation.

Reason : As a reference in the construction of power plant with regard to the impact of traffic management and road transportation around PLTU Indramayu 2 x 1000 MW.

- 9) Law of the Republic of Indonesia No. 21 of 1992 concerning Shipping.

Reason : As a reference in the construction of power plant with regard to the management of traffic and impact of sea transport for the distribution of coal.

- 10) Law of the Republic of Indonesia No. 6 of 1993 concerning Climate Change.

Reason : As a reference in the construction of the power plant with regard to the management of the impact of climate change as a result of construction activities PLTU Indramayu 2 x 1000 MW.

- 11) Law of the Republic of Indonesia No. 5 of 1994 concerning Ratification of the International Convention Regarding Biodiversity.

Reason : As a reference in the construction of the power plant with regard to the management of the impact on flora and fauna.

- 12) Law of the Republic of Indonesia No. 5 of 1995 concerning Ratification of the Climate Convention.

Reason : As a reference in the construction of power plant with regard to climate change.

- 13) Law of the Republic of Indonesia No. 6 of 1996 concerning Indonesian Waters.

Reason : As a reference in the construction of power plant with regard to the activities of PLTU Indramayu 2 x 1000 MW in the area of Indonesian waters.



- 14) Law of the Republic of Indonesia No. 13 of 2003 concerning Manpower.

Reason : As a reference in the construction of power plant with regard to the management of the impact of labor mobilization.

- 15) Law No. 7 of 2004 concerning Water Resources

Reason : As a reference in the construction of power plant with regard to the use of water for the construction of PLTU Indramayu 2 x 1.000 MW.

- 16) Law No. 31 of 2004 concerning Fisheries.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of impacts.

- 17) Law No. 32 of 2004 concerning Regional Government (which has been amended by Government Regulation in Lieu of Law No. 3 of 2005).

Reason : As a reference in the construction of power plant as it relates to the development policy in Indramayu Regency

- 18) Law No. 27 of 2007 concerning Management of Coastal Areas and Small Islands.

Reason : As a reference in the management of PLTU Indramayu 2 x 1000 MW relating to the activities of PLTU Indramayu 2 x 1000 MW located in coastal areas.

- 19) Law No. 26 of 2007 concerning Spatial Planning.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to possible changes in land use due to the power plant.

- 20) Law No. 26 of 2008 concerning Regional Spatial Planning.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW related to spatial planning in the area of the power plant construction plan.

- 21) Law No. 30 of 2009 concerning Electricity.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of the impacts.

- 22) Law No. 32 of 2009 concerning Protection and Management of the Environment.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the obligation in the context of preparation of the EIA document for environmental management mainly due to the impacts caused by the project activity.

- 23) Law of the Republic of Indonesia No. 36 of 2009 concerning Health.

Reason : As a reference in the construction of power plant with regard to the management of public health impact.

- 24) Law No. 27 of 2007 concerning Management of Coastal Areas and Small Islands (PWP PPK)

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the typology of the coastal region.

### **1.3.2. Government Regulation**

- 1) Government Regulation No. 13 of 1987 concerning Industrial Business License.

Reason : As a reference for the permits in the construction of PLTU Indramayu 2 x 1000 MW

- 2) Government Regulation No. 6 of 1988 concerning Vertical Institutional Coordination in Regions.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW as it relates to development policy in Indramayu Regency.

- 3) Government Regulation No. 10 of 1989 *juncto* Government Regulation No. 26 of 2006 concerning Provision and Use of Electric Power.

Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.

- 4) Government Regulation No. 41 of 1993 concerning Road Transportation.

Reason : As a reference for the management of transportation used in PLTU Indramayu 2 x 1000 MW.

- 5) Government Regulation No. 43 of 1993 concerning Road Infrastructure and Traffic.

Reason : As a reference for the mobilization of facilities and infrastructure management in the activities of construction of PLTU Indramayu 2 x 1000 MW.

- 6) Government Regulation No. 69 of 1996 concerning Exercise of Rights and Performance of Duties as well as Forms and Procedures for Public Participation in Spatial Planning.

Reason : As a reference to the participation of the local community towards PLTU Indramayu 2 x 1000 MW.

- 7) Government Regulation No. 70 of 1996 concerning Seaport.

Reason : As a reference in the construction of jetties that will be used for the distribution of coal.

- 8) Government Regulation No.7 of 1999 concerning Preservation of Plants and Animals.  
Reason : As a reference in environmental management so that the construction activities of PLTU Indramayu 2 x 1000 MW do not disturb plants and animals around the site
- 9) Government Regulation No. 8 of 1999, concerning use of plants and wildlife.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW so as to not disturb the plants and animals around the construction site.
- 10) Government Regulation No. 18 of 1999 *juncto* Government Regulation No. 85 of 1999 concerning Management of Hazardous and Toxic Waste.  
Reason : As a reference in waste management mainly due to the impact caused by the project activity.
- 11) Government Regulation No. 19 of 1999 concerning Sea Pollution and / or Destruction Control.  
Reason : As a reference in the solution in the event if issues / impact of activities on the sea around PLTU Indramayu 2 x 1000 MW.
- 12) Government Regulation No. 27 of 1999 concerning Environmental Impact Analysis.  
Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.
- 13) Government Regulation No. 41 of 1999 concerning Air Pollution Control.  
Reason : As a reference in the solution in the event of issues / impact of activities against air quality.
- 14) Government Regulation No. 47 of 1999 concerning Spatial Planning.  
Reason : As a reference in the spatial change with the construction of PLTU Indramayu 2 x 1000 MW
- 15) Government Regulation No. 82 of 1999 concerning Water Transport.  
Reason : As a reference in traffic management and mobilization of the power plant's raw materials by sea.
- 16) Government Regulation No. 81 of 2000 concerning Navigation.  
Reason : As a reference for coordination with the sea transportation office on the management and monitoring of sea lanes to be used as a coal raw material supplier.
- 17) Government Regulation No. 74 of 2001 concerning Management of Hazardous and Toxic Materials (B3).

Reason : As a reference in waste management mainly due to the impact caused by the project activity.

- 18) Government Regulation No. 82 of 2001 concerning the Management of Water Quality and Water Pollution Control.

Reason : As a reference in the solution in the event of issues / impact of activities on water quality.

### **1.3.3. Presidential Regulation**

- 1) Regulation of the President of the Republic of Indonesia No. 71 of 2006 concerning Assignment to PT. PLN (Persero) for Performing Accelerated Construction of Coal Power Plant.

Reason : As a reference for PT. PLN (Persero) to construct PLTU Indramayu 2 x 1000 MW.

- 2) Regulation of the President of the Republic of Indonesia No. 72 of 2006 concerning Coordinating Team for the Acceleration of Construction of Power Plant..

Reason : As a reference for PT. PLN (Persero) to immediately form a coordinating team in the construction of PLTU Indramayu 2 x 1000 MW.

- 3) Regulation of the President of the Republic of Indonesia Nomor 109 tahun 2006 concerning Handling of Oil Spill at Sea.

Reason : As a reference for PT. PLN (Persero) to handle with emergency of oil spills at sea originating from its business and / or activities.

### **1.3.4. Ministerial Regulation**

- 1) Regulation of the Minister of Manpower and Transmigration No. 1 of 1980 concerning Occupational Safety and Health in Building Construction

Reason : As a reference in worker health and safety in the construction of PLTU Indramayu 2 x 1000 MW

- 2) Regulation of the Minister of Manpower No. 5 of 1985, concerning Lifting and Transporting Apparatuses.

Reason : : As a reference in the use of Apparatuses, Junis Cranes, Dozers, Excavators, Fork-lifts which meet the requirements of K3.

- 3) Regulation of the Minister of Health No. 718/MENKES/PER/XII/1987 concerning Noise Related to Health.

Reason : As a reference for the solution in the event of issue or impact of the activities mainly related to noise that can affect health.

- 4) Regulation of the State Minister of Agrarian / Head of BPN No. 1 of 1994 concerning Implementing Regulations of Presidential Decree No. 55 of 1993.

Reason : As a reference for the solution in the event of issues / impact of activities related to land release / land acquisition.

- 5) Regulation of the Minister of Environment No. Kep. 08 of 2006 concerning Guidelines for the Preparation of Environmental Impact Analysis.

Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.

- 6) Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business Plan and / or activities which must be equipped with EIA.

Reason : As a reference that PLTU Indramayu 2 x 1000 MW project is an activity that must have EIA documents.

- 7) Regulation of the Minister of Environment No. 12 of 2006 concerning Licensing Requirements and Disposal of Wastewater to the Sea.

Reason : As a reference for the solution in the event of issues / impact of activities primarily those related to the possibility of the waste from PLTU Indramayu 2 x 1000 MW.

- 8) Regulation of the State Minister of Environment 5 of 2009 concerning Management of Waste in Port.

Reason : As a reference for the solution in the event of issues / impact of activities primarily related to Waste Management in the Port.

- 9) Regulation of the State Minister of Environment No. 18 of 2009 on Licensing Procedures for the Management of Hazardous and Toxic Material Waste.

Reason : As a reference for the solution in the event of issues / impact of activities primarily related to Management of Hazardous and Toxic Material Waste.

- 10) Regulation of the State Minister of Environment No. 30 of 2009 on Procedures for Licensing and Supervision of Management of Hazardous and Toxic Waste Material and Waste Pollution Control Recovery Due to B3 by local government.

Reason : As a reference for the solution in the event of issues / impact of activities primarily related to Management of Hazardous and Toxic Waste Materials and Waste Pollution Control Recovery Due to B3 by local government.

#### **1.3.5. Presidential decree**

- 1) Presidential Decree No. 04 of 1980 on Obligatory Manpower Report.  
Reason : As a reference in recruitment for PLTU Indramayu 2 x 1000 MW.
- 2) Presidential Decree No. 55 of 1993 on Land Procurement for Development for Public Interest.  
Reason : As a reference in the determination of land for the construction of PLTU Indramayu 2 x 1000 MW Indramayu
- 3) Presidential Decree No. 10 of 2000 concerning Environmental Impact Management Agency.  
Reason : As a reference in the determination of regulatory, executive and reporting agency for the environmental impact control of PLTU Indramayu 2 x 1000 MW

#### **1.3.6. Ministerial decree**

- 1) Decree of the Minister of Manpower No. SE.OI/MEN/1978 concerning Ambient Air Quality Standards in Work Environment.  
Reason : As a reference in the assessment of the environment, especially increase of ambient air pollution that can be caused by the construction activities of PLTU Indramayu 2 x 1000 MW.
- 2) Decree of the State Minister of Population and the Environment No. KEP-49/MENKLH/6/1987 concerning Determination of Significant Impacts.  
Reason : As a reference in the assessment of environmental factors as activities that have an important impact.
- 3) Decree of the Minister of Environment No. KEP-14/MENLH/3/1994 concerning General Guidelines for the Preparation of Environmental Impact Analysis.  
Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.
- 4) Decree of the Minister of Mining and Energy No: 103.K/008/M.PE/1994 concerning Supervision of the Implementation of RKL and RPL in the field of Mining and Energy.  
Reason : As a reference in the process of monitoring the implementation of the RKL and RPL of PLTU Indramayu 2 x 1000 MW
- 5) Decree of the State Minister of Environment No. Kep. 13/MENLH/3/1995 concerning Emission Quality Standard from Immovable Sources.  
Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.

- 6) Decree of the State Minister of Environment No. Kep. 51/MENKLH/10/ 1995 concerning Liquid Waste Quality Standard for Industrial Activities.

Reason : As a reference in the assessment of the environment, especially wastewater that can be caused by PLTU Indramayu 2 x 1000 MW.

- 7) Decree of the State Minister of Environment No. KEP-48/MENLH/XI/1996 concerning Quality Standard of Noise Level.

Reason : As a reference in the assessment of the environment, especially noise that can be caused by PLTU Indramayu 2 x 1000 MW.

- 8) Decree of the Minister of Environment No. KEP-49/MENLH/XI/1996 concerning Quality Standards of Vibration Levels.

Reason : As a reference in the assessment of environmental conditions, especially the level of vibration that can be caused by PLTU Indramayu 2 x 1000 MW.

- 9) Decree of the Minister of Environment No. KEP-50/MENLH/XI/1996 concerning Baku Quality Standards of Odor.

Reason : As a reference in the assessment of the environment, especially the odor that can be caused by PLTU Indramayu 2 x 1000 MW

- 10) Decree of the State Minister of Environment No. KEP-13/MENLH/III/1996 concerning Quality Standards of Emission from Immovable Sources.

Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.

- 11) Decree of the Minister of Environment No. KEP-299/MENLH/11/1996 concerning Social Aspects in EIA study.

Reason : As a reference in the assessment of the environment, especially the socioeconomic and cultural condition around the activities of PLTU Indramayu 2 x 1000 MW.

- 12) Decree of the State Minister of Environment No. KEP-45/MENLH/10/1997 concerning Air Pollution Quality Standards Index.

Reason : As a reference in air pollution assessment based on the quality standards of air pollutants acceptable to the environment.

- 13) Decree of the State Minister of Environment No. KEP-02/MENLH/8/1998 concerning Guidelines for the Determination of Environmental Quality Standards.

Reason : As a reference in the assessment of environmental conditions.

- 14) Decree of the Minister of Transportation No. KM-26 of 1998 concerning Seaport.

Reason : As a reference for jetty construction activities of PLTU Indramayu 2 x 1000 MW

- 15) Decree of the Minister of Mining and Energy No. 1457K/28/MEN/2000 concerning Guidelines for the Preparation of Environmental Management Plan of Mining and Energy Activities.

Reason : As a reference in the preparation of documents and implementation of the EIA study of PLTU Indramayu 2 x 1000 MW.

- 16) Decree of the Minister of Health No. 907 of 2002 concerning Conditions of Water Quality Monitoring.

Reason : As a reference in environmental assessment, especially with regard to the quality of water.

- 17) Decree of the Minister of Health No.1405 of 2002 concerning Health Requirements of Office and Industry.

Reason : As a reference in the assessment of the environment, particularly health in the surrounding environment, especially around the construction activities of PLTU Indramayu 2 x 1000 MW.

- 18) Decree of the Minister of Energy and Mineral Resources No. 1752.K/34/MEM/2002 concerning Implementation of Electricity Inspection.

Reason : As a reference in the assessment of the environment, especially the activities of electricity that may cause the impact of the activities of PLTU Indramayu 2 x 1000 MW.

- 19) Decree of the Minister of Environment No. 51 of 2004 concerning Sea Water Quality Standard.

Reason : As a reference in environmental assessment, especially the quality of sea water.

#### **1.3.7. Decree of the Head of Environmental Impact Controlling Agency**

- 1) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 056 of 1994 concerning Guidelines for the Determination of Significant Impacts.

Reason : As a reference in determining significant impacts.

- 2) Decree of the Head of the Environmental Impact Controlling Agency No. 01 of 1995. concerning Procedures and Technical Requirements for Storage and Collection of Hazardous and Toxic Waste Materials.



Reason : As a reference in the assessment of environmental conditions particularly hazardous and toxic waste that can be caused by PLTU Indramayu 2 x 1000 MW.

- 3) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 04/BAPEDAL/09/1995 concerning Procedures and Requirements for Stockpiling Processing, Requirements for Ex- Location of Processing and Requirements for Ex Location of Hazardous and Toxic Waste Materials.

Reason : As a reference for environmental assessment mainly the result of processing of hazardous and toxic waste materials that can be caused by PLTU Indramayu 2 x 1000 MW.

- 4) Decree of the Director General of Electricity and Energy Development No. 75 – 12/008/6002/1995 concerning Implementing Guidelines and Environmental Monitoring of Electricity.

Reason : As a reference in the study of the impact of electricity.

- 5) Decree of the Head of the Environmental Impact Controlling Agency No. Kep. 205/BAPEDAL/07/1996 concerning Technical Guidelines for Controlling Air Pollution from Immovable Sources.

Reason : : As a reference in the study of the impact of air pollution.

- 6) Decree of the Head of the Environmental Impact Controlling Agency No. 299 of 1996 concerning Technical Guidelines of Social Aspects Assessment in the preparation of EIA.

Reason : As a reference in social impact assessment.

- 7) Decree of the Head of the Environmental Impact Controlling Agency No. Kep- 124/12/1997 concerning Public Health Aspects Study in the Preparation of EIA.

Reason : As a reference in the study of health effects.

- 8) Decree of the Head of the Environmental Impact Controlling Agency No. 8 of 2000 concerning Public Involvement and Information Disclosure in the Process of Environmental Impact Analysis.

Reason : As a reference to the participation of the public in the EIA of PLTU Indramayu 2 x 1000 MW

### **1.3.8. Decision of the Governor of West Java**

- 1) Regional Regulation of West Java Province No. 25 of 2002 concerning establishment of SOTK BAPEDAL of West Java Province.

Reason : As a reference in the study of the construction committee of PLTU Indramayu 2 x 1000 MW.

- 2) Regional Regulation of West Java Province No. 36 of 2002 concerning Spatial Planning.

Reason : As a reference in relation to the possibility of changes in land use due to PLTU Indramayu 2 x 1000 MW.

- 3) Regional Regulation of West Java Province Nomor : 02 of 2003 concerning General Spatial Plan of West Java Province.

Reason : Sebagai acuan dalam kaitannya dengan kemungkinan adanya perubahan penggunaan lahan akibat adanya pembangunan PLTU Indramayu 2 x 1.000 MW.

- 4) Regional Regulation of West Java Province No : 3 of 2004 concerning Management of Water Quality and Water Pollution Control.

Reason : As a reference in the impact assessment of water quality.

- 5) Regulation of the Governor of West Java No. 2 of 2006 concerning Coal Utilization.

Reason : As a reference in the study of the impact of coal fuel.

#### **1.3.9. Regional Regulation**

- 1) Regional Regulation No. 01 of 1996 concerning General Spatial Plan for Indramayu Regency.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW in accordance with the Spatial Plan of Indramayu Regency

- 2) Circular Letter of the Regent of Indramayu No.660.1/882-LH/III/1997 concerning the Implementation of EIA studies, UKL and UPL.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 3) Decision of the Regent of Indramayu No. 660/Kep.265-Org/2000 concerning Establishment of the Audit Commission of the EIA and Environmental Management Plan / Environmental Monitoring Plan of Indramayu Regency.

Reason : As a reference in the process of establishing the EIA commission of PLTU Indramayu 2 x 1000 MW.

- 4) Regional Regulation of Indramayu Regency No. 26 of 2003 concerning Guidelines for the Implementation of Environmental Management and Utilization Efforts.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 5) Regional Regulation No. 5 of 2003, concerning Implementation of Manpower Administration in Indramayu Regency.

Reason : As a reference in the recruitment process of PLTU Indramayu 2 x 1000 MW.

## BAB II

### BUSINESS PLAN

#### 2.1. IDENTITY OF INITIATOR AND DRAFTER OF ENVIRONMENTAL ANALYSIS IMPACT

##### 2.1.1. Identity of Initiator

- a. Agency : PT. PLN (Persero) **Java-Bali Grid Network Construction Main Unit**
- b. Address : Jl. Slamet No. 1, Candi Baru Semarang 50232
- c. Person in Charge : PT. PLN (Persero) General Manager of PT. PLN (Persero) **Java-Bali Grid Network Construction Main Unit**
- d. Telephone : (024) 8310060
- e. Faximile : (024) 8317241

##### 2.1.2. Identity of Environmental Analysis Impact Drafter

- a. Agency : Faculty of Geology Padjadjaran University
- b. Address : Jalan Raya Bandung Sumedang KM 21 Jatinangor  
Telp./Fax. (022) 7796545 – Postal Code 45363
- c. Person in Charge : Dr. Ir. Hendarmawan, M.Sc.
- d. Title : Dean of Faculty of Geology Padjadjaran University

##### 2.1.3. Structure of Assesment Team

EXPERTS	
POSITION	NAME
Team Leader	Drs. Rusydi, M.Si.
Hydrologist	Totok Herwanto, Ir., M.Eng.
Expert in Climate and Air Quality	Dr. Dadan Sumiarsa, M.S.
Expert in Hydro-Oceanography	Budi Gunadharma, ST; MM.
Geologist	Boy Yosef, ST, MT.
Expert in Water Quality	Dr. Sunardi, M.S.
Land and Marine Biologist	Dr. Yayat Ruchiyat.
Expert in Land Spatial Layout and Transportation	Drs. Rusydi, M.Si.
Expert in Social Economy and Culture	Dra. Sri Mulyasari.
Expert in Public Health	Sjazili Muhibat, drg., M.S.
Expert in Electricity	Ir. Hery Waskitho

## **2.2. SCOPE OF ASSESSED ACTIVITY PLAN AND ALTERNATIVE OF BUSINESS AND/OR ACTIVITY PLAN COMPONENTS**

Scope of assessed activity plan including the status of PLTU Indramayu 2 x 1000 MW development plan, compliance of site plan with the Spatial Layout of Indramayu Regency, activities that are causing environmental impacts, and activities around the PLTU Indramayu 2 x 1000 MW site plan. Brief description regarding its impact will be shown in flow chart.

### **2.2.1. Activity Status**

PLTU Indramayu 2 x 1000 MW development plan is a development for new power plant which assessment for environmental analysis impacts was conducted along with the Indramayu 2 x 1000 MW Power Plant's feasibility study, 1) on the planning stage, 2) Feasibility Study, 3). Land Procurement.

### **2.2.2. Compliance of Business/Activity Plan with the Spatial Layout of Indramayu Regency, West Java Province Activity Plan of PLTU Indramayu 2 x 1000 MW**

Site for PLTU Indramayu 2 x 1000 MW is located on the coordinate of S6° 16' 33" and E 107° 58' 60" in Mekarsari, Patrol Lor and Patrol Baru Village, Patrol Sub-District, and Sumuradem Village, Sukra Sub-District, Indramayu Regency, West Java Province or approximately 180 Km away from i Jakarta. Project site can be seen in Figure 2.1 and 2.2. Capacity of planned PLTU Indramayu 2 x 1000 MW, along with its supporting facilities, is 2 x 1000 MW.

The location is adjacent to 1st PLTU Jawa Barat (3 x 330 MW) which is still on final stage of construction. Facing Java Sea on North side, rice fields and public settlements and north coast national road on South side ( $\pm$  2 Km), in West side, adjacent to the 1st PLTU Jawa Barat and in West side adjacent to irrigation canal, shrimp ponds, and fish ponds. Details about location can be seen in Figure 2.1

According to the Regional Regulation of Indramayu Regency No. 4 of 2005 on Spatial Layout, Indramayu Regency has dedicated zone for industrial affairs in respective Sub-District, such as Sukra and Balongan. Planned location for this PLTU Indramayu 2 x 1000 MW project is in Sukra Sub-District which has been dedicated for industrial zone. Therefore, this location is already suitable for the development of coal-fired Steam Power Plant.



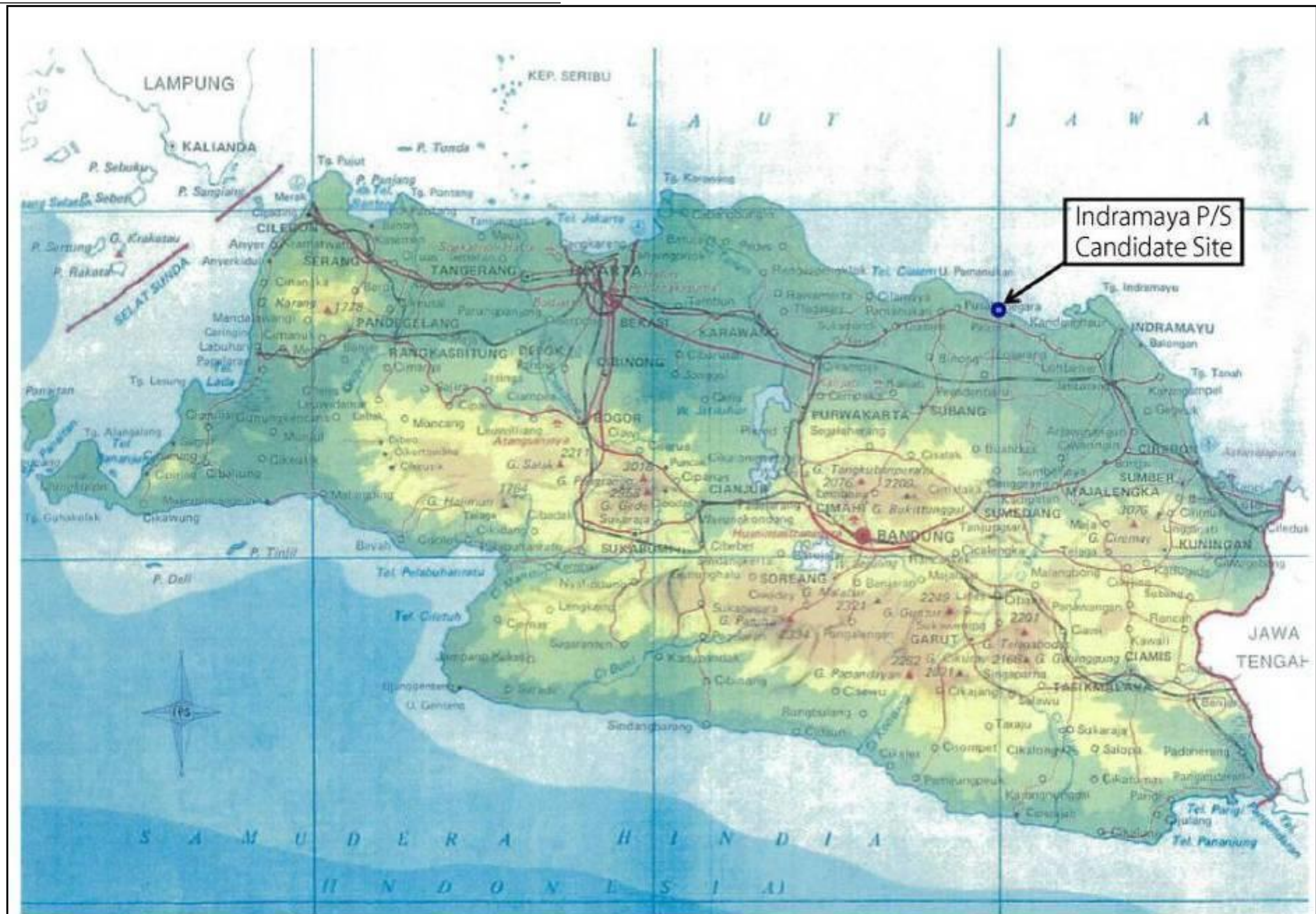
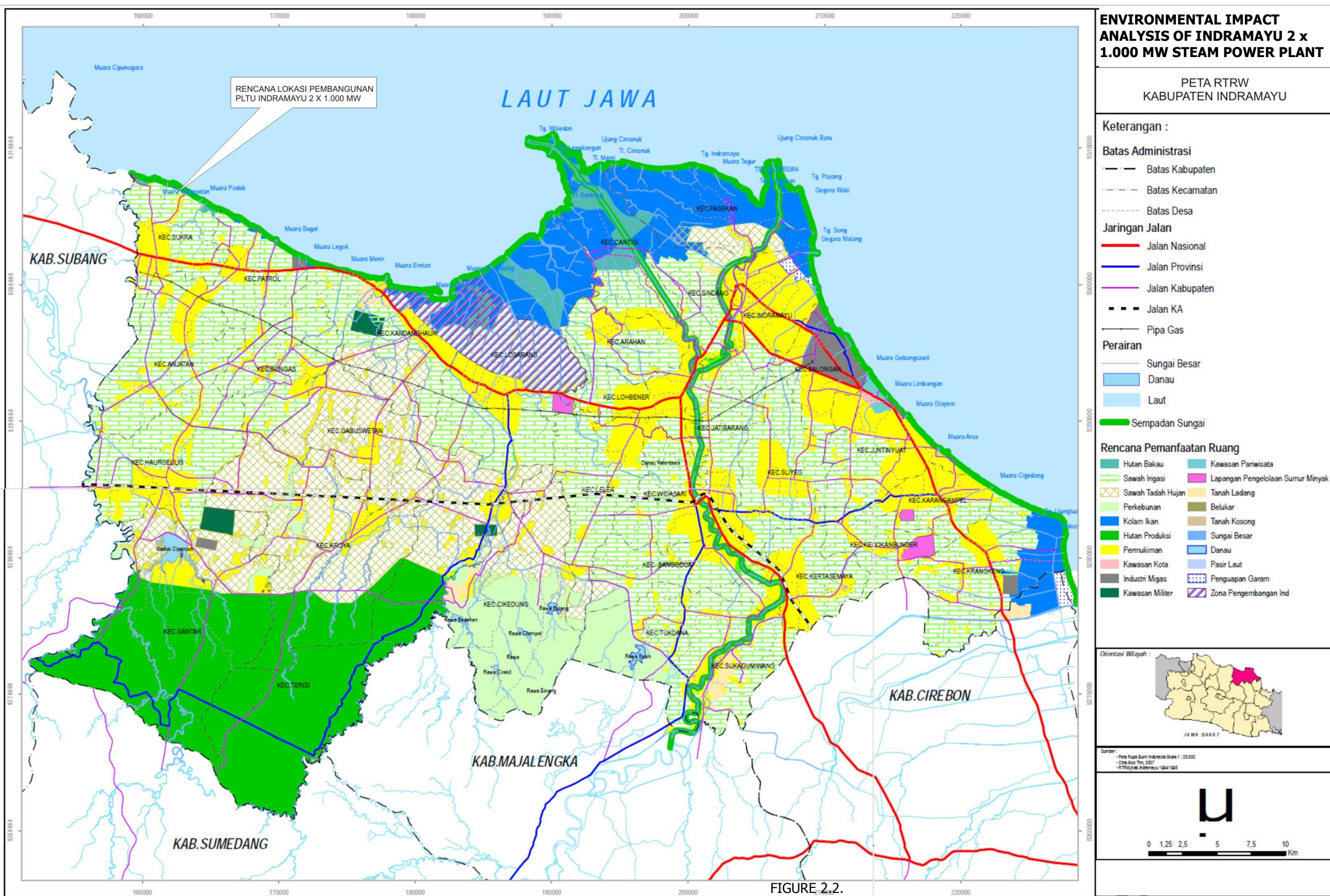


FIGURE 2.1.

MAP OF ACTIVITY SITE FOR 2 X 1.000 MW STEAM POWER PLANT DEVELOPMENT PLAN







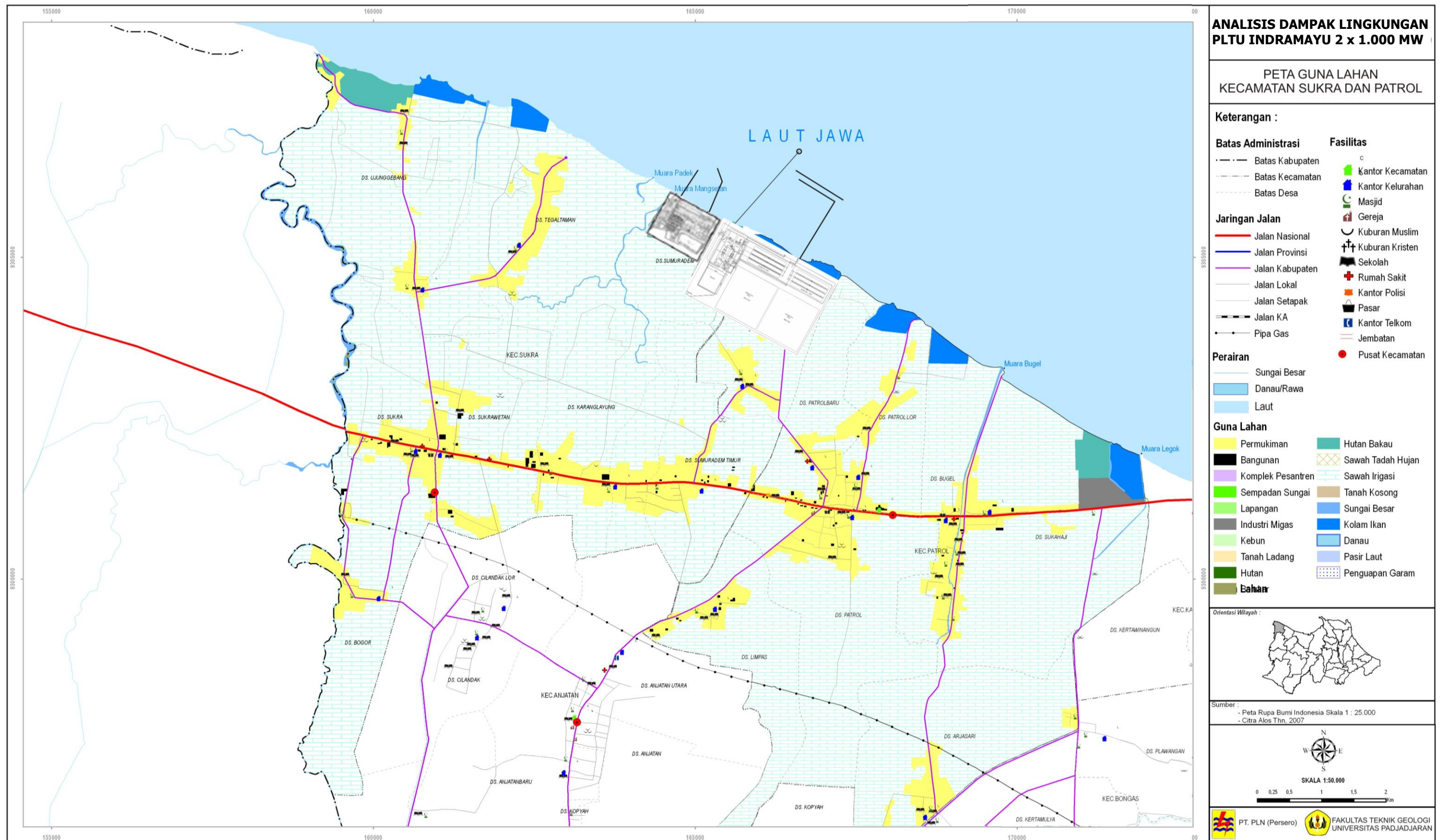


FIGURE 2.3.  
ACTIVITY SITE OF 2 X 1.000 MW STEAM POWER PLANT DEVELOPMENT PLAN, IN MEKARSARI VILLAGE,  
PATROL SUB-DISTRICT, INDRAMAYU REGENCY, WEST JAVA PROVINCE



### 2.2.3. Other Activities Around The PLTU Indramayu 2 x 1000 MW Project Site

In shore area around the power plant construction site, beside of Indramayu 2 x 1000 MW Steam Power Plan, there are some other activities such as fisherman activity, agricultural irrigation, salt ponds, and public settlements in South side. Another notable activities are office, workshops, government agency, and industrial matters.

### 2.2.4. Resources Availability

#### 1). Coal

To fulfill coal requirements during the operational phase of PLTU Indramayu 2 x 1000 MW, coal procurement will be obtained from Sumatra and Kalimantan delivered by Coal Vessel. According to coal specifications shown on Table 2.1, by using Supercritical Power Plant (SC) process, required coal for 1000 MW is 3,752 million tonnes per year. Coal reserve for operational purpose of PLTU Indramayu 2 x 1000 MW will be stored at Coal Yard with accomodating capacity for 60 days operation.

$$CC = (MW_g \times 0,860) \times (100/\eta_{pg}) / GCV \times 8760 \times (CF/100) \text{ (tonne/year)}$$

where;

- CC : annual coal consumption (tonne/year)
- MW<sub>g</sub> : Power (MW)
- 0.860 : Power conversion factor from MW to Kcal /hr (Kcal/MWh)
- η<sub>pg</sub> : Thermal Gross Efficiency of Power Plant Generator (%)
- GCV : Gross Calorie Value of Coal Calorie (kcal/kg)
- 8760 : Working hours calendar per year (Hour/Year)
- CF : Generator's Capacity Factor, 80 (%)

Current coal specification can be seen on Table 2.1. while contained coal specification and coal ash (in detail) will be presented on Environmental Analysis Impact document.

**Table 2.1. Coal Specification**

Coal Characteristic	Unit	Range Limit	
Proximate Analysis (as received)			
Total Moisture	%	35.00	
(Inherent Moisture)	%	(18.00)	
Fixed Carbon	%	25.00	
Volatile Matter	%	35.00	
Ash	%	5.00	
Total	%	100.00	
Specific Energy (as received)			
Gross calorific Value (GCV)	kcal/kg	4,000	Typical
Net calorific Value (NCV)	kcal/kg	3,620	
Fuel Ratio (FC/VM)	-	0.714	
Hardgrove Grindability Index	HGI	50	
Ultimate Analysis (dry, ash free)			
Carbon	%	69.65	
Hydrogen	%	5.70	
Oxygen	%	23.17	
Nitrogen	%	1.13	
Sulphur	%	0.35	
Total	%	100.00	Maximum

Coal Characteristic	Unit	Range Limit	
Ultimate Analysis (as received)			
Moisture	%	35.00	
Ash	%	5.00	
Carbon	%	41.79	
Hydrogen	%	3.42	
Oxygen	%	13.90	
Nitrogen	%	0.68	
Sulphur	%	0.21	
Total	%	100.00	
Ash Fusion Temperature (Red.)			
Initial Deformation (IDT)	°C	1150	
Softening (ST)	°C	1200	
Hemispherical (HT)	°C	1250	
Fluid (FT)	°C	1300	
Slagging and Fouling Index	-	Medium	

Source : Preparatory Survey for Indramayu Coal-fired Power Plant Project in Indonesia

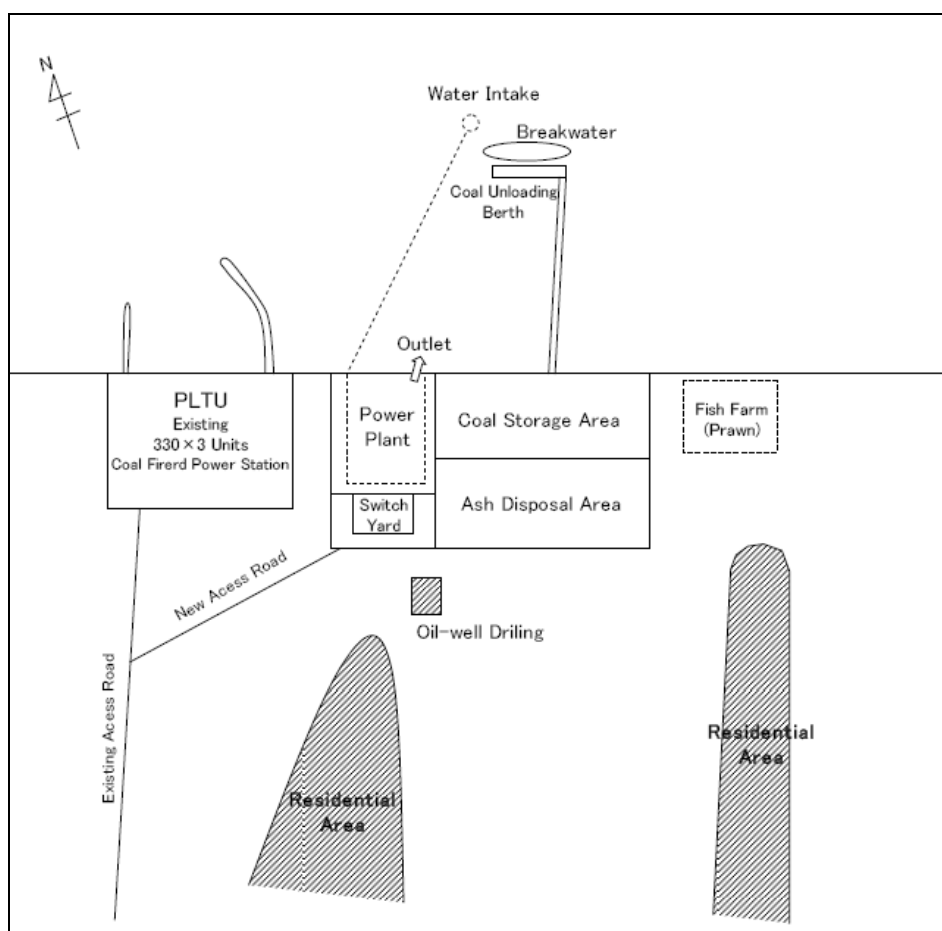
## 2). Water Requirement

During construction phase, the development of PLTU Indramayu 2 x 1000 MW required approximately  $\pm 100 \text{ m}^3$  of water/hour and also estimated water requirements for coolant and service water, and drinking water as much as  $90 \text{ m}^3/\text{second}$ . Water supply will be obtained from the sea, about 2 km from the shore in 5 m deep during tidal time through steel pipe. The water intake will be placed on the end of coal discharge jetty and pipe will be placed underneath the jetty line to the PLTU Indramayu 2 x 1000 MW installation. Sea water treatment process will use desalinantion-RO, demineralisation.

### 2.2.5. Development Plan Spatial Layout of PLTU Indramayu 2 x 1000 MW

Development plan of PLTU Indramayu 2 x 1000 MW by PT. PLN (Persero) consists of the development of generator unit, coal stockpiling yard, ash stockpiling yard, cooling water intake, and discharge outlet as seen on Figure 2.4.

Layout map of PLTU Indramayu 2 x 1000 MW



**FIGURE 2.4.**  
**LAYOUT MAP OF INDRAMAYU 2 X 1000 MW STEAM POWER PLANT**

Land use estimation for PLTU Indramayu 2 x 1000 MW is as shown on Table 2.2.

**Table 2.2. Land Use Estimation for PLTU Indramayu 2 x 1000 MW**

Designation	Area (m <sup>2</sup> )
Generator Area	3,195,000
Power Plant Area	510,000
Coal Yard Area	640,000
Ash Disposal Area	1,364,000
Switchyard	90,000
Other facilities (chimney, Waste Water Treatment Installation, water management system)	591,000
Water Drainage	61,080
New Connecting Road	20,000
Total	3,276,080

Source : Preparatory Survey for Indramayu Coal-fired Power Plant Project in Indonesia

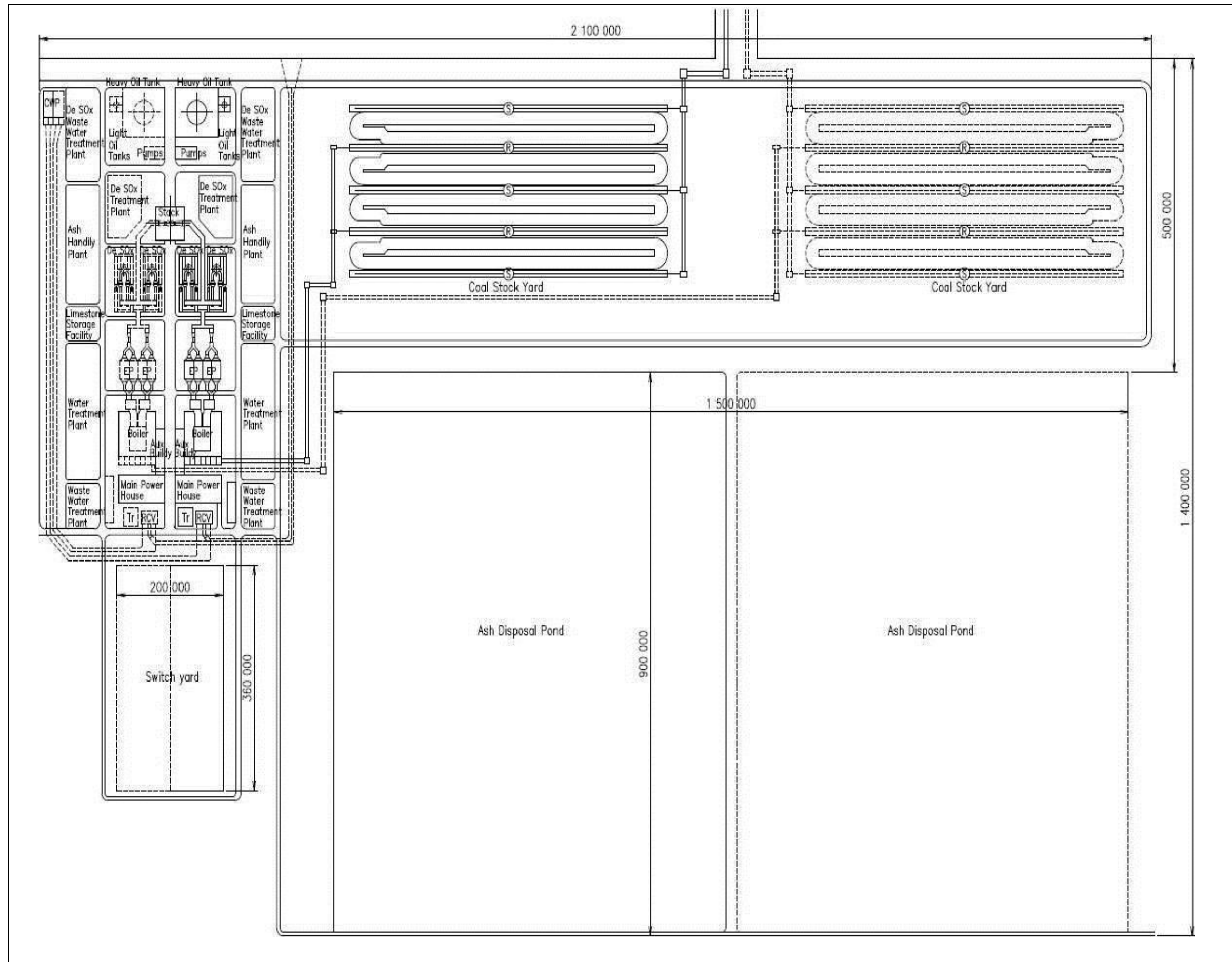


FIGURE 2.5. INDRAMAYU STEAM POWER PLANT LAY OUT

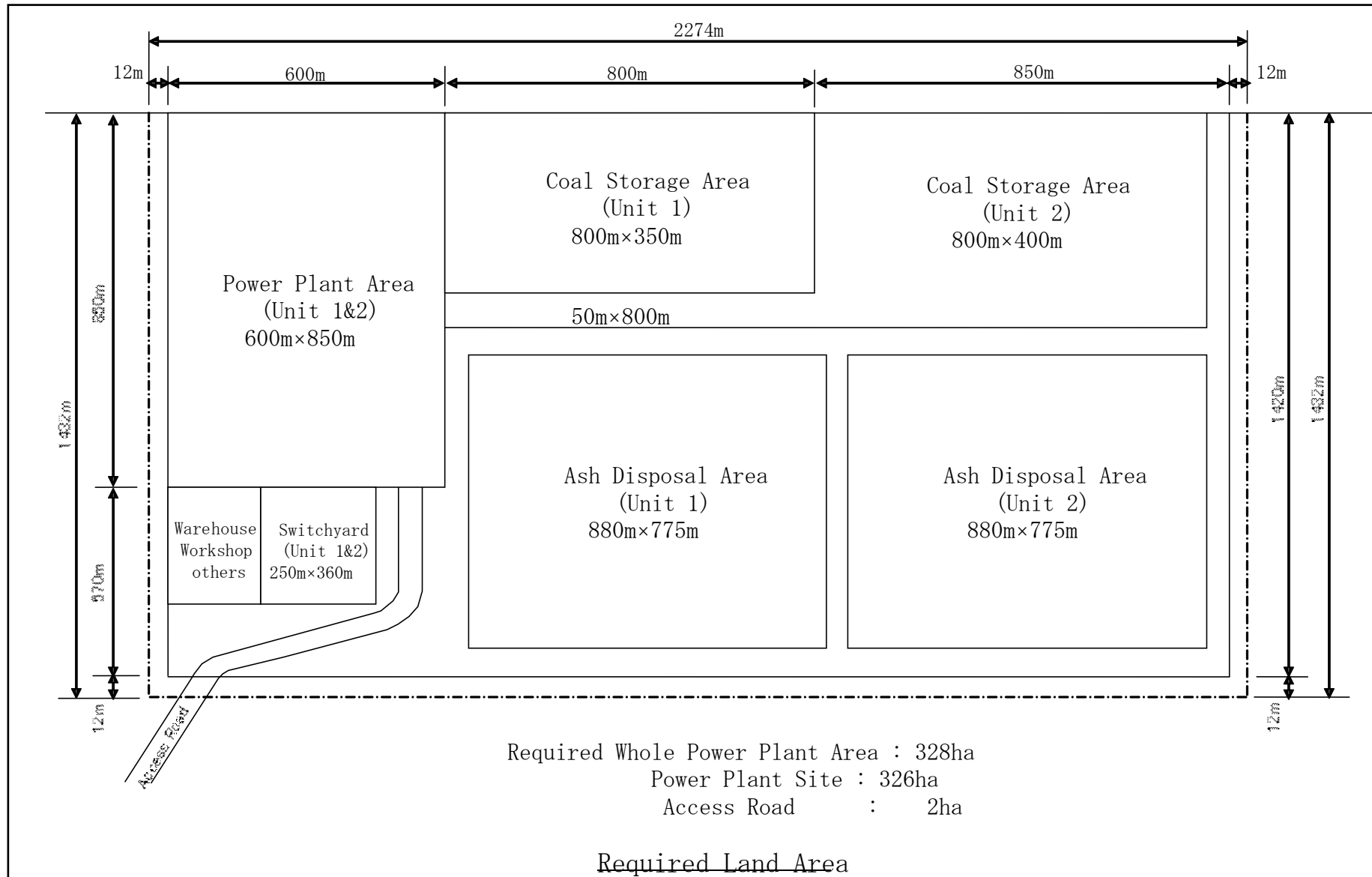


FIGURE 2.6. LAND ALLOCATION ESTIMATION FOR INDRAMAYU 2 X 1.000 MW

### 2.2.6 Electricity Production Process

Coal Handling as a primary source of energy for PLTU Indramayu 2 x 1000 MW will be directly discharged from the loading vessel by using Receiving Conveyor to be retained in staker-reclaimer, directly using conveyor from the vessel and stocked in Coal Storage Area. This has to be conducted in order to maintain Coal's calorie value required by the boiler. The coal that are going to be transferred to the unit by using belt conveyor or BC which will go through the power house as connector between BC. Loading process to the Mill will be regulated by conveyor. From Mill Bunker, coal will be passed to the coal feeder as the coal flow regulator to Pulverizer, which later grounded into PF – Pulverized Fuel. Thermal energy produced from the combustion will be used to heat and transform water into steam. The used gas can be utilized as further heater for Superheater, Reheater and Economizer to produce a drier steam quality and fill up the Efficiency Boiler, it also can be used to spin the Turbine. Ash Handling from the Boiler, half of heavy ash will be fallen into Bottom Boiler and stacked in Ash Valley. While the dried ash will be discharged and caught by EP or Electrostatic Precipitator, and collected in several Hoppers before transferred to Ash Silo. Steam flow of Main Steam/ReHeat Steam on  $\pm 593^{\circ}\text{C}$  will spin the High Pressure Turbine. Water will fill the Economizer for heating process in Boiler and transformed from water into steam. The Turbine coupled with 3000 rpm Generator, the Generator is a tool that transform kinetic energy into electric energy, it contain copper spool within its rotor or stator. DC current from the Exciter flown on the rotor which is connected to AVR (automatic Voltage Regulator) system in order to produce magnetic field with a couple of polar. When turbine reach 3000 rpm, induction conducted in stator spool which cause the electricity flown from Generator (Stator) with 23,5 kV and 50 Hz frequency which is regulated or controlled by AVR. Furthermore, Generator Voltage is stepped-up in GSU or Generator Step Up Transformer to 500 kV and connected to switch yard as the final result of process in PLTU Indramayu 2 x 1000 MW.

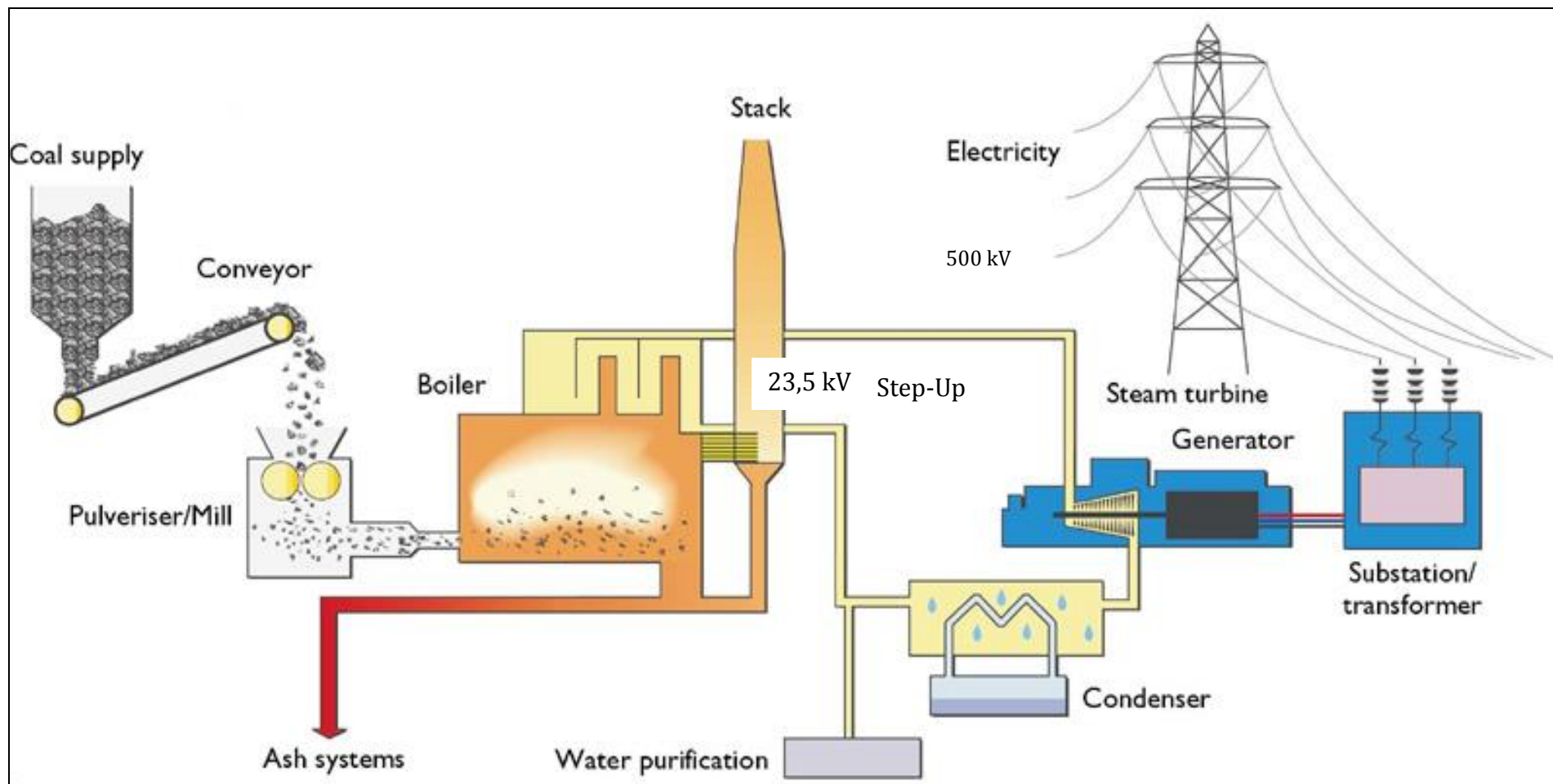


FIGURE 2.7. PROCESS OF COAL CONVERSION TO ELECTRICITY



**Steam Power Plant Control & Instrumentation :**

In general, in a Steam Power Plant, the ongoing process is as follows:

**A. Raw Material Transportation and Processing**

In this process, water and fuel are prepared to produce steam. Generally known as Auxiliary system. From the arrangement of loading train, belt scale conveyor, coal drying, until ready to be loaded to feeder.

**B. Boiler Combustion (Pulverization of Coal / CFB)**

In Boiler, combustion, as the main process, is conducted in Thermal Powerplant. Since the combustion process will affect the generator effectiveness, number of used fuel, amount of air sufficient during combustion will be regulated to generate a desired combustion (insufficient amount of air during combustion will cause explosion due to fuel deposit, excessive number of air will cause inefficient combustion process). The combustion level will also adjusted according to it operational load.

**C. Turbine (Steam Turbine and Heat Recovery) Monitoring and Control**

The Turbine is another important part, a DEH (Digital Electro Hydraulic) system is used as a safety system for turbine in case of fault condition. In particular condition, turbine control is also used to adjust the voltage frequency so it can be in line with grid voltage.

**D. Generator and Plant Electrical System Monitoring and Control**

In this process, we must maintain Generator Excitation, along with electrical safeties, relay, etc.

**E. Waste and Exhaust Treatment**

In this process, treatment on combustion results such as gas desulphurization and slag transmission is conducted. Reduction effort regarding NO<sub>x</sub> emission is highly important for a sustainable and healthy nature.

Applied technology in this Steam Power Plant is Clean Coal Technology (CCT), the Super or Ultra Super Critical pressure plant (USC). This technology was chosen due to its superiority compared to other type, 5.4% higher thermal efficiency compared to SubCPP, and lower CO<sub>2</sub> emission, approximately 350.000 tonnes/year. Besides, USC type generator can be used with low-rank coal.

**2.2.7. Business Plan and/or Impact Causation Activity****A. Pre Construction**

Pre-construction activity stage includes: survey (field research including investigation), land acquisition, and licensing process of PLTU Indramayu 2 x 1000 MW development plan.

### **1) Survey**

Referred survey activity is a survey with respect to feasibility study which includes field measurement activity and land investigation for the location of PLTU Indramayu 2 x 1000 MW developments. Beside of abovementioned activities, survey is also conducted in accordance with requirements of ongoing Environmental Analysis Impact study. During this activity, both in direct and indirect manner, interactions were made through the Sub-District official, Village official and public figures around the PLTU Indramayu 2 x 1000 MW development site.

### **2) Land Acquisition**

Land required for the development of PLTU Indramayu 2 x 1000 MW including its facilities and infrastructure is about 327 hectares for 2 x 1000 MW generator capacities. Land requirements will be procured by PT. PLN by land acquisition after both parties agree upon such price through P2T (Panitia Pengadaan Tanah/Land Procurement Committee) and will be stipulated by the Decree of Regent.

### **3) Licensing**

Licensing process will be conducted in accordance with applicable provisions prior to survey, construction, and operational activity to the authorized and related agencies.

## **B. Construction**

### **1) Labor Recruitment and Personnel Mobilisation**

During the peak stage on PLTU Indramayu 2 x 1000 MW construction, required labor is approximately 1.400 persons with various skill level and consists of 1.106 domestic labors and 138 foreign labors. Based on their skills, those labors are categorized into supervisors, piping expert, electrician, engineer, blacksmith, carpenter, foreman, labor, human resources staff, etc. Requirement regarding construction labor will be procured by the PT. PLN appointed contractor with consideration to availability of local labor potential.

### **2) Equipment and Material Mobilisation**

The main equipment of PLTU Indramayu 2 x 1000 MW is will be generator and its facilities during construction stage will be shipped from abroad, and transported through sea line.

Meanwhile, the supporting materials such as pile-up soil and rocks required for the filling and constructing activities for PLTU Indramayu 2 x 1000 MW infrastructure will be procured by local contractor, provided that the mining method is in accordance with the applicable regional regulation. Mining location is still evaluated until recently.

Material optimization will be chosen by considering its quality, timeliness, cost, and other factors. Supporting materials will be transported through inland road. Access road used to enter the location is the existing road of PLTU Jawa Barat.

Designated transportation contractor is obliged to comply with applicable law and prevent the excess of pile-up soil. Some of heavy equipments that will be used in civil works can be seen on Table 2.3.

Amount and size of main equipment for construction activity will be described in detail, on need-basis, by the implementing contractor. One of the high mobility equipment is Dump Truck which will be used to transport materials during construction process and Excavator (back hoe) to load pile-up or excavation material to dump truck.

**Table 2.3. Construction Equipment Type and Required Amount in The PLTU Indramayu 2 x 1000 MW Development Project**

No.	Equipments
1.	Crawler cranes
2.	Truck cranes
3.	Hydraulic cranes
4.	Pick-up truck
5.	Dump Truck
6.	Bulldozer
7.	Excavator / Backhoes
8.	Compactor / Motor graders
9.	Hydraulic shovels
10.	Fork lift
11.	Concrete pump
12.	Asphalt paver
13.	Submersible Water Pump
14.	Compressor
15.	Welding machines
16.	Generator
17.	Misc motor
18.	Scraper
19.	Pile driver / Hammer
20.	Wheel loader

Source : Preparatory Survey for Indramayu Coal-fired Power Plant Project in Indonesia

### 3) Land Preparation

What is referred to as land preparation is the cleaning process of project site candidate and its connecting roads from any plants. Furthermore, land leveling from materials such as rocks, irrigation canal and other unnecessary construction. Land filling will be done after along with initial soft-soil excavation or soil surface stripping. Amount of required materials for land filling and reclamation is limited to the land

surface level permitted by the PLTU Indramayu 2 x 1000 MW (with respect to safe elevation to the highest tide level). Result of this particular land surface works is must be stock-piled. Filling activity will be done for 2.0 meters in height on the 327 hectares project site, approximately 6.5 million m<sup>3</sup>.

Land-filling materials will be obtained from outside of project site since the available land-filling material around the project site is insufficient.

Dike will be built in the length of irrigation canal in Easter side of project site.

#### 4) Facilities and Infrastructure Development

Facilities and infrastructure that will be built in PLTU Indramayu 2 x 1000 MW are including main equipment building (generator) and supporting facilities for coal transportation, mainly in Jetty, such as base camp, praying room, access road and project site fencing. While the other building and road will be subjected to detailed analysis of local data land and other research result.

Construction of the main building will be initiated by planting the pile. Heavy buildings will be supported by 600 mm steel pipe, 0,3 – 0,5 mm reinforced concrete pile with 18 m in length. The other building is general concrete building and wall construction is done on concrete wall reinforcement. During this stage of development, generator is used for welding process.

##### a) Development of Power House

The power block including the construction works of main building which contains of several blocks, mainly boiler room building and turbine building. These main buildings will be used as a place for main equipment of generator such as turbine and generator, mechanic equipments and it facilities, and also electrical equipments and it facilities.

##### 1. Boiler Building

The boiler building can be used to place boiler and also facilities to control air pollution. Boiler characteristic of PLTU Indramayu 2 x 1000 MW and it facilities is presented on Table 2.4.

**Table 2.4. Boiler characteristic of PLTU Indramayu 2 x 1000 MW**

Item	Design Particular
------	-------------------

Item		Design Particular
Type of Boiler		Radiant reheat variable pressure once-through boiler (outdoor installation)
Steam flow rate	Main steam	2920 t/h at Boiler MCR
	Reheat steam	2480 t/h at Boiler MCR
Steam pressure	Super heater outlet	25.40 MPa (g) at Boiler MCR
	Re heater outlet	4.75 MPa (g) at Boiler MCR
	Re heater inlet	5.07 MPa (g) at Boiler MCR
Steam temperature	Super heater outlet	604 °C
	Re heater outlet	602 °C
	Re heater inlet	358 °C at Boiler MCR
Feed water temperature Economizer inlet		287 °C at Boiler MCR
Fuel		Coal, HSD oil (30% MCR)
Firing system		Low NOx burners and over fire air or two stage firing
Pulverized coal firing system		Direct-fired with pressurized roller type mills
Draft system		Balanced draft
Primary air system		Cold primary air fan system
Heat recovery system for starting up		Boiler water circulating pump
Steam temperature control range		B-MCR to 40% load for main steam B-MCR to 60% load for reheat steam
Steam temperature control method		Feed water/fuel ratio, spray water, flue gas dumper

Source: Preparatory Survey for Indramayu Coal-fired Power Plant Project in Indonesia

Structure for boiler sustainer building will be made of steel and equipped with lifting facilities. Boiler will be designed with open chamber and closed in some particular parts. Two reservoirs with 1000 tonnes capacity each for diesel oil deposit are also planned to be built, the transportation will be conducted by trucks.

## 2. Generator Turbine Building

Type of generator turbine that going to be used is: Tandem or cross compound, single reheat, Supercritical, Double Flow Condensing. Chamber (placement) of turbine will be built with the combination of reinforced concrete structure with closed steel structure with vent system. The building would also be equipped with sufficient loading bay and equipment maintenance. Reinforced concrete base of generator turbine is designed to survive static and dynamic weight caused by machine's weight and seismic factor.

## 3. Administration Building

Administration building will be built with reinforced concrete structure. It planned to be 2 (two) stories building with the capacity of ± 50 employees.

## 4. Workshop, steel structure type

## 5. Workhouse, steel structure type

**6. Stack Building and Electrostatic Ash Catching System**, reinforced concrete structure type

**7. Substation Building**

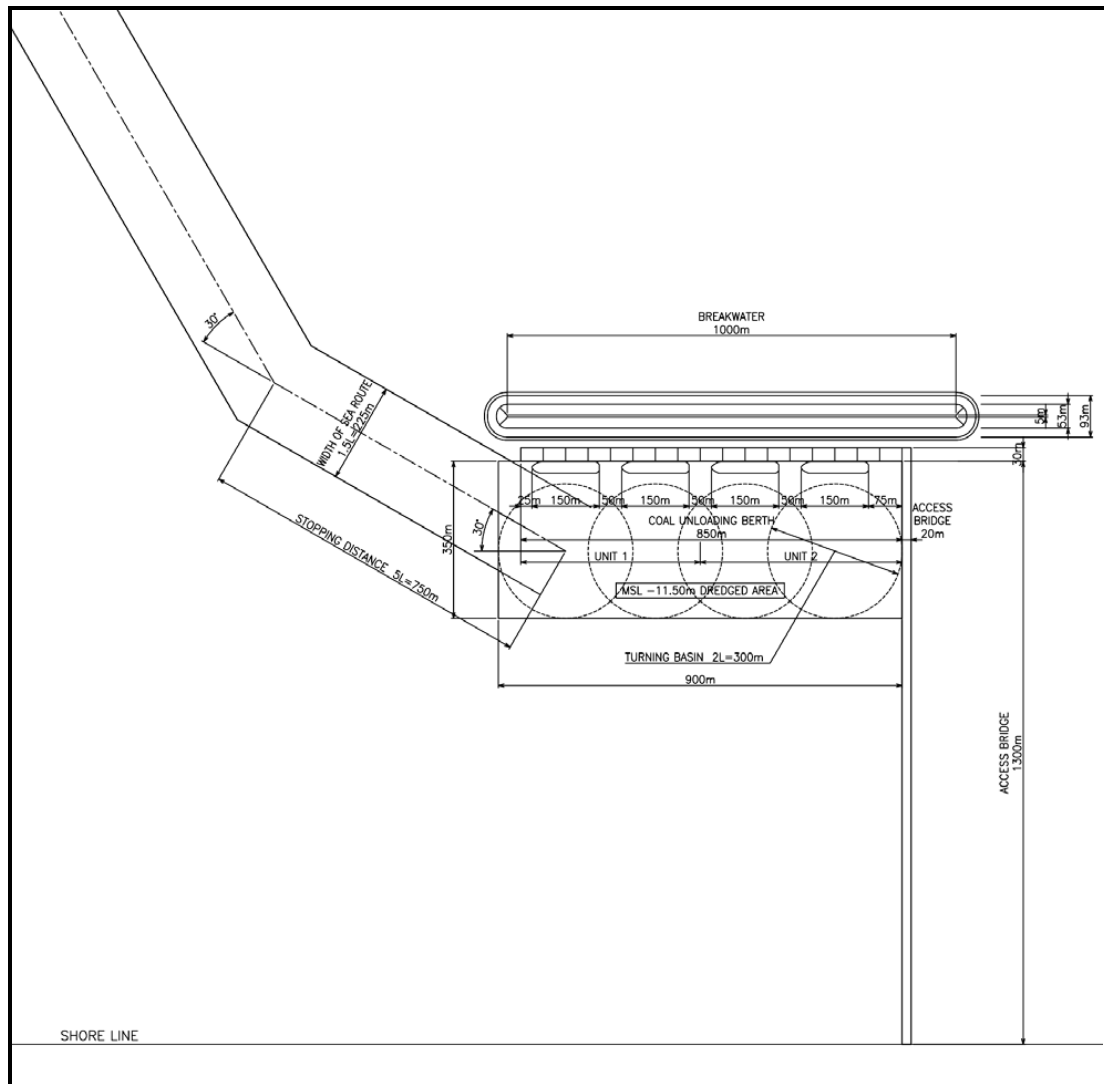
**b) Development of Coal Unloading Jetty Facility**

Sea transport of coal and other materials required for PLTU Indramayu 2 x 1000 MW can be done through Jetty. Such Jetty specification is as follows:

- Size : 12.500 DWT
- Construction : Steel Structure
- Depth : ± 9 m
- Length : ± 800 m (4 berth)

This PLTU Indramayu 2 x 1000 MW development project will built a jetty for coal receiving activity from the vessel. Location of the jetty is coast area, about 1,5 to 2,5 km in Northern side of plant location with pile and dredging system. Water-break pile around the jetty (break water piled jetty type) with coal vessel weight of 12.500 DWT required to be planted in 9 m deep. Other method and facilities in coal transporting system will be in compliance with marine regulation of Indonesia. The disposal of excavation material will be done by hopper barge, the pile-up soil will be discharged off-shore after environmental assessment and agreement with local fishermen completely done, in the > 40 m depth for example.

Jetty maintenance activity along with it facilities is particularly emphasized on the maintenance of port pond and maintenance dredging by **dredger**. Discharge of deposit materials undertaken on the area of Java Sea with location that has more than 40 meters in depth. Another conducted activities are pipe joint maintenance, conveyor wheels lubrication and concrete maintenance.



**FIGURE 2.8.**  
**JETTY LAYOUT**

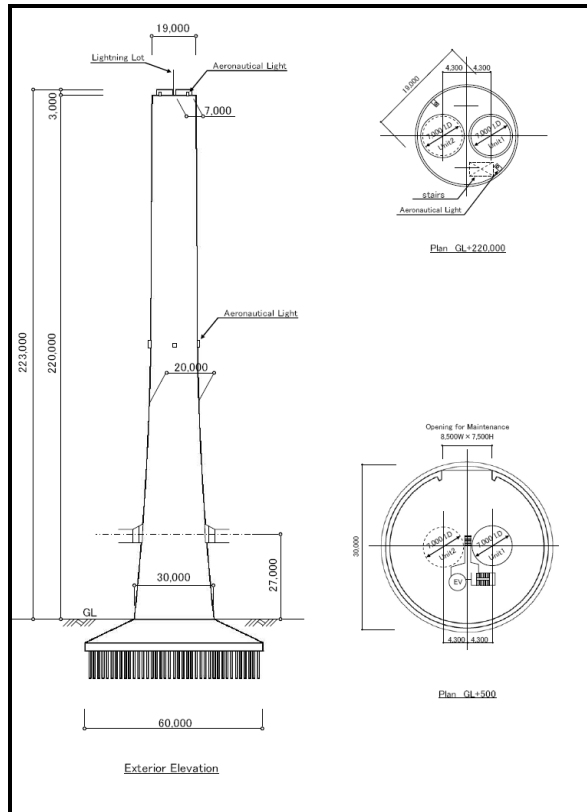
### **c) Development of Coal Stock-piling Building**

Coal stock-piling building is designed to accommodate coal required for 60 days operation, approximately 687.000 tones. Around such building, a drainage system that will be used to collect and pass rain water to a collecting pond (coal run off pond) will be built, and will be forwarded to liquid waste management instalation afterwards.

### **d) Development of Air Quality Control System**

Air quality control system that will be built to prevent nvironmental impact is a stack equipped with ash control system called ESP (Electrostatic Precipitator), SO<sub>2</sub> gas control, FGD (Flue Gas desulfirization) to anticipate coal quality deformation (S content), it will also equipped with air polltuion

monitoring system called CEM (Continuous emission monitoring). The building of air quality control includes stack, ESP and FGD.



**FIGURE 2.9.**  
**STACK SCHEME OF INDRAMAYU 2 X 1000 MW STEAM POWER PLANT**

#### **e) Development of Water and Liquid Waste Management Unit**

Water requirement during operating stage of PLTU Indramayu 2 x 1000 MW estimate about 2 x 48,1 m<sup>3</sup>/second with allocation for coolant water about 2 x 45 m<sup>3</sup>/second, for Service water which previously processed through desalinisation, demineralisation and RO with the capacity of 2 x 0,063 m<sup>3</sup>/second for other purpose. The sea water will be directed to desalination process, in which the expected water quality is pH 6-8, TSS < 10 mg/L and iron < 0,05 mg/L. Result of desalinisation will be collected in a tank for boiler supply (Boiler Make-Up Water) which required further process such as demineralizer. Water quality is SiO<sub>2</sub> < 0,015 ppm, TDS < 10 ppm, CO<sub>2</sub> 0,8 ppm and pH 6,5-7,5. Beside of used for boiler supply, this water can also be used for laboratory purposes. This desalinized water can be used for generator utility (waste treatment system, water regeneration) and as consumption water and reserved water (cleaning, washing, etc.). Water chart is presented on Figure 2.10.



Liquid waste management system will be built with a sufficient capacity to collect and process water from the entire activity within generator installation until it complies with the criteria and ready to be disposed in receiving water body. The processed waste are originated from:

- Waste from generator station unit
- Waste from water processing installation for make up boiler
- Oil-based waste
- Laboratory waste
- Waste from coal stock-piling yard and waste from the washing of coal installation and its surface.
- Waste from ash handling system

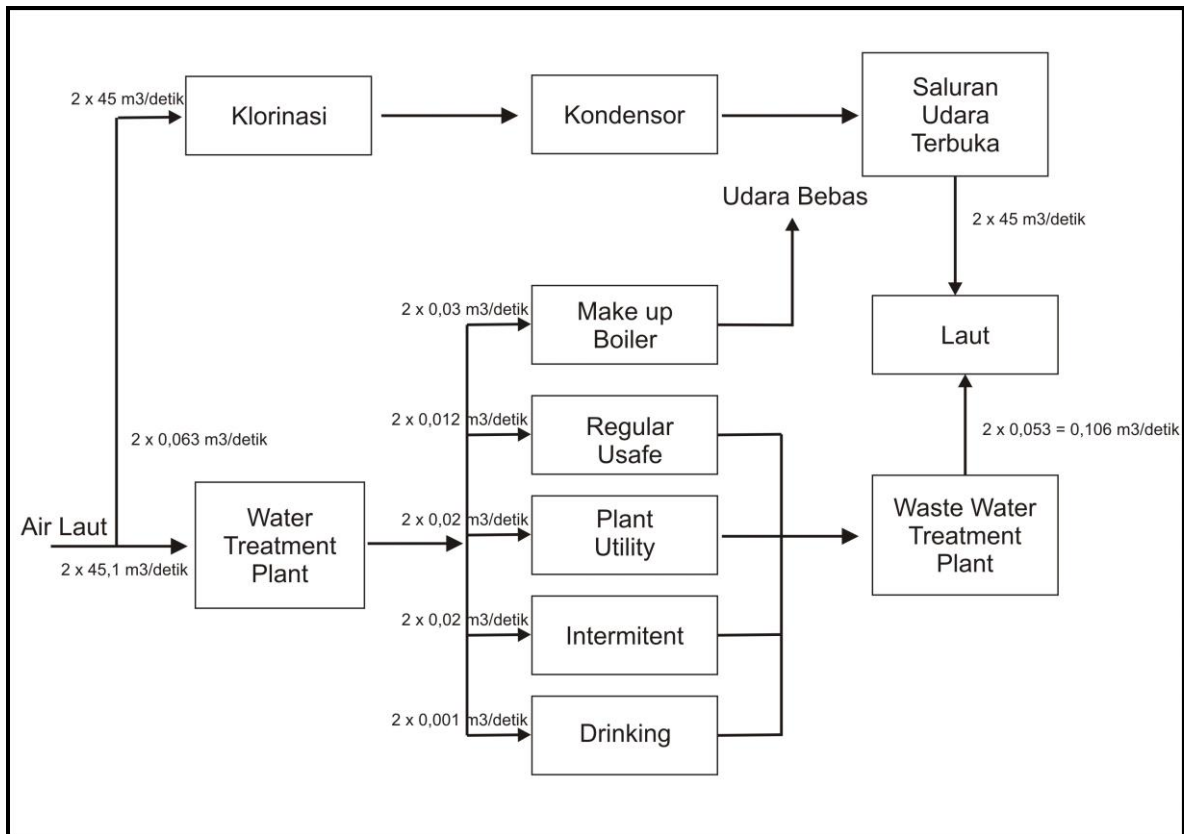
Liquid waste originated from domestic activity (sanitary waste) is processed with separated treatment before disposal. Waste that originated from such activity will be processed in such way until it complies with the provision of disposal water quality.

The spesification of liquid waste treatments are:

- pH Adjustment : Chemical addition
- SS reduction method : precipitation and addition of chemical contents

Equipment used in waste treatment process including:

- Waste water storage tank : 1 set
- pH regulator tank : 2 sets
- Coagulation tank : 2 sets
- Sedimentation tank : 2 sets
- Intermediate tank : 1 set
- Sludge storage tank : 1 set
- Neutralizing tank : 1 set
- Filter : 2 sets
- Dehydration equipment : 1 complete set
- Supply pump : 2 sets
- Intermediate pump : 2 sets
- Sludge discharge pump : 2 sets x 2
- Dehydrator supply pump : 2 sets



**FIGURE 2.10.**  
**WATER UTILIZATION CHART**

#### **f) Development of Coolant Water System**

To prevent disturbance of sea water ecosystem, PLTU Indramayu 2 x 1000 MW will develop a cooling system. Implemented cooling system is one-through and closed water cooling system. Cooling water intakes will be dredged under the sea. Water coolant circulation is using open cycle. Required sea water volume for water coolant reached 162.000m<sup>3</sup>/hour.

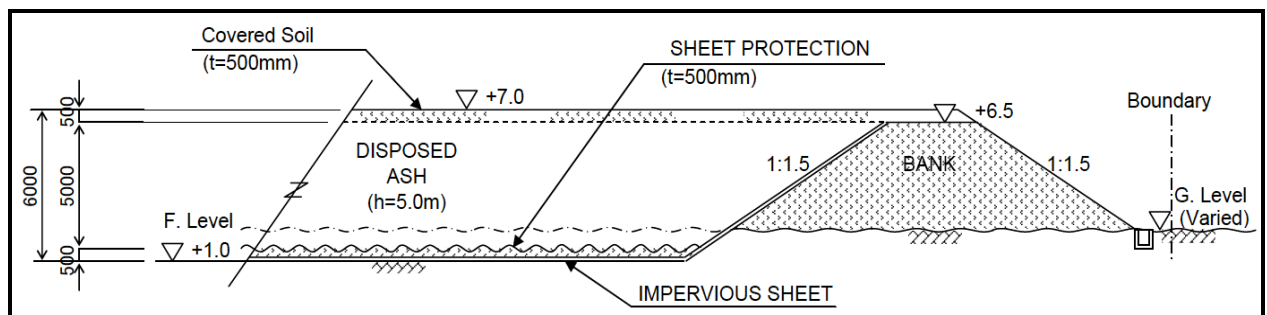
Used Outlet discharge system is open system with tunnel, the construction is made of reinforced concrete. Debit discharge outlet at the end of discharge outlet is 2,5 m/second (in **LWL**) therefore it will not interfere with ship and vessel traffic. To prevent scouring on discharge outlet, gabions will be built about 20 meters before the outlet.

Cooling process is equipped with screen and the addition of natrium hypochloride (NaClO) will be made as suppressant for micro-organism and alga. The water quality in cooling system is in accordance with the applicable national standard.

### g) Development of Ash Stock-piling System Facility

Location for ash stock-piling facility from PLTU Indramayu 2 x 1000 MW is located in generator area. The ash stock-piling facility will be equipped with ground-water monitoring well to check whether there is a leach seepage or not.

Location of coal yard on the Eastern side of PLTU Indramayu 2 x 1000 MW is estimated to required a land as large as 68,2 hectares, with assumption that it will not be used for other purpose such as coal yard. It capacity is approximately 4.284.500 tonnes for 20 years of operational period with 80% of load factor. Deposit height is 50 cm, with HDPE (High density Polyethylene) layer and permeability coefficient ( $K$ ) =  $10^{-6}$  (Figure 2.11).



**Figure 2.11.**

#### **COAL ASH DEPOSIT SCHEMATIC SYSTEM**

Location of coal deposit is equipped with leachate treatment unit, drainage water from the ash deposit is collected in a deposit pool located around the ash deposit which is recycled in ash waste treatment process afterwards. Excessive amount of water waste will be processed in the water waste treatment unit before they are ready for disposal.

Bottom ash transportation from and to the deposit location is conducted by truck. Ash deposition will be done by dumping the ash from the truck to the ash disposal yard, filled by soil layer by layer and leveled afterwards.

Ash handling equipments :

#### **1. Bottom Ash**

- Transporting method : Conveyor
- Capacity :  $\pm 10$  % ash content

#### **2. Floating ash system (heating and filter bag)**

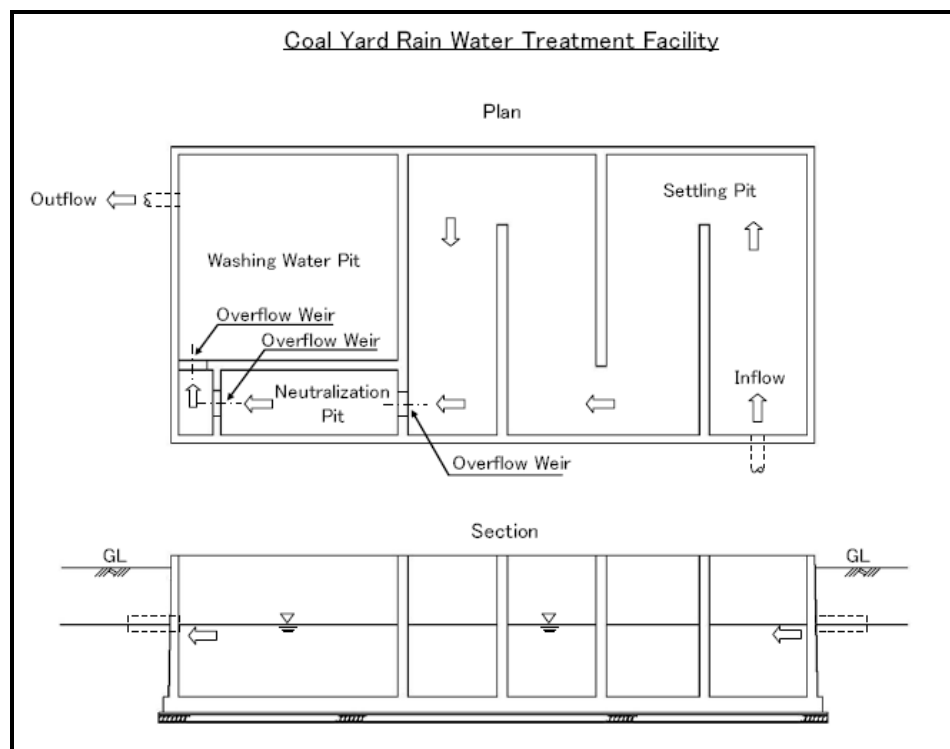
- Type : Vacuum Pressure
- Transporting Method : Conveyor

- Capacity :  $\pm 90$  % ash content

### 3. Floating Ash Silo

- Hopper Capacity : 1 x 200 m<sup>3</sup>
- Collecting Time : 10 hours operation for one plant
- Construction Material : steel

To prevent water run-off from the surface of coal deposit and coal ash deposit yard due to rain fall to the water sewage, drainage system will be built around it. The drainage tunnel is heading to reservoir pond which also functioning as deposit pond. The drainage system is also put into consideration, where the flow of rain fall will be collected in a pond with up to 2.920 m<sup>3</sup>/day of capacity, to be distributed to liquid waste management unit afterwards. In order to prevent ground water below the ash deposit yard from the seepage of coal ash materials due to rain water **percolation**, canal way and deposit pond will be covered by clay and plastic, as shown on Figure 2.12. After the tailing took place in the pond, contained sediment can be used for filling material, while the water will be pumped back to the water waste treatment center.



**FIGURE 2.12.**  
**DEPOSIT POND AND DRAINAGE SYSTEM**

### 5) Employment Termination

After the completion of construction work, termination would be done to the

involved labor. It is estimated that the foreign labor can still settle or live around the activity site with expectation to be involved in several operational activities. Employment termination will be conducted gradually according to construction stage and will be done by the contractor.

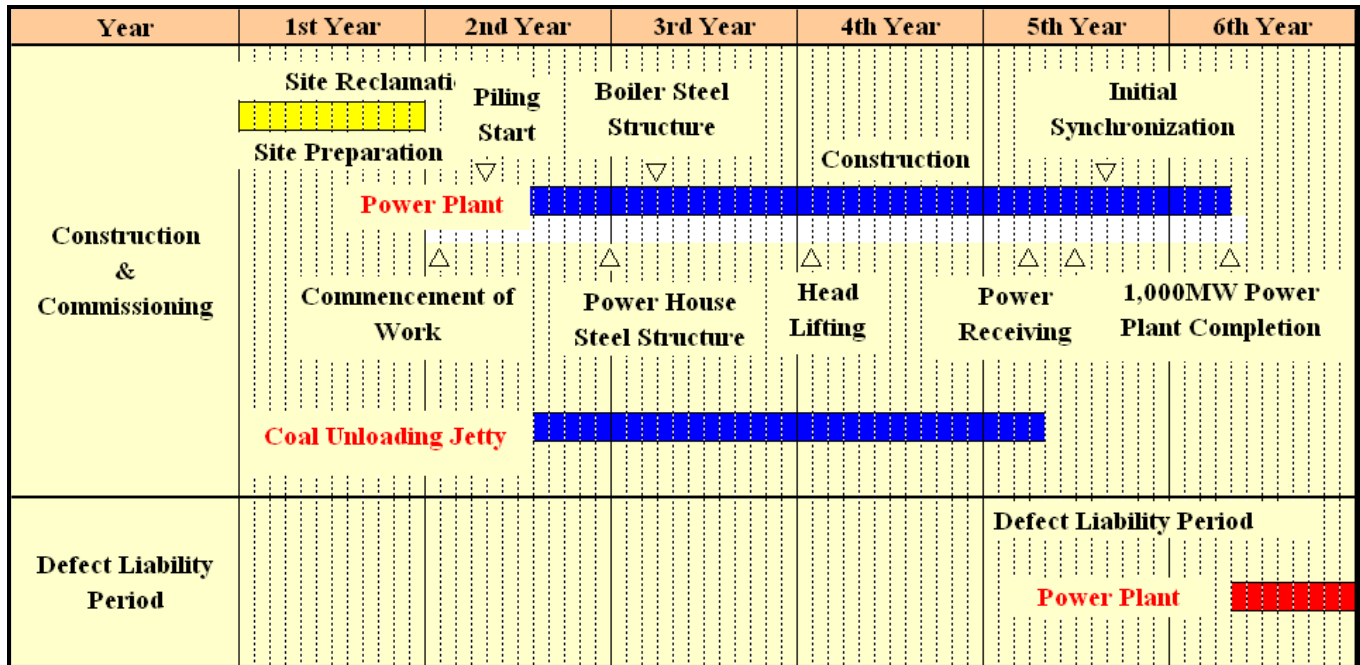


FIGURE 2.13.

### CONSTRUCTION SCHEDULE OF INDRAMAYU 2 X 1000 MW STEAM POWER PLANT

#### C. Operational Stage

##### 1) Labor Recruitment

To support the operational phase of PLTU Indramayu 2 x 1000 MW, labors with various specifications are required, based on needs, approximately around 200 – 250 labor with various expertise.

##### 2) Coal Offloading

Coal for generator purpose is shipped from Kalimantan and transported by vessel. Coal transporting process for PLTU Indramayu 2 x 1000 MW operational purpose is transported by vessel and offloaded through the jetty which is particularly built for such purpose.

Coal handling system will be conducted since the receiving with direct barging by vessel, conveyor, stock pile, pulverizer and coal combustion system. Coal vessel has a capacity of 1.250 DWT from Kalimantan will be berthed at the Jetty of PLTU Indramayu 2 x 1000 MW and on the designated place to discharge the coal. From the vessel, coal will be transferred by coal unloader with capacity of 1.500 tonnes per hour.

Every unloader will transfer the coal to conveyor with capacity of 3.600 tonnes per hour. Next, magnetic separator will be installed at the end of Jetty's conveyor. From the conveyor, coal is loaded by stacker reclaimer and conveyor to the coal yard location or directly to the location of silo. If the coal reserve inside the silo is reduced, stacker reclaimer will automatically supply through the conveyor of coal silo.

### **3) Operation of Coal Handling System Pengoperasian**

From barge, coal will be discharged to the coal yard or directly to the coal bunker in boiler by belt conveyor. Coal yard with open system has a capacity of 687.000 tonnes with 7 – 8 meters in height or capable to accomodate coal supply for operating 2 boilers for 60 days. Coal stacking and **raking** in coal yard are undertaken by stacker reclaimed unit. Later, coal from coal yard will be put in hopper, and transported by using belt conveyor to the coal bunker within the boiler. Type of coal handling can be seen on Figure 2.14.

Weighing and sampling system is provided to ensure the quantity and quality of delivered coal. A scale will be installed on the receiving conveyor. Sampling system and mover conveyor will be palced in mover chamber which initially designed for equipment. Coal crushing process has to be done to shape the coal into less than 30 mm in size. Magnetic separation and automatic cleaning are installed on the top side of conveyor to prevent damage on crushing machine and other machinery. Magnetic separator, coal crusher and mover are stored in crusher chamber which is designed in sufficient size for equipment storage and maintenance.

### **4) Operation of Main Generator and It Facilities**

#### **a) Operation of Unit Steam Generating**

Steam boiler is designed according to the operation of turbine system. When a damage occured to the generator, steam from the boiler will be distributed directly to the condensor with by-pass system. Coal furnace should be designed to reduce NO<sub>x</sub> to ensure the conformity with the standard limit of emission quality of 850 mg/Nm<sup>3</sup>. "draft system" has two pushing fans and two primary fans to control the furnace through automatic control. The steam boiler is equipped with steel sustainer, platform, and ladder for the ease of access and unit maintenance.

#### **b) Operation of Furnace**

Parts of the furnace are consist of: superheater, air and gas system, combustion system, combustion control system and steam tank.

#### **c) Operation of Turbine Generator Unit**

Steam turbine has a Multistage standard and designed for steam parameter with pressure of **25,4 MPa bar at 604 °C** m before closing outlet of high-pressure turbine and outlet condensor on the condensor's cooling water temperature and also equipped with by-pass system. Design specification of PLTU Indramayu 2 x 1000 MW equipment in general can be seen on Table 2.5.

#### **d) Operation of Condensing Equipment**

The condensor is a surface condensor type which is designed to be air-tight since the condensor has a water cooling system that has a direct corrosive nature, titanium steel or titanium metal sheet is used for condensor tube cover.

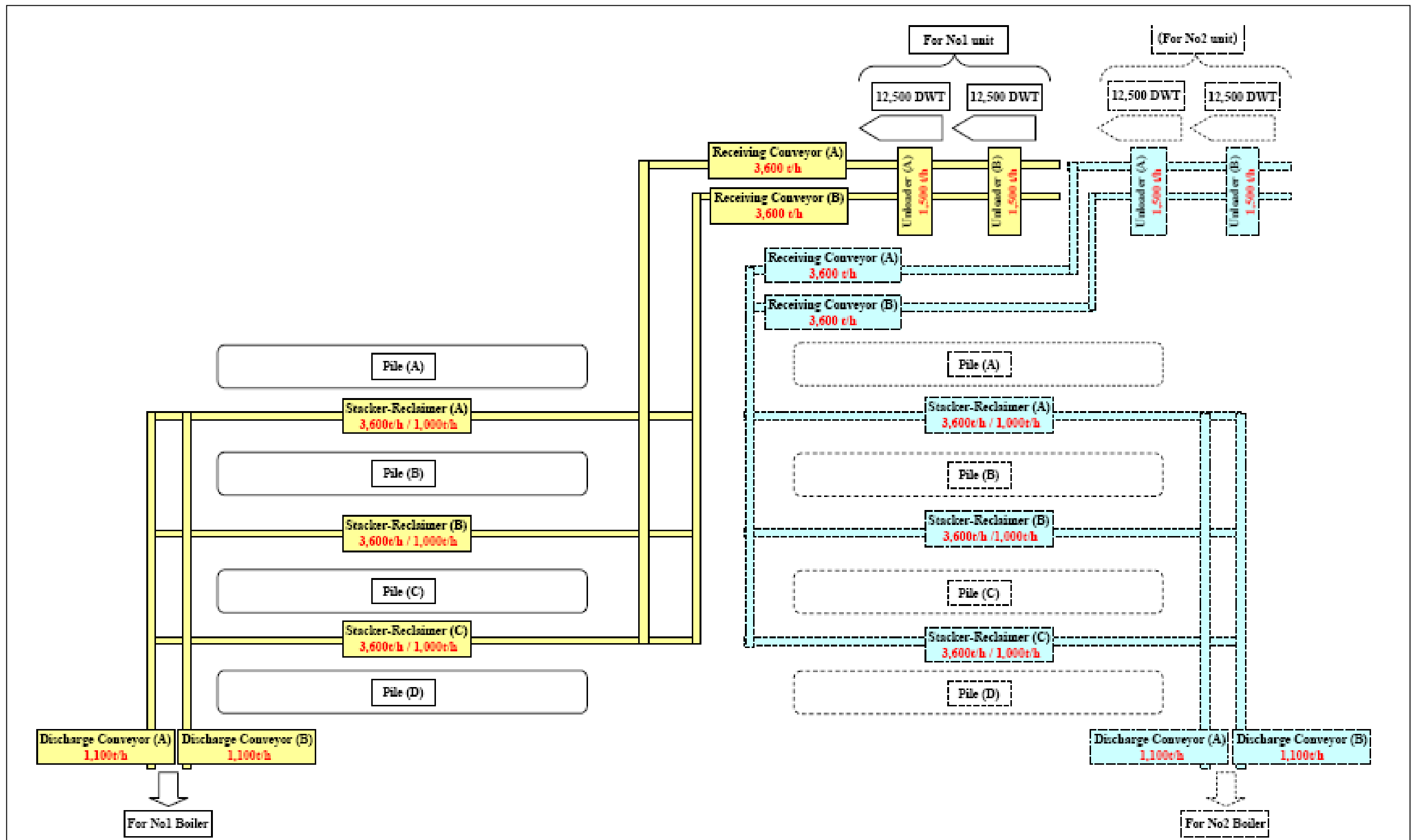


FIGURE 2.14.  
COAL HANDLING SYSTEM



**TABLE 2.5.**  
**DESCRIPTION ON DESIGN OF INDRAMAYU 2 X 1000 MW STEAM POWER PLANT**

No	Equipment Type	Spesification
1.	Steam Generators 1. <u>Steam Generator</u> Type Amount Steam Flow 2. <u>Induced Draft Fan (IDF)</u> Type Amount 3. <u>Precipitator</u> Type Amount	2 ± 2920 Tonnes/Hour Axial Fan 2 Electro Static Precipitator 2
2.	Steam Turbine System Type Amount Output Flow Pressure Steam Temperature	Tandem or cross compound, single reheat, ultrasupercritical, four (4) flow, condensin type 1 2920 tonnes/Hour 25,4 MPa 604 ° C
3.	Condensing System 1. <u>Condenser</u> Type Amount Tube Cleaning	Surface cooling, single-pass one division, shell & tube 1 On line
4.	Condensate and Feed Water System 1. <u>Condensate Pump</u> Type Amount 2. <u>Boiler Feed Water Pump</u> - Turbine driven Type Amount -Start-up Type Amount	Surface cooling, single-pass one division, shell & tube 8 including dearator Horizontal, Multistage Diffuser (turbine driven) 2 x 50 % Horizontal, Multistage Diffuser (motor driven) 1 x 30 %

No	Equipment Type	Spesification
5.	Cooling Water System	
	1. <u>Circulating Water</u>	
	Water sourcer	Sea Water
	Inlet Temperature	30° C
	2. <u>Circulating Water Pump</u>	
	Type	Mixed Flow
	Amount	2
	Capacity	2 x 45 m <sup>3</sup> /second
6.	Water Treatment System	
	1. <u>Desalination plant system</u>	
	Type	Flash
	Amount	2
	Production Capacity	3000 m <sup>3</sup> /day
	Deposit Tank Capacity	2 x 6500 m <sup>3</sup>
	2. <u>Demineralized water system</u>	
	Type	Mixed Bed
	Amount	2
	Capacity	2500 m <sup>3</sup> /day
	Deposit Tank Capacity	2 x 1500 m <sup>3</sup>

Sumber : Preparatory Survey for Indramayu Coal-fired Power Plant Project in Indonesia

## 5) Operation of Environmental Control Facility during Operational Stage

### a) Operation of NOx Control

Every boiler will be equipped with Low NOx burner, or other NOx controlling device to comply with Indonesian environmental regulation.

This NOx controlling device will supply air and fuel, therefore the available oxygen will reduce the formation of NOx gas to the lowest level and also minimize the number of burned fuel at the peak temperature.

### b) Operation of Ash Handling System

#### i. Fly Ash System

Every boiler will be equipped with Elektrostatik Presipitator (EP) which is designed to catch the fly ash originated from discharged gas flow to the atmosphere. Fly ash will be collected in hopper and transported to the ash deposit yard afterwards. ESP efficiency will be designed to comply with Indonesian environmental regulation with more than 99,7 % efficiency.

Volume of coal ash is estimated as 201.624 tonnes per year in every unit, for 2 unit. For fly ash deposit, 2 (two) silos with 1 x 200 m<sup>3</sup> capacity will be

used temporarily. The fly ash handling system will transfer the deposit ash in the EP with pneumatic pressure transfer system, which has capability to transfer 150% more ash from expected. Silo of fly ash is equipped with single dry unloading chute and single batch mixer to dampen the fly ash before it poured to the truck to be transported to the ash deposit yard or sold to third party.

## **ii. Bottom Ash System**

Bottom ash system is equipped with slag cooler and transfer conveyor which is used to load bottom ash from main chamber to the dampening chamber, the ash will be put into three adjacent containers and transported to the ash deposit/discharging yard

## **iii. Coal Ash Handling in Stockpile due to Sea Breeze**

closed conveyor will be installed for coal transportation from jetty to coal yard, coal deposit will be water-sprayed to keep it moist and not easily blown by the wind. Local plant will also planted with consideration of local climate to prevent the impact of strong wind.

## **c) Operation of SO<sub>2</sub> Controlling System**

Discharged gas from the stack will be directed to FGD facility. Air will be sprayed into this device to oxidize SO<sub>2</sub> contained in the discharged gas and transformed into SO<sub>3</sub>. Furthermore, the discharged gas will be distributed with sea water as absorbent of SO<sub>3</sub> and becomes sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) as it reacts with water (H<sub>2</sub>O). Disposed discharged gas from FGD system is free from sulfuric oxide. Sulfuric acid liquid will be treated in the Waste Water Treatment Installation with other liquid waste.

## **d) Liquid Waste from Cooling Process**

### **i. Type of Liquid Waste**

- Liquid waste from cooling process generally contaminated with natrium hypochloride, demineralisation process is resulting dissolved salt, evaporation process is resulting anti-crust chemical and foam, HCl and NaOH, laboratory activities are resulting liquid waste from chemicals, maintenance activity is contaminated with spilled oil and lubricants, coal deposit resulting coal and ash leach, while the domestic activity is contaminated with detergent, soap, and oil.
- Liquid waste containing natrium hypochloride from cooling process is directly disposed to the sea. Liquid waste treatment is done by adding

an exact amount of sodium hypochlorite into cooling water according to applicable standard. Besides, sodium hypochlorite is also consumed by micro-organism and algae, the percentage of it is quite small within the sea water and not endangering the condition of water life-forms.

- Hot liquid waste from cooling process is treated by distributed to the canal first to meet required standard temperature before disposed to the sea. The canal is  $\pm 1$  meter wide and  $\pm 360$  meters long.
- Domestic liquid waste during construction and operational stage will be treated by preliminary settling basin process, biological oxidation, and disinfectant.
- Liquid waste that contains oil and lubricant will be treated by oil separator, to separate oil and water. Caught oil/lubricant in the oil trap will be put into drums and piled up. The separated water can be used for water-spraying the coal yard and coal ash.
- Liquid waste from generator process (liquid waste from desalination process, demineralisation process, evaporation process in boiler (blow down air boiler) and laboratory are collected in Waste Water Treatment Installation to be treated with neutralisation, coagulation, and flocculation, sedimentation, and filtration process to clear the waste water.
- Water that is separated from the oil, water from domestic waste water treatment, liquid waste from generator, are used for water-spraying the coal yard and coal ash yard, this process will result in leach water of coal and coal ash. Coal leach together with the rain water will be put into Ash Run Off Pond. From both ponds, liquid waste is treated with neutralisation, coagulation, and flocculation, sedimentation, and filtration process. Treated waste water and complies the quality requirements will be directly disposed to the sea.

Flo chart of liquid waste treatment in generator production process is presented on Figure 2.15.

## **ii. Liquid Waste Treatment System**

Liquid waste treatment system from generator consists of several systems, namely:

- Oil Separation System,  
Liquid waste that contains oil come from turbine hall, fire fighting pump house and transformer compound. This oily liquid waste is collected by

gravity collection system to separate oil with water. Oil will be caught by oil trap. The liquid waste later pumped to the circulating water outfall only if such waste is clean enough or to the ash system as make up water, while the oil is collected and stored in a drum.

- Recycling system for coal and ash deposit (direct re-use of effluent for coal pile dust suppression or ash system make up).

Liquid waste from Waste Water Treatment Plant outlet of domestic waste water and generator that have been separated from the oil can be used for water-spraying on coal yard and coal ash yard without further treatment. Liquid waste from spraying activity will be collected together with rain water, each will be put in Coal Run Off Pond and in Ash Run Off Pond. Furthermore, it will be put and treated in Waste Water Treatment Plant until such waste water becomes clear and in accordance with environmental standard.

- Waste water cleaning system (waste water clarification/metal cleaning). This system will clean the waste water that is highly contain dissolved solids and heavy metals. This liquid waste is originated from pile run-off, boiler blow down, air heater washing, acid cleaning, demineralization effluent, turbin hall drain and flushing EP.

The liquid waste will be collected in an equilisation pond to homogenize the waste water quality. Neutralisation process (by adding acid or alkaline) is necessary to neutralize pH level so it would be easier to perform coagulation and flocculation. After a neutral pH obtained, coagulation and flocculation are performed to precipitate the heavy metals. After the solid and heavy metals precipitations, the liquid will be distributed through the filtration pond to make it cleaner and odor-less and ready to be disposed to the sea.

Mud developed from such process will be distributed to ash disposal area. Before the utilisation of such mud, laboratory analysis will be conducted to determine its quality. If the analysis result shown that such mud categorized as B3 waste, it will be subject to further process in accordance with applicable regulation or transported to **PPLI**.

#### e) **Solid Waste Treatment**

Ash will be collected in electrostatic, economizer and air heater and will be loaded by pneumatic to the silo for temporary storage. Bottom ash originated from combustion process will be collected with "slag cooler" or "transfer conveyor", water-sprayed and moved to the temporary storage site. Bottom

ash and fly ash will be combined, conditioned, and transported to the ash deposit yard or used as marketable construction material. Ash that has been conditioned in "just damp state" will be transported to the ash deposit yard with closed truck, which particularly designed for transporting fly ash.

Ash deposit yard is designed to accomodate the entire fly ash and bottom ash, the ash will be mixed with water from wet scrubber. Deposit yard will be equipped or will be designed according to environmental standard/regulation of Indonesia and internationally accepted. Drainage is used to collect seepage water from ash deposit yard which then distributed to the run off water treatment installation if necessary.

Base of ash deposit yard is covered with category 2 geotextile to prevent leach seepage to the ground water. Besides, for easily-flown ash, water-spraying will be conducted and then covered by permanent soil. To prevent erosion and ground ran-off, grass plantation will be done on the top layer.

To determine type and quantity of coal for the boiler, conveyor reclaim is equipped with scale and sampling system. The scale is also used to monitor loading amount to prevent over-loading and spill-over. Coal sampling system and distribution system from conveyor reclaim in silo is using conveyor tripper which is placed in distribution tower. Coal is moved from the bunker with traveling trippers. To prevent ash emission and coal spill-over, closed conveyor is used for coal transportation.

Resulted energy will be distributed to the water inside the furnace wall through convection and radiation. Extremely hot steam released from the furnace to the steam tank and distributed to steam turbine. Steam turbine will convert heat energy into kinetic energy to spin the turbine propeller. Turbine tunnel spinning is connected to the generator to create electricity. Deposits from coal combustion are disposed gas, bottom ash and fly ash.

#### **f) Noise Controlling**

Noise resulted from operations of machinery of this power plant and this installation will be equipped with noise reduction/prevention device. Noise level from spinning machinery will be reduced by the installation of sound-proofing device or specially-designed acoustic layers. If the noise level within installation is approaching 85 dB(A), the employees are obliged to wear ear protections (earplug and earmuff). At the border of installation site, noise level will not exceeding 70 dB(A) at noon (06.00 – 22.00 WIB) and not exceeding 65 dB(A) at night (22.00 – 06.00 WIB).

### g) Re-planting Facility

One of the effort to prevent the possibility of released coal ash to the atmosphere is by planting protective plants (green belt) around the activity site. Besides, these protective plants are intended as wind deflector or wind breaker around the coal yard area where the wind can be blocked by these trees and prevent the coal ash from flying all over the place. Type and layout for this plant is determined based on it purposes on such location. Plant criteria as a pilot model presented on Table 2.6.

**Table 2.6. Plant Type for Re-Planting**

No.	Location	Purposes	Plant Type
1.	Border of activity site	As a mark for project border as well as aesthetic	Palms ( <i>Roystonea regia</i> ), bamboo ( <i>Bambusa</i> sp) and canary ( <i>Canarium</i> sp) or big wooden trees, with heavy leaves and produce flower/fruit.
2.	Around the Coal yard	Keeping the distribution of coal ash, wind-breaking, and aesthetic	Type of plant with many branches and heavy leaves, such as decorative bamboo ( <i>Bambusa</i> sp) or <b>tanaman tanjung</b> ( <i>Mimusops elengi</i> )
3.	Activity site	Giving aesthetic value and as shelter	Shelter trees with heavy canopy such as <b>kisabun (<i>Felecius decipiens</i>)</b> , <b>dadap merah (<i>Erythrina cristagali</i>)</b> , <b>palmaceae</b> , <b>kaliandra (<i>Caliandra catahartica</i>)</b> , <b>kemuning (<i>Muraya paniculata</i>)</b> serta jenis herba hias.

### h) Fire Protection System

To prevent fire hazard, fire extinguisher system that will be used in power plant are :

- Fire water system : for building and others
- Foam system : for oil tank
- CO<sub>2</sub> system : for hardware and electronic device

Fire protection system consists of:

1. Automatic controlled high velocity spray water system for the area of :
  - steam turbin lube oil system
  - boiler feed pump system
  - Transformer
  - coal conveyor
2. Automatic controlled low velocity spray water system for the area of:
  - Fuel reservoir tank.
  - fuel oil daily tank.
3. Automatic total flooding system for computer room and control room.

4. Portable fire extinguisher will be placed in strategic areas.
5. Alarm for fire and detection system.



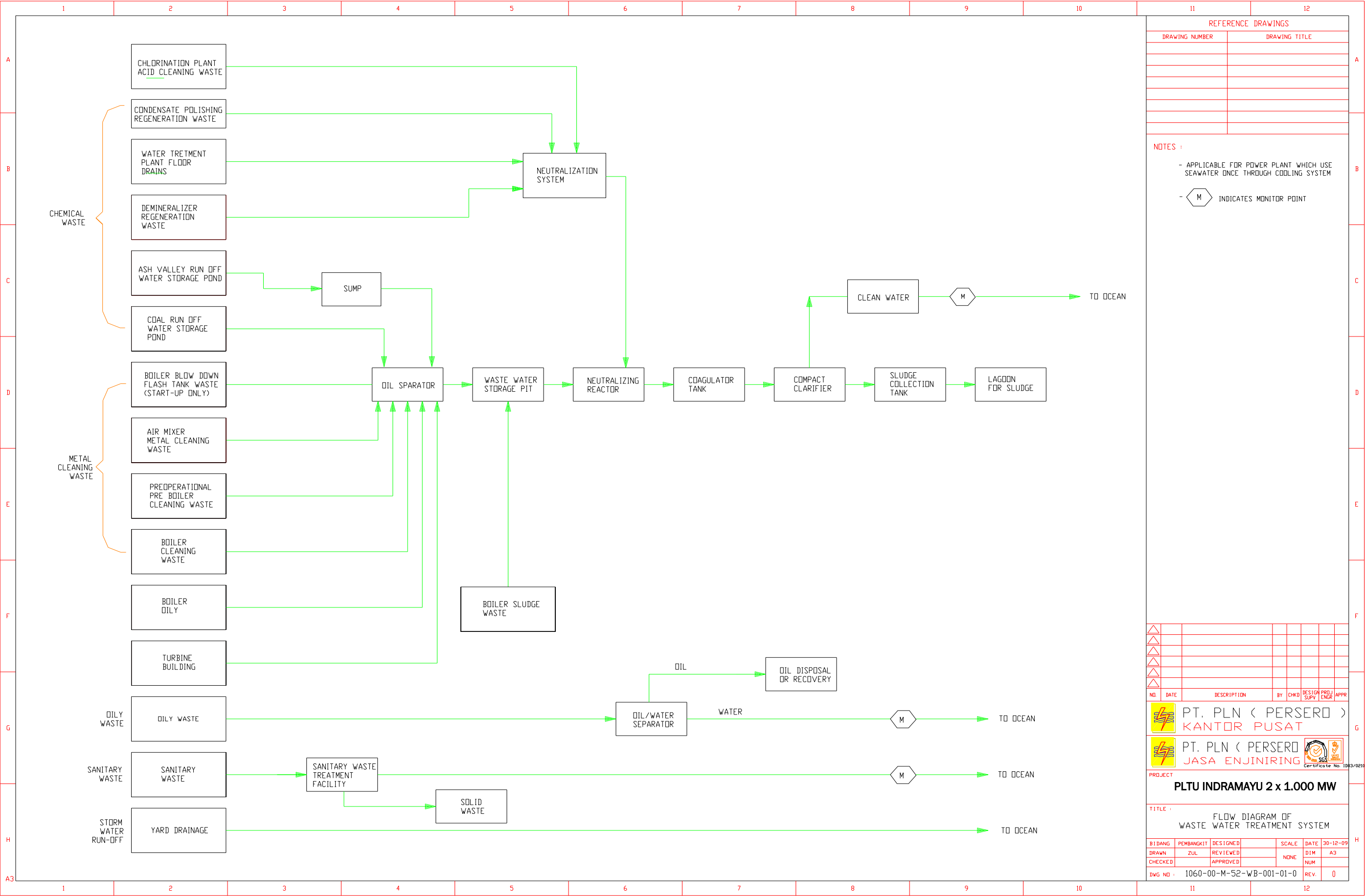


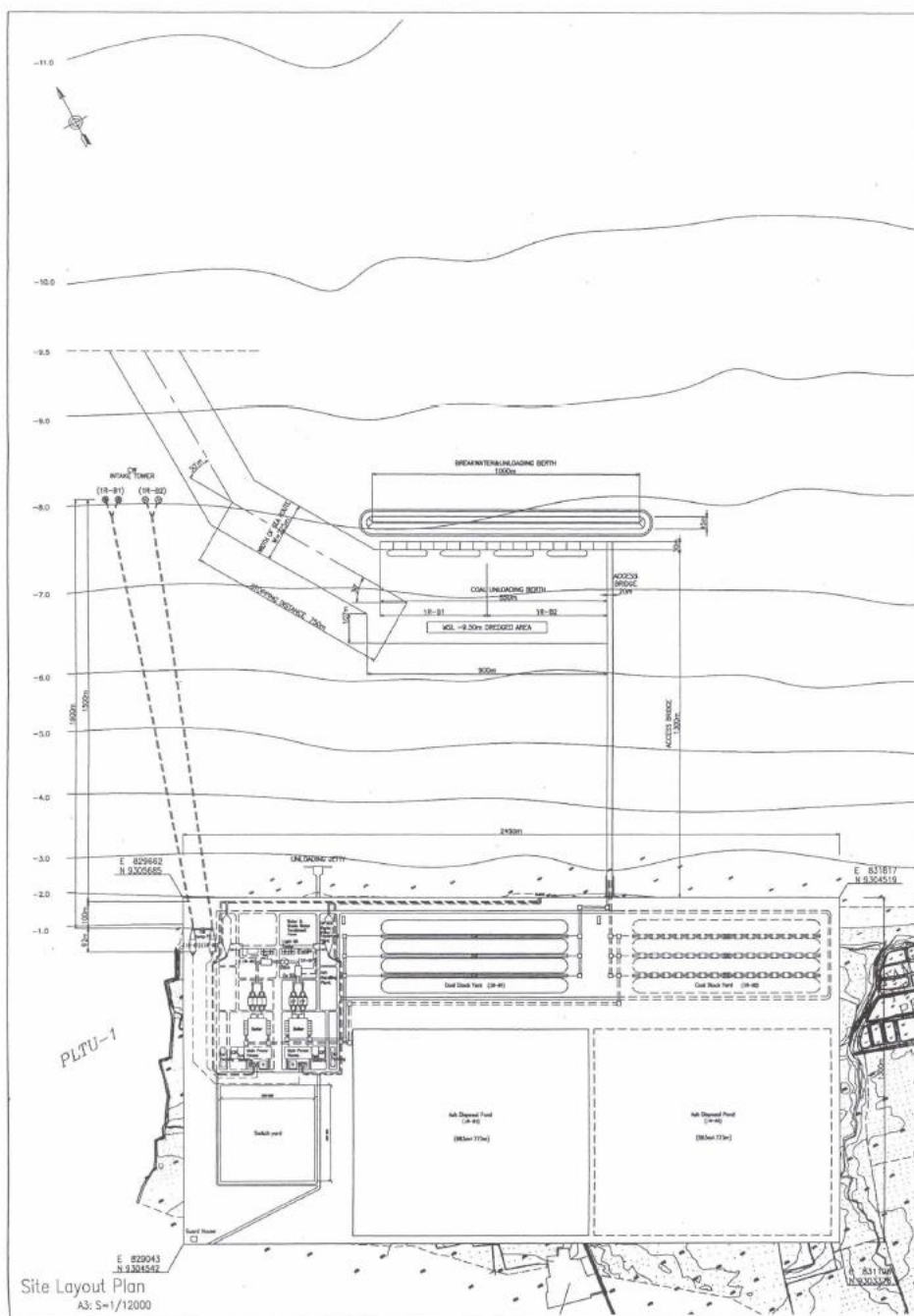
FIGURE 2.15.  
WASTE WATER TREATMENT PLANT SCHEME

## **6) Work Health and Safety Handling**

Handling of work health and safety for employees and surrounding area of power plant are integrated within work health and safety program/activity. This program is including handling towards ash distribution and noise at work also other activities that are capable of causing work accident during power plant operational phase. Effort to prevent the ash from affecting thier health is by facilitating such work with work health and safety device such as working mask and earmuff or earplug to prevent noise at work.

## **7) Electricity Production**

This Indramayu 2 X 1000 MW Steam Power Plant is capable of producing electricity amounted 22,8 kV and stepped-up by Generator Step-up Transformer into 500 kV, the electricity will be distributed to the 500 kV Indramayu-Cibatu transmission line. Distance of every conection point of Indramayu 2 X 1000 MW Steam Power Plant is approximately 450 meters each.



VI-66

## **BAB III ENVIRONMENTAL BASELINE**

### **3.1. CHEMICAL GEOPHYSIC COMPONENTS**

#### **3.1.1. Climate**

Around the prospective project site area of PLTU Indramayu 2 x 1.000 MW, climatology station is absent. Therefore, data regarding climatology was obtained from the nearest station, Sukamandi Climatology Station ( **06° 55' S and 107° 36' E**) with elevation of **12** meters above sea level.

This climate characteristic is necessary to described to analyze one of the components required in predicting the change in surface run-off, the erosion threat on prospective project site area of PLTU Indramayu 2 x 1.000 MW. Besides, such data can be used to optimized farming activities around the the prospective project site area.

Data of climate series for the last 10 (tesn) years has been collected from **Climate Observation Station of Sukamandi Rice Research Center**, in Sukamandi, Subang Regency (Table 3.1). To analyze the climate zone, especially rainfall intensity on the prospective project site area of PLTU Indramayu 2 x 1.000 MW, 4 rainfall monitoring stations were used. Data recapitulation of rainfall on study area is shown by Table 3.4, and Table 3.5.

Data regarding climate elements on the prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on **Attachment A, Table A-1 to A-6**, while the recapitulation of rainfall on the prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.4 and Table 3.5. Furthermore, annual rainfall data of respective station is presented on Attachment **B, Table B-1 to Table B-5**.

TABLE 3.1.

## RECAPITULATION OF CLIMATE ELEMENTS ON PROSPECTIVE PROJECT AREA OF PLTU INDRAMAYU 2 X 1.000 MW (2001-2010)

NO	MONTH	CLIMATE ELEMENT								
		TEMPERATUR E	RELATIVE MOISTURE	DURATIN OF RADIATIO N	RADIATION INTENSITY	WIND SPEED		EVAPORATIO N	RAIN	RAIN DAY
		(°C)	(%)	(hour)	(Cal)	(m/sec)	(Km/hr)	(mm/day)	(day)	(mm/month )
1	Januari	26,85	86,21	117,42	350,39	2,25	5,86	4,66	267,20	17
2	Februari	26,49	88,02	90,86	333,01	2,44	5,65	4,35	349,90	16
3	March	27,29	84,64	147,74	368,10	2,01	5,69	5,40	197,37	14
4	April	28,07	82,33	198,94	387,44	1,42	3,90	5,27	116,25	10
5	May	28,01	80,50	247,13	356,17	1,31	4,14	4,50	68,80	7
6	June	27,22	79,45	217,55	360,33	1,33	3,35	4,47	52,06	4
7	July	26,81	78,07	259,28	361,59	1,58	3,78	5,07	35,36	4
8	August	26,94	75,54	168,05	398,69	2,11	4,76	5,99	33,00	4
9	September	27,63	74,60	0,00	412,90	2,19	4,97	6,61	40,57	4
10	October	28,04	74,09	0,00	397,00	2,04	4,86	5,98	73,31	8
11	November	28,07	80,32	0,00	360,60	1,93	4,64	5,40	129,41	10
12	December	27,19	83,46	0,00	323,72	1,98	5,27	4,44	157,12	12
<b>Total;</b>		<b>328,60</b>	<b>967,24</b>	<b>1446,97</b>	<b>4409,93</b>	<b>22,59</b>	<b>56,88</b>	<b>62,13</b>	<b>1520,3<sub>5</sub></b>	<b>111</b>
<b>Maximum</b>		<b>28,07</b>	<b>88,02</b>	<b>259,28</b>	<b>412,90</b>	<b>2,44</b>	<b>5,86</b>	<b>6,61</b>	<b>349,90</b>	<b>17</b>
<b>Minimum</b>		<b>26,49</b>	<b>74,09</b>	<b>90,86</b>	<b>323,72</b>	<b>1,31</b>	<b>3,35</b>	<b>4,35</b>	<b>33,00</b>	<b>4</b>
<b>Average</b>		<b>27,38</b>	<b>80,60</b>	<b>180,87</b>	<b>367,49</b>	<b>1,88</b>	<b>4,74</b>	<b>5,18</b>	<b>126,70</b>	<b>9</b>

Source : Climate Observation Station of Sukamandi Rice Research Center (processed)

#### 3.1.1.1. Temperature

The highest monthly temperature recorded in Climate Observation Station of Sukamandi Rice Research Center was occurred in November (2002) for 29,75 °C, and the lowest temperature occurred in Februari (2008) approximately 24,62° C. Average monthly temperature during 2001 – 2010 is around 26,49 °C (Februari) to 28,07 °C (April and November). Brief explanation regarding monthly temperature is presented on Table 3.1. **and Attachment A Table A-1.**

Temperature range recorded by such Climate Observation Station is not a problem for agricultural cultivation activity around the prospective project site area of PLTU Indramayu 2 x 1.000 MW.

#### 3.1.1.2. Relative Moisture

The highest monthly relative moisture recorded by Climate Observation Station of Sukamandi Rice Research Center during 2001-2010 period was occurred in February 2002 for 93,83 %, and the lowest monthly relative moisture was occurred in October 2002 for 68,56 %. Average monthly relative moisture is around 74,60 % (September) to 88,08 % (February). Brief explanation regarding monthly average moisture in Climate Observation Station of Sukamandi Rice Research Center during the decade of 2001-2010 is presented on Table 3.1., and Attachment **A Table A-2.**

Moisture range recorded by Climate Observation Station of Sukamandi Rice Research Center is indicate that relative moisture is not a problem for agricultural cultivation activity around the prospective project site area of PLTU Indramayu 2 x 1.000 MW.

#### 3.1.1.3. Wind Speed

Data regarding wind speed and wind direction in study area from 2006 to 2010 is obtained from Climate Observation Station of Sukamandi Rice Research Center. Result of data analysis is presented on Table 3.2 and Figure 3.1., the result shows that east wind pattern in Indramayu coast and its surrounding can be categorized as follows:

- According to annual pattern, the dominant wind direction is South with 25,0 % of occurrence and North with 13,5 % of occurrence. Besides, wind pattern in study area is also dominated by sea breeze and land breeze pattern. Wind speed is around 1,0-1,9 m/sec with 30,3 % of occurrence.
- Accoring to rainy season pattern, the dominant winddirection is West with 28,9 % of occurrence and South with 16,8 % of occurrence. Dominant wind speed is around 1,0 -1,9 m/sec with 30,4 % of occurrence.
- According to dry season pattern, South wind was occurred 29,3 %, and North wind occurred about 14,9 %. Dominant wind speed is around 1,0-1,9 m/sec with 29,8 % of occurrence.

- According to daily wind pattern, dominant wind direction is North in the morning, but in afternoon to evening, it change to the opposite way (South). Dominant wind speed is calm (<0,4 m/detik) during morning, but the dominant wind speed in afternoon is around 4,0 – 5,9 m/sec.
- During 2006 – 2010 period, the highest wind speed is 8,0 m/sec with 1,4 % of occurrence.

**TABLE 3.2.**  
**WIND SPEED OCCURRENCE RATIO (%) (2006-2010 PERIOD)**

<b>Wind Dir.</b> <b>Wind Speed</b>	<b>NE</b>	<b>E</b>	<b>SE</b>	<b>S</b>	<b>SW</b>	<b>W</b>	<b>NW</b>	<b>N</b>	<b>Total</b>
0,5-0,9(m/sec)	0,4	0,7	0,4	0,4	0,3	1,8	1,9	3,6	9,5
1,0-1,9(m/sec)	1,5	2,3	1,8	7,1	2,8	4,5	1,3	8,7	30,0
2,0-2,9(m/sec)	0,8	1,4	1,6	7,5	3,2	3,1	0,2	0,8	18,6
3,0-3,9(m/sec)	0,1	0,5	0,8	2,3	0,8	1	0	0,2	5,7
4,0-5,9(m/sec)	0,3	0,9	2	5,9	2,2	2,1	0	0,2	13,6
6,0-7,9(m/sec)	0	0,5	0,7	1,6	0,8	0,5	0	0	4,1
8,0< (m/sec)	0	0,4	0,6	0,2	0,1	0,1	0	0	1,4
Total	3,1	6,7	7,9	25,0	10,2	13,1	3,4	13,5	-
Calm(<0,4 m/sec)									16,9

Source: Sukamandi Rice Research Center 2006 – 2010

**TABLE 3.3.**  
**RESUME OF DOMINANT MONTHLY WIND SPEED AND DIRECTION (2006-2010 PERIOD)**

<b>Month</b>	<b>Dominant Wind</b>		<b>Dominant Direction</b>	
	<b>Speed (m/Sec)</b>	<b>%</b>	<b>Direction</b>	<b>%</b>
January	1,0-1,9	30,2	South East	34,9
	4,0-5,9	15,3	East	24,2
February	1,0-1,9	30,0	South East	29,1
	2,0-2,9	18,9	East	23,4
March	1,0-1,9	26,6	South	27,1
	2,0-2,9	20,1	South East	16,8
April	1,0-1,9	40,6	South	32,5
	2,0-2,9	19,5	North	26,8
May	1,0-1,9	35,2	West	25,2
	2,0-2,9	19,6	South	17,7
June	1,0-1,9	39,5	West	35,6
	<0,4	18,7	North	14,9
July	1,0-1,9	30,3	West	32,0
	2,0-2,9	21,1	North West	17,2
August	<0,4	20,6	West	23,6
	4,0-5,9	19,8	North West	23,2
September	1,0-1,9	20,4	South	37,9
	4,0-5,9	19,9	North West	17,9
October	1,0-1,9	27,7	South	39,7
	4,0-5,9	19,7	North	16,4
November	1,0-1,9	33,5	South	38,6
	<0,4	15,9	North	21,6



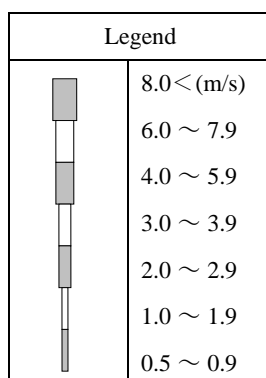
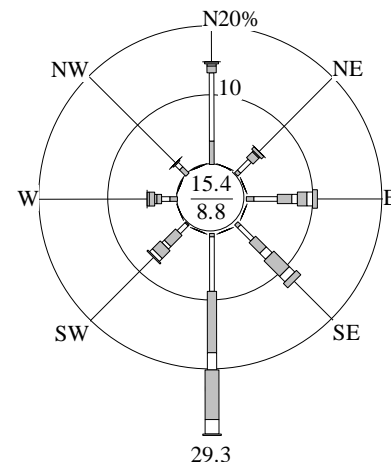
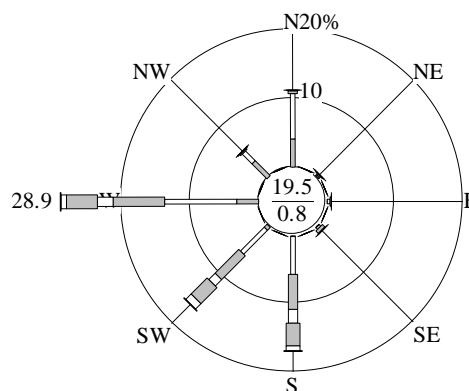
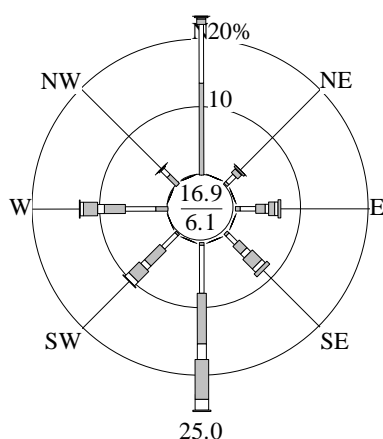
Month	Dominant Wind		Dominant Direction	
	Speed (m/Sec)	%	Direction	%
December	1,0-1,9 2,0-2,9	28,7 18,3	South East	25,8 18,6
Annual	1,0-1,9 2,0-2,9	30,0 18,6	South North	25,0 13,5
Rain Season	1,0-1,9 <0,4	30,4 19,5	West South	28,9 16,8
Dry Season	1,0-1,9 2,0-2,9	29,8 18,6	South North	29,3 14,9
All Morning	<0,4 1,0-1,9	44,7 31,4	North North East	31,1 5,4
All Mid-Day	4,0-5,9 2,0-2,9	33,3 22,1	South West	41,9 19,9
Evening	1,0-1,9 2,0-2,9	44,6 31,6	South West	32,6 17,1

Source: Sukamandi Rice Research Center 2006 – 2010

Annual Wind Direction

Rain Season

Dry Season



**FIGURE 3.1.**  
**WINDROSE**

#### 3.1.1.4. Sun Radiation Intensity

Sun radiation intensity will affect the plant's photosynthe process which is also affecting the growth process of such plant. Furthermore, sun radiation intensity can be used to predict amount of evapotranspiration of a plant.

Highest sun radiation intensity recorded by Climate Observation Station of Sukamandi Rice Research Center, during 2001 - 2010 period was occurred in April 2009 for 501,67 cal/cm<sup>2</sup>, and the lowest is in December 2007 for 207,58 cal/cm<sup>2</sup>. The average of monthly sun radiation intensity is around 323,72 cal/cm<sup>2</sup> (December) to 412,9 cal/cm<sup>2</sup> (September).

Range of sun radiation intensity recorded by Climate Observation Station of Sukamandi Rice Research Center indicates that sun radiation intensity is not a problem for agricultural cultivation activity around the prospective project site area of PLTU Indramayu 2 x 1.000 MW.

#### 3.1.1.5. Evaporation

The highest daily evaporation recorded by Climate Observation Station of Sukamandi Rice Research Center during 2001 – 2010 period was occurred in September 2001 for 8,4 mm/day, while the lowest evaporation was occurred in May 2002 for 2,49 mm/day. While the average of monthly daily evaporation is about 4,35 mm/day (February) to 6,61 m/day (September). Summary of monthly evaporation recorded by the Climate Observation Station of Sukamandi Rice Research Center during the decacde of 2001-2010 is presented on Table 3.1. and **Attachment A Table A-6**.

#### 3.1.1.6. Rainfall

In general, prospective project site area of PLTU Indramayu 2 x 1.000 MW has an average annual rain fall around **1.014,6 mm to 1.208,9 mm, with the average rain day of 99 days**. Detailed description regarding rainfall and rain day in prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.4 and Table 3.5.

In general, prospective project site area of PLTU Indramayu 2 x 1.000 MW is a coastal low land, dry season occurred from June to August. The area is dominantly categorized as agroclimate E4 zone (Oldeman, 1975), which means an area with 6 months; or more, continuously dry season and continuous rain season which is less than 3 months. Detailed description about climate type based on OLDEMAN method in rainfall observation station in the prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.6.

According to MOHR classification (1933) the prospective project site area of PLTU Indramayu 2 x 1.000 MW can be classified into IV climate type which means rainfall with amount of

dry season (<60mm/bulan) for 4-6 months and wet season (> 100 mm/month) for 4-7 months. Detailed description of climate type according to MOHR method in rainfall observation station in the prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.6.

According to SCHMID and FERGUSON classification, the prospective project site area of PLTU Indramayu 2 x 1.000 MW can be classified into climate E type which means ratio of rainfall during dry season (< 60 mm/bulan) and amount of rainfall during wet season (> 100 mm/bulan) is around 100 % - 167 %. Detailed description on climate type based on SCHMID and FERGUSON method in rainfall observation station in prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.6.

The same thing happened to OLDEMAN (1975) classification, the prospective project site area of PLTU Indramayu 2 x 1.000 MW is dominantly classified into E4 climate type which means amount of rainfall during wet season continuously (> 200 mm/month) < 3 months and amount of rainfall during dry season continuously (< 100 mm/month) > 6 months. Detailed description on climate type based on OLDEMAN method in rainfall observation station in prospective project site area of PLTU Indramayu 2 x 1.000 MW is presented on Table 3.6.

#### **3.1.1.7. Global Warming**

Industrial revolution started in Europe in 1840 was marked by the utilization of fossil fuel, particularly coal fuel, which has significantly increase the amount of green house gas in atmosphere. Green house gas produced mainly by the combustion of such fossil fuel is carbondioxide (CO<sub>2</sub>). As the result, the existence of such green house gas has triggered the inclination of earth temperature globally from years to years significantly. This phenomenon is known as global warming.

Global change caused by green house gas obviously has and will keep affecting global climate, including climate of Indramayu Regency or climate in Indramayu 2x 1.000 MW Steam Power Plant study area.

WWF Indonesia and IPCC (1999) has reported that annual temperature in Indonesia has arised 0,3 °C since 1990. A climate change scenario (WWF Indonesia and IPCC, 1999) predicted that the temperature will arise between 1,3 °C to 4,6 °C in 2100 with 0,1 °C – 0,4 °C annual trend. Furthermore, Susandi (2006) projected that temperature rising in Indonesia will reached 3,5 °C by 2100, while the earth global temperature will reach maximum point of 6,2 °C during the same year. As the result of temperature rising, sea water surface will increase 100 cm by 2100. This impact will affect the infrastructure, building and human activities in present and future.

One of the affected human needs due to global warming is water availability. Water availability is a crucial issue related to the climate change as stated by Vorosmarty et.al (2000), they shows that water issue is prevailing since the increasing number of population lead to increasing demand of water. Increasing water demand will put pressure on global water system which is closely

related to the impact of global warming. Increasing number of population and economy are the main trigger for water demand while its availability is affected by evapotranspiration (evaporation) caused by increasing earth temperature. This matter has a strong correlation with need for the existence of integrated water resource management system. The absence of such system will trigger a bigger impact to the degradation of water resources physically, institutionally, and finally affecting the socio-economy aspects.

Water management in Indonesia is still facing a hard time. Abandonment of this particular matter will end up with unfavorable situation. Therefore, planned and systematic prevention system is necessary. Without a full and thorough approach, the problem will not be solved, unless a comprehensive and sustainable solution for such problem is applied.

**Table 3.4.**  
**MONTHLY RAINFALL IN STUDY AREA (mm) 2001-2010 PERIOD**

NO	MONTH	YEAR										MAXIMUM	MINIMUM	AVERAGE
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010			
1	January	209,0	451,5	150,0	238,0	279,0	341,0	147,0	285,5	374,0	197,0	451,5	147,0	267,2
2	February	194,1	578,5	338,5	537,0	154,0	80,5		525,5	366,0	375,0	578,5	80,5	349,9
3	March	180,8	131,5	179,5	368,0	201,0	231,5		137,0	203,0	144,0	368,0	131,5	197,4
4	April	140,0	105,0	54,5	74,5	137,0	93,0	197,5	48,0	179,0	134,0	197,5	48,0	116,3
5	May	131,5	25,0	51,0	89,0	70,0	30,0	58,5	45,0	72,0	116,0	131,5	25,0	68,8
6	June	129,5	22,0		57,0	13,0	9,5	153,5	13,0	8,0	63,0	153,5	8,0	52,1
7	July	2,0	88,0		9,0	24,0	37,0	5,5			82,0	88,0	2,0	35,4
8	August	71,5				4,0			2,5		54,0	71,5	2,5	33,0
9	September	16,0	2,0	92,0		3,0		36,0		10,0	125,0	125,0	2,0	40,6
10	October	94,0		70,0		163,0	2,0	60,5	73,0	6,0	118,0	163,0	2,0	73,3
11	November	279,0	102,5	103,0	148,0	47,5	16,0	110,5	150,2	208,0		279,0	16,0	129,4
12	December	157,0	136,0	98,0	119,0	182,5	156,5	209,6	111,5	244,0		244,0	98,0	157,1
<b>Total</b>		<b>1604,4</b>	<b>1642,0</b>	<b>1136,5</b>	<b>1639,5</b>	<b>1278,0</b>	<b>997,0</b>	<b>978,6</b>	<b>1391,2</b>	<b>1670,0</b>	<b>1408,0</b>	<b>1670,0</b>	<b>978,6</b>	<b>1374,5</b>
<i>Source : Climate Observation Station of Sukamandi Rice Research Center (processed)</i>														

**Table 3.5.**  
**MONTHLY RAIN DAY IN STUDY AREA 2001-2010 PERIOD**

NO	MONTH	YEAR										MAXIMUM	MINIMUM	AVERAGE
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010			
1	January	23	23	11	13	20	17	12	16	17	21	23	11	17
2	February	14	23	21	18	7	8		24	19	13	24	7	16
3	March	22	10	15	14	10	12		16	15	13	22	10	14

NO	MONTH	YEAR										MAXIMUM	MINIMUM	AVERAGE
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010			
4	April	10	11	8	6	9	12	14	9	11	12	14	6	10
5	May	9	5	4	12	5	5	8	3	9	10	12	3	7
6	June	8	2		3	2	2	5	3	2	9	9	2	4
7	July	2	6		2	4	1	3			7	7	1	4
8	August	3				2			1		11	11	1	4
9	September	3	1	3		1		1		2	14	14	1	4
10	October	10		5		8	3	7	4	11	12	12	3	8
11	November	16	5	11	14	9	5	10	11	11		16	5	10
12	December	12	8	11	13	15	12	17	13	11		17	8	12
<b>Total</b>		<b>132</b>	<b>94</b>	<b>89</b>	<b>95</b>	<b>92</b>	<b>77</b>	<b>77</b>	<b>100</b>	<b>108</b>	<b>122</b>	<b>132</b>	<b>77</b>	<b>99</b>
<i>Source : Climate Observation Station of Sukamandi Rice Research Center 2001-2010 (processed)</i>														

Table 3.6.

## RECAPITULATION OF RAINFALL AND CLIMATE TYPE IN STUDY AREA

NO	STATION NAME	PERIOD	MONTH												ANNUAL	CLIMATE TYPE		
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		MOHR	SCHMIDT FERGUSON	OLDEMAN
1	Bugel	1997 - 2010	316,0	267,1	116,0	96,6	61,0	0,0	0,0	0,0	0,0	0,0	0,0	131,3	1237,5	IV	E	E4
2	Sukra	1997 - 2010	266,9	225,6	99,2	62,6	62,1	0,0	0,0	0,0	0,0	0,0	0,0	87,3	1014,6	V	F	E4
3	Sukamandi	2001 - 2010	267,2	349,9	197,4	116,3	68,8	52,1	35,4	33,0	40,6	73,3	129,4	157,1	1374,5	IV	E	E3
<b>STUDY AREA AVERAGE</b>			<b>283,4</b>	<b>280,9</b>	<b>137,5</b>	<b>91,9</b>	<b>64,0</b>	<b>17,4</b>	<b>11,8</b>	<b>11,0</b>	<b>13,5</b>	<b>24,4</b>	<b>43,1</b>	<b>125,2</b>	<b>1208,9</b>			
<b>MAXIMUM</b>			<b>316,0</b>	<b>349,9</b>	<b>197,4</b>	<b>116,3</b>	<b>68,8</b>	<b>52,1</b>	<b>35,4</b>	<b>33,0</b>	<b>40,6</b>	<b>73,3</b>	<b>129,4</b>	<b>157,1</b>	<b>1374,5</b>			
<b>MINIMUM</b>			<b>266,9</b>	<b>225,6</b>	<b>99,2</b>	<b>62,6</b>	<b>61,0</b>	<b>0,0</b>	<b>0,0</b>	<b>0,0</b>	<b>0,0</b>	<b>0,0</b>	<b>0,0</b>	<b>87,3</b>	<b>1014,6</b>			

Source : Perusahaan Umum (Perum) JASA TIRTA II - DIVISI II SEKSI PATROL (processed).

### 3.1.2. Air Quality and Noise

#### 3.1.2.1. Air Quality

Result of air quality monitoring during May – July 2010 is shown on Table 3.7, it indicates that the measured concentration of NO<sub>2</sub>, SO<sub>2</sub>, CO, oxide, hydrocarbon, PM<sub>10</sub>, dust and Pb is still within the ambient air quality standard based on Government Regulation No 41 of 1999.

- SO<sub>2</sub> concentration in resident area within 1 – 10 km of distance is not detected. Different to Indramayu – Subang intercity road, the concentration is higher, 16,90 µg/m<sup>3</sup> (1 hour) since the SO<sub>2</sub> emission level is higher, particularly from solar-fueled vehicles.
- NO<sub>2</sub> concentration is also similar to SO<sub>2</sub> concentration measurement result; concentration in resident area is lower than the road. NO<sub>2</sub> concentration in resident area is 11,16 – 19,57 µg/m<sup>3</sup> (1 hour) and 27,47 µg/m<sup>3</sup> (1 hour) in the road.
- PM<sub>10</sub> particulate concentration in resident area is higher, (88,10 µg/m<sup>3</sup> (24 hours) compared to the road 56,9 µg/m<sup>3</sup> (24 hours). This is because resident area is still dominated by soil.

According to air quality monitoring data in project site conducted on May 2010, it shows that all of the ambient air quality parameters are still comply with ambient air quality standar based on Government Regulation No. 41 of 1999 on ambient air quality control. Result of air quality measurement around the activity site of PLTU Indramayu 2 x 1.000 MW conducted in July 2010 shows that the concentration of NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>, HC, PM<sub>10</sub> and TSP are 1,03 – 31,94, not detected -5,66, 252-1784, not detected -14,95, not detected - 2,47, 50-91 and 58,9 – 186,3 µg/m<sup>3</sup> respectively.

#### 3.1.2.2. Noise

Noise level measurement result in resident area (station 1 and 2) around the project site in general is still comply with noise level standard based on the Decree of Minister of Environment No. 46 of 1996 for resident area, namely, less than 55 dBA. Meanwhile, noise level on the intercity road of Cirebon – Jakarta (North Coast) has exceeded the standard, namely, around 70 – 80.

**TABLE 3.7.**  
**AIR QUALITY MEASUREMENT RESULT**

No	Parameter	Unit	Method	Measuring Result								9	Standard
				1	2	3	4	5	6	7	8		
CHEMICAL													
1	Nitrogen Dioxide (NO <sub>x</sub> )	µg/m <sup>3</sup> per 1 hour	Saltzman (SNI 19-7119.2-2005)	14.59	15.45	19.57	13.74	13,74	12,88	17,17	11,16	27,47	400
2	Sulfur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup> per 1 hour	Pararosanilin (SNI 19-7117.3.1-2005)	tt	tt	6.66	tt	tt	tt	tt	1,18	16,90	900
3	Karbon Monoxide (CO)	µg/m <sup>3</sup> per 1 hour	Iodine Pentoxide	840	1,260	1,260	1,890	1680	2940	420	420	2520	30000
4	Oxidants (O <sub>3</sub> )	µg/Nm <sup>3</sup> per 1 hour	NBKI-Spektrofotometri	12.46	11.79	14.95	11.14	12,46	7,19	23,01	16,41	12,46	235
5	Hydrocarbon (HC)	µg/Nm <sup>3</sup> per 3 hours	Chromatographic Gas (SNI 19-4842-1998)	1.56	2.47	1.58	2.47	1,06	2,03	1,15	2,47	4,82	160
6	Particle <10 µm (PM <sub>10</sub> )	µg/Nm <sup>3</sup> per 24 hours	Gravimetri (ASTM D 4096-9-2003)	86.0	66.0	67.0	30.8	80,5	52,2	39,0	45,0	56,9	150
7	Dust (TSP)	µg/Nm <sup>3</sup> per 24 hours	Gravimetri (SNI 19-6603-2001)	111.7	72.9	166.3	98.7	128	153	58	177	368	230
8	Lead (Pb)	µg/Nm <sup>3</sup> per 1 hour	Destruksi (SNI 19-7119.4-2005)	tt	tt	tt	tt	tt	tt	tt	tt	tt	2

**REMARKS:**

Sampling Station:

1. =Housing around the Project Site (06°18'10"S – 107°54'16"E)
2. = Housing around the Project Site (06°16'59"S – 107°59'21"E)
3. = Housing around 5 km from the Project Site (06°19'26"S – 107°58'51"E)
4. = housing around 10 km from the Project Site (06°18'10"S – 107°54'16"E)
- 5 = Blok Warakas, Mekarsari Village, coordinate point (06°17' 62"S - 107°58' 79"E)
- 6 = Head Office of Patrol Lor Village, coordinate point (06°18' 44"S - 107°59' 81"E)
- 7 = Karanglayung Village, coordinate point (06°18' 41"S - 107°57' 57"E)
- 8 = Bogege, Karanglayung Village, coordinate point (06°18' 31"S - 107°57' 26"E)
- 9 = Jl. Raya Indramayu-Subang, Sukra Sub-District, coordinate point (06°18' 56"S - 107°57' 26"E)

tt = Not Detected

\*) Standard based on the Government Regulation of the Republic of Indonesia No. 41 of 1999 on National Ambient Air Standard

\*\*) Decree of Minister of Environment No. 48 of 1996 on Noise Level Standard

-For Industry : 70 dBA

-For Housing and Settlement : 55 dBA



**TABLE 3.8.**  
**NOISE MEASUREMENT RESULT**

No	Location	Measurement Result (dBA)	Standard
1	Settlement	55	55
2	Settlement	52	55
3	Indramayu-Jakarta Intercity Road	74	70
4	Station 4 of Indramayu-Jakarta Intercity Road	75	70
5	Station 5	48	55
6	Station 6	50	55
7	Station 7	52	55
8	Station 8	48	55
9	Station 9	70	70

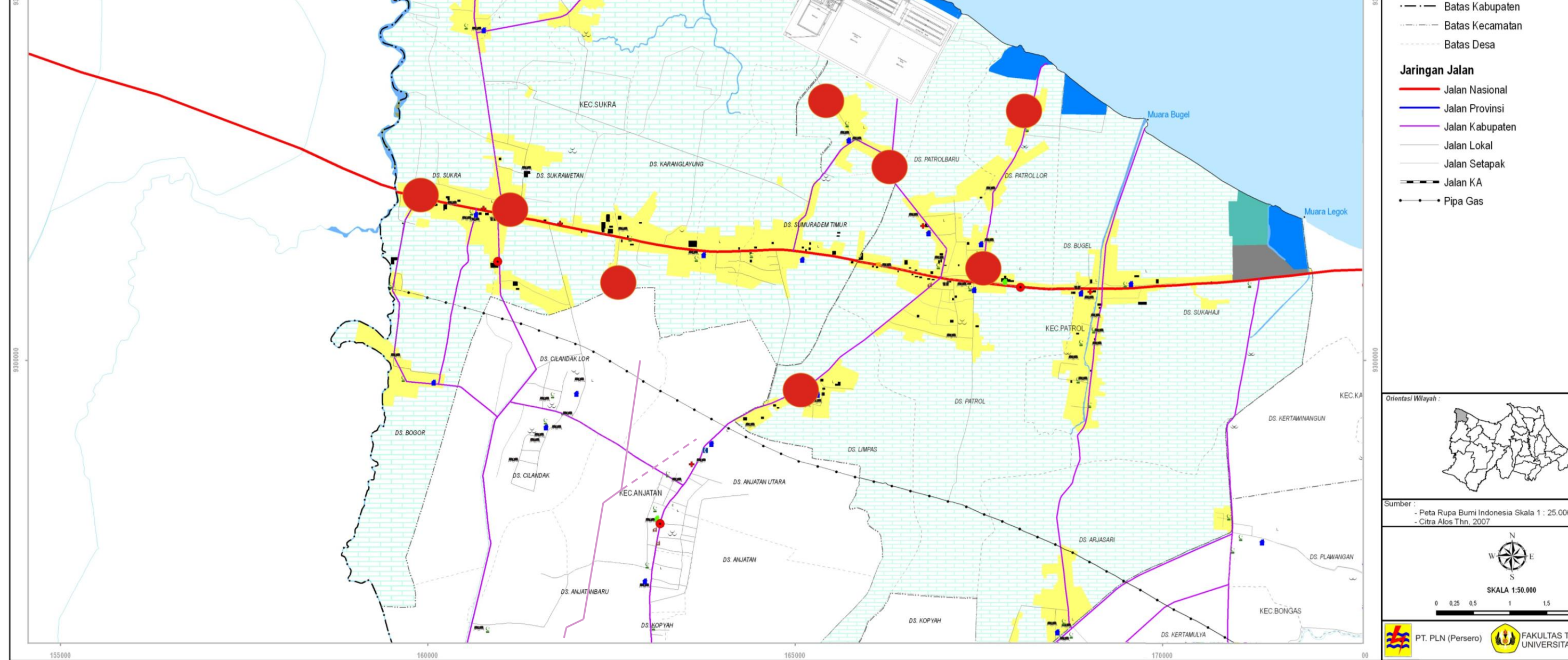
**REMARKS:**

Sampling Station:

- 1.= Housing around the Project Site (06°18'10"S – 107°54'16"E)
- 2.= Housing around the Project Site (06°16'59"S – 107°59'21"E)
- 3.= Housing around 5 km from the Project Site (06°19'26"S – 107°58'51"E)
- 4.= Housing around 10 km from the Project Site (06°18'10"S – 107°54'16"E)
- 5 = Blok Warakas, Mekarsari Village, coordinate point (06°17'62"S - 107°58'79"E)
- 6 = Head Office of Patrol Lor Village, coordinate point (06°18'44"S - 107°59'81"E)
- 7 = Karanglayung Village, coordinate point (06°18'41"S - 107°57'57"E)
- 8 = Bogeg, Karanglayung Village, coordinate point (06°18'31"S - 107°57'26"E)
- 9 = Jl. Raya Indramayu-Subang, Sukra Sub-District, coordinate point (06°18'56"S - 107°57'26"E)

\*\*) Decree of Minister of Environment No. 48 of 1996 on Noise Level Standard

- For Industry : 70 dBA
- For Housing and Settlement : 55 dBA



### 3.1.3. Water Quality

#### 3.1.3.1. Sea Water Quality

Sea water quality measurements are conducted in several points (Figure 3.3.), sea water quality measurements results both in physic and chemical are presented on Table below:

**TABLE 3.9.**  
**SEA WATER QUALITY AROUND PROSPECTIVE AREA FOR THE PLTU INDRAMAYU**  
**2 X 1.000 MW**

NO	PARAMETER	UNIT	METHOD	STATION					STAND ARD *
				L1	L2	L3	L4	L5	
PHYSIC									
1	Transparency	cm	-	45	90	180	110	80	-
2	Suspended solids	mg/L	SNI 06.6989.27.05	3.4	3.7	4.4	2.6	3.4	80
3	Dissolved solids	mg/L	SNI 06.6989.27.05	31440	28502	29480	30320	31300	-
4	Turbidity	NTU	-	0.27	0.31	0.38	0.19	0.27	< 5
5	Temperature	°C	SNI 06.6989.23.05	29.2	29	28.9	28.9	28.6	Natural
6	Salinity	‰	-	33.6	34.6	34.8	34.8	34.7	Natural
7	DHL	µmhos/cm	SNI 06.6989.27.05	48000	43500	45000	46300	47800	-
ORGANIC CHEMICAL									
1	pH	-	SNI 06.6989.11.04	7.75	7.93	7.75	7.97	7.72	7,0-8,5
2	BOD	mg/L	SNI M-69-1990-03	6.6	6.2	6.4	6.4	6.4	20
3	COD	mg/L	SNI M-70-1990-03	18	16	16	17	16	-
4	DO	mg/L	SNI 06.6989.14.04	5.1	5.4	4.8	4.8	4.5	> 5
5	Ammonia (NH <sub>3</sub> -N)	mg/L		0.111	0.177	0.185	0.192	0.188	0,3
6	Nitrite (NO <sub>3</sub> )	mg/L	SNI 06.6989.9.04	0.585	0.429	0.488	0.62	0.395	0,002
7	Cobalt (Co)	mg/L	SNI 06.2473.91	0.019	0.024	0,028	0.033	0.035	-
8	Barium (Ba)	mg/L	SNI M-36-1990-03	0.566	0.720	0.490	0.666	0.543	-
9	Boron (B)	mg/L	SNI 06.2481-1991	2.4	1.88	2.16	2.05	2.17	-
10	Selenium (Se)	mg/L	SNI M-44-1990-03	0.005	0.003	0.007	0.003	0.005	-
11	Cadmium (Cd)	mg/L	SNI 06.6989.37.05	< 0,003	< 0,003	< 0,003	< 0,003	< 0,003	0,001
12	Chromium (Cr <sup>6+</sup> )	mg/L	SNI 19.1132.91	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	0,002
13	Iron (Fe)	mg/L	SNI 06.6989.49.05	0.482	0.511	0.392	0.244	0.372	-
14	Lead (Pb)	mg/L	SNI 06.6989.45.05	< 0,004	< 0,004	< 0,004	< 0,004	< 0,004	0,008
15	Manganese (Mn)	mg/L	SNI 06.6989.41.05	0.063	0.038	0.051	0.058	0.040	-
16	Mercury (Hg)	ppb	SNI 06.3605.94	0.0039	0.0058	0.0060	0.0029	0.0040	1
17	Zinc (Zn)	mg/l	SNI 06.2520.89	0.066	0.075	0.08	0.061	0.055	0,05
18	Cyanide (CN)	mg/l	SNI 06.6989.41.05	< 0,001	< 0,001	< 0,001	< 0,001	< 0,001	0,05
19	Fluoride (F)	mg/L	SNI 06.2484.91	2.94	2.75	2.80	2.60	2.91	-
20	Nitrite (NO <sub>2</sub> )	mg/L	APHA 4500-NO <sub>3</sub> E.98	0.007	0.007	0.012	0.005	0.006	-
21	Sulphate (SO <sub>4</sub> )	mg/L	SNI 06.6989.20.04	12000	11080	11470	11680	11840	-

NO	PARAMETER	UNIT	METHOD	STATION					STAND ARD *
				L1	L2	L3	L4	L5	
22	Free Chlor	mg/L	SNI 06-4824-1998	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	-
23	Sulphide (H <sub>2</sub> S)	mg/L	SNI M-39-1990-03	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	0,002
24	<b>Hardness</b> (CaCO <sub>3</sub> )	mg/L	SNI 06-4161-1996	7.501	6.76	7.205	7.402	7.509	-
25	Oil + Fat	mg/L	SNI 06.2502.1991	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	1
26	Sulfactant	mg/L	-	0.711	0.580	0.554	0.614	0.488	-
27	Chloride	mg/L	SNI 06-6989.19.04	22300	20270	21000	21580	22280	-
28	Phenol	mg/L	SNI 06.6989.21.04	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	0,02

According to direct measurement on sea water quality around the prospective project site of PLTU Indramayu 2 x 1.000 MW conducted on 2010, it shows that most of the measured parameters, both physic and chemical, has comply with the applicable government's standard based on the Decree of Minister of Environment No. 51 of 2004 on Sea Water Quality Standard for marine life forms. In general, measured physic and chemical parameters are still within the limit of applicable standard. However, some of the parameters are still exceeding or fail to comply with the applicable standard such as Dissolved Oxygen (DO) and Nitrate (NO<sub>3</sub>).

DO concentration that fails to comply with required standard is at sampling point of L3, L4 and L5 with values of 4,8, 4,8 and 4,5 mg/L respectively, while the applicable concentration is > 5 mg/L. Moreover, Nitrate concentration is around 0,395 to 0,650 mg/L, with the applicable standard is 0,002 mg/L. thus, it can be concluded that all of the sampling point at the sea shows nitrate concentration that are exceeding the applicable standard. Low DO and nitrate concentration in sea water can be caused by several reasons, particularly from organic disposal source such as river, fish auction port activity, and domestic activity along the beach, domestic waste from existing Steam Power Plant, and fertilizer utilization in agricultural area.

### 3.1.3.2. River Water Quality

Analysis result from water sampling activity conducted in river around the prospective project site of PLTU Indramayu 2 x 1.000 MW is shown on the Table below:

**TABLE 3.10.**  
**RIVER WATER QUALITY AROUND THE PROSPECTIVE PROJECT SITE OF**  
**PLTU INDRAMAYU 2 X 1.000 MW**

NO	PARAMETER	UNIT	METHOD	STATION			STANDARD *
				L1	L2	L3	
PHYSIC							
1	Transparency	Cm	-	18	18	18	-
2	Suspended solids	mg/L	SNI 06.6989.27.05	68	82	87	80
3	Dissolved solids	mg/L	SNI 06.6989.27.05	481	492	390	-

NO	PARAMETER	UNIT	METHOD	STATION			STANDARD *
				L1	L2	L3	
4	Turbidity	NTU	-	39.4	55	60	< 5
5	Temperature	°C	SNI 06.6989.23.05	-	-	-	Natural
6	Salinity	‰	-	34,7	35,1	35,1	Natural
7	DHL	µmhos/cm	SNI 06.6989.27.05	744	750	603	-
<b>ORGANIC CHEMICAL</b>							
1	pH	-	SNI 06.6989.11.04	7.53	7.43	7.46	7,0-8,5
2	BOD	mg/L	SNI M-69-1990-03	6.2	4.4	6.6	20
3	COD	mg/L	SNI M-70-1990-03	16.2	14.7	18.5	-
4	DO	mg/L	SNI 06.6989.14.04	6.4	3.2	5.7	> 5
4	Ammonia (NH <sub>3</sub> -N)	mg/L		0.133	0.169	0.173	0,02
5	Natrium (Na)	mg/L	APHA 4500.P.98	64	80	66	0,015
6	Nitrate (NO <sub>3</sub> )	mg/L	SNI 06.6989.9.04	0.166	0.204	0.222	0,002
8	Arsen (As)	mg/L	SNI 06.6989.39.05	< 0,002	< 0,002	< 0,002	0,005
9	Cobalt (Co)	mg/L	SNI 06.2473.91	0.004	0.008	0.011	-
10	Barium (Ba)	mg/L	SNI M-36-1990-03	0.284	0.211	0.292	-
11	Boron (B)	mg/L	SNI 06.2481-1991	< 0,05	< 0,05	< 0,05	0,002
12	Selenium (Se)	mg/L	SNI M-44-1990-03	< 0,001	< 0,001	< 0,001	-
13	Cadmium (Cd)	mg/L	SNI 06.6989.37.05	< 0,003	< 0,003	< 0,003	0,001
14	Chromium (Cr <sup>6+</sup> )	mg/L	SNI 19.1132.91	< 0,002	< 0,002	< 0,002	0,002
15	Copper (Cu)	mg/l	SNI 06.2517.91	< 0,0007	0.0008	0.00013	0,008
16	Iron (Fe)	mg/L	SNI 06.6989.49.05	0.824	0.911	0.975	-
17	Lead (Pb)	mg/L	SNI 06.6989.45.05	< 0,004	< 0,004	< 0,004	0,008
18	Manganese (Mn)	mg/L	SNI 06.6989.41.05	0.029	0.054	0.027	-
19	Mercury (Hg)	Ppb	SNI 06.3605.94	0.0021	0.0033	0.0039	1
20	Zinc (Zn)	mg/L	SNI 06.2520.89	0.013	0.016	0.011	0,05
21	Cyanide (CN)	mg/L	SNI 06.6989.41.05	< 0,001	< 0,001	< 0,001	0,05
22	Fluoride (F)	mg/L	SNI 06.2484.91	0.177	0.202	0.148	-
23	Nitrite (NO <sub>2</sub> )	mg/L	APHA 4500-NO <sub>2</sub> E.98	< 0,002	< 0,002	< 0,002	-
24	Sulphate (SO <sub>4</sub> )	mg/L	SNI 06.6989.20.04	29.5	33.4	29.1	-
25	Free Chlor	mg/L	SNI 06-4824-1998	< 0,02	< 0,02	< 0,02	-
26	Sulphide (H <sub>2</sub> S)	mg/L	SNI M-39-1990-03	< 0,05	< 0,05	< 0,05	0,002
27	Hardness (CaCO <sub>3</sub> )	mg/L	SNI 06-4161-1996	185	197	158	
28	Oil + Fat	mg/L	SNI 06.2502.1991	< 0,05	< 0,05	< 0,05	1
29	Sulfactant	mg/L	-	0.116	0.137	0.060	
30	Chloride	mg/L	SNI 06-6989.19.04	6.6	40	22	
31	SAR	mg/L	-	2.42	2.55	2.29	
32	RSC	mg/L	-	-	-	-	
33	Phenol	mg/L	SNI 06.6989.21.04	< 0,002	< 0,002	< 0,002	0,02

Monitoring result of river water samples from around the prospective project site of PLTU Indramayu 2 x 1.000 MW, it can be identified that, in general, the river water quality is



still within the applicable standard based on the Decree of Governor of West Java No.39 of 2000 on Water Purpose and Water Standard of Citarum River and its tributaries in West Java. Water physics parameters such as water temperature and salinity, also water chemical parameters such as pH, DO, BOD, COD, and sulfide in general are still within the applicable standard (see Table 3.10.).

However, there are some of chemical parameters that fails to comply with applicable standard, those parameters are suspended solids (68 - 87 mg/L), turbidity (39,4 – 60 NTU), natrium (64 – 80 mg/L), ammonia (0,133 – 0,173 mg/L), and nitrate (0,166 – 0,222 mg/L). increasing level of suspended solids in water body is caused by constantly changing land condition such as land conversion, intensive agricultural cultivation activity and other activities. Ammonia and nitrate are elements that oroginated from elements that contains air-releasing nitrogen. The polluting materials and elements can be found in domestic waste, industrial waste, and fertilizer used in agricultural activity. The existence of such elements in water body can affect the balance of river ecosystem such as algae blooming or terminating organisms that are sensitive to such polluting materials. Consentration of such polluting materials and elements have to be controlled to prevent negative impacts towards water ecosystem.

### 3.1.3.3. Resident's Well Water Quality

Result of laboratory analysis on resident's well water quality around the prospective project site is shown on Table below:

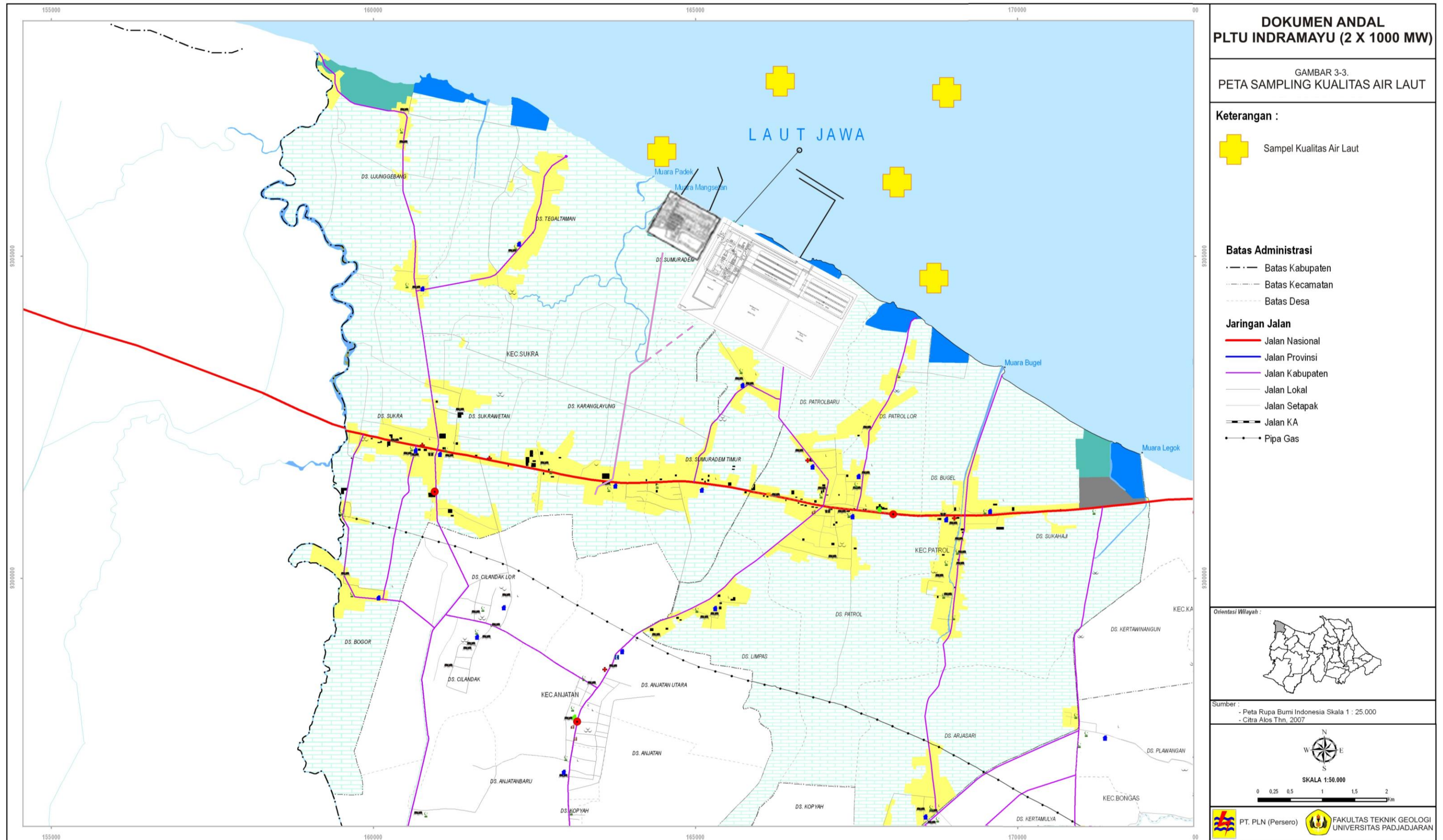
**TABLE 3.11.**  
**WELL WATER QUALITY AROUND THE PROSPECTIVE PROJECT SITE OF**  
**PLTU INDRAMAYU 2 X 1.000 MW**

NO	PARAMETER	UNIT	METHOD	STATION			STANDARD *
				L1	L2	L3	
PHYSIC							
1	Odor	-	-	Odorless	Odorless	Odorless	Odorless
2	Taste	-	-	Tasteless	Tasteless	Tasteless	Tasteless
3	Color	Unit PtCo	SNI 06-2413-1991	1.29	4.7	8.85	50
4	Dissolved solids	mg/L	SNI 06.6989.27.05	2380	910	440	1500
5	Turbidity	NTU	-	1.37	15.2	44.7	25
6	Temperature	°C	SNI 06-2413-1991	-	-	-	Natural
7	Salinity	‰	-	19	18	2	Natural
8	DHL	µms/cm	SNI 06.6989.27.05	4	175	626	-
ORGANIC CHEMICAL							
1	pH	-	SNI 06.6989.11.04	7.67	6.86	7.33	6.5-9
2	DO	mg/L	SNI 06.6989.14.04	5.1	3.8	2.7	> 5
3	Nitrate (NO <sub>3</sub> )	mg/L	SNI 06.2484-1991	0.611	0.727	0.590	10
4	Cadmium (Cd)	mg/L	SNI 06-2466-1991	< 0,003	< 0,003	< 0,003	0.005

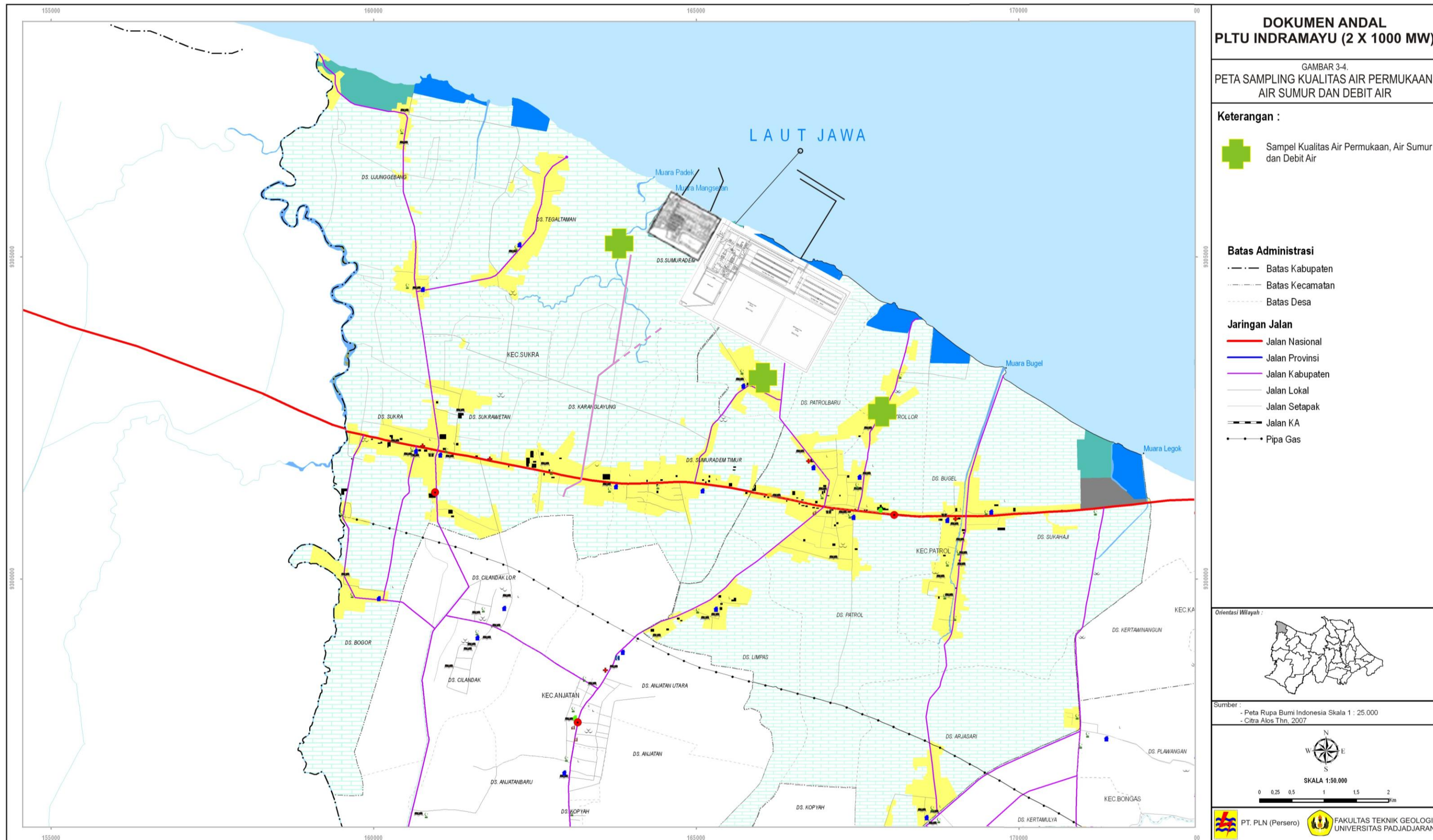
NO	PARAMETER	UNIT	METHOD	STATION			STANDARD *
				L1	L2	L3	
5	Chromium (Cr <sup>6+</sup> )	mg/L	SNI 06-2512-1991	< 0,002	< 0,002	< 0,002	0.05
6	Copper (Cu)	mg/l	SNI 06-6989-6.04	< 0,002	< 0,002	< 0,002	-
7	Iron (Fe)	mg/L	SNI 06-2523-1991	0.028	0.103	0.448	1.0
8	Lead (Pb)	mg/L	SNI 06-2517-1991	< 0,004	< 0,004	< 0,004	0.05
9	Manganese (Mn)	mg/L	SNI 06-2497-1991	0.055	0.058	0.061	0.5
10	Zinc (Zn)	mg/L	SNI 06-2507-1991	0.168	0.175	0.189	15
11	Cyanide (CN)	mg/l	SNI 06.6989.41.05	< 0,001	< 0,001	< 0,001	0.1
12	Fluoride (F)	mg/L	SNI 06-2482-1991	0.572	0.211	0.184	1.5
13	Nitrite (NO <sub>2</sub> )	mg/L	SNI 06-2484-1991	0.016	0.009	0.007	1
14	Sulphate (SO <sub>4</sub> )	mg/L	SNI 06.6989.20.04	380	75	44	400
15	Sulphyde (H <sub>2</sub> S)	mg/L	SNI M-39-1990-03	< 0,005	< 0,005	< 0,005	0,002
16	Hardness (CaCO <sub>3</sub> )	mg/L	SNI 06-4161-1996	454	209	177	500
17	Active element of Methylene Blue	mg/L	SNI 06-2476-1991	0.381	0.195	0.326	0.5
18	Chloride	mg/L	SNI 06-6989.19.04	626	267	117	600
19	Permanganat Value	mg/L	SNI 06-2506-1991	12.6	8.4	11.3	10
<b>MICRO BIOLOGY</b>							
1	Faecal Coli	JPT/100 ml	Dual Tank, APHA 9221 A-C.Ed.20.1998	460	1100	2400	-
2	Total Choliform	JPT/100 ml	Dual Tank, APHA 9221 E.Ed.20.1998	1100	2400	11000	1000

Current data regarding ground water quality, namely resident's well water, shows that there are several physical, chemical, and biological parameters which are failed to comply with applicable standard based on the Regulation of Minister of Health No.416/Menkes/Per/IX/1990 on water quality monitoring and requirements. Those parameters are, inter alia, dissolved solids, turbidity, dissolved oxygen, chloride, permanganate value, and choliform.

Resident's well water has a range of dissolved solids around 440 – 2380 mg/L, with the location of well number 1 that contain suspended solids. Meanwhile, the range of turbidity is 1,37 – 44,7 NTU where the well number 3 failed to comply with the required standard. This condition can be caused by inappropriate soil condition for ground water or bad well construction which is unable to fulfill the health requirements. Generally, resident's wells are sumur gali with low depth.







Dissolved oxygen (DO) concentration is around 2,7 – 5,1 mg/L, where the well number 2 and 3 has a lower concentration under the required standard. Chloride concentration is around 117 – 626 mg/L where the well number 1 has the highest concentration exceeding the required standard. The value of **permanganat** is around 8,4 – 812,6 mg/L, where the sampling point number 1 and 3 have the exceeding value of permanganat based on the required standard. Value of choliform in the entire well shows that all of three wells are contaminated by choliform with value around 1.100 to 11.000 JPT/100 ml, while the required standard is 1.000 JPT/100ml. Choliform contamination in water well is caused by a bad sanitary system and proximity of sanitary facility with clean water well.

#### 3.1.3.4. Sea Sediment Quality

Result of sea sediment quality measurement around the PLTU Indramayu 2 x 1.000 MW development plan is as follows:

**TABLE 3.12.**  
**SEA SEDIMENT QUALITY AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW**

No	Parameter	Unit	Station		
			1	2	3
1	Ca	mg/kg	10.320	14.72	13.80
2	Ba	mg/kg	133.3	152.5	160
3	B	mg/kg	168.5	206.7	211.2
4	Se	mg/kg	4.74	7.01	7.52
5	Cd	mg/kg	0.666	0.842	0.911
6	Cr <sup>2+</sup>	mg/kg	0.514	0.716	0.720
7	As	mg/kg	1.482	2.692	3.114
8	Zn	mg/kg	28.70	33.48	37.05
9	Pb	mg/kg	0.975	0.880	0.812
10	Cu	mg/kg	4.882	5.529	5.405
11	Hg	mg/kg	0.00205	0.00311	0.00294
12	Mn	mg/kg	4.786	5.05	6.112
13	Fe	mg/kg	10.06	9.11	12.03

According to heavy metals analysis on sea bottom sediment, it is clear that the existence of the entire measured metal parameter were detected. However, based on the standard issued by EPA Regional V (Table 3.12.) it shows that metals contained in the sediment is still within normal range.

**TABLE 3.13.**

**SEDIMENT CRITERIA FROM EPA REGIONAL V (mg/KG DRY WEIGHT)**

No	Metal Type	Unpolluted	Slightly Polluted	Heavily Polluted	Average concentration in earth crust
1	Pb	< 40	40 – 60	>60	16
2	Zn	< 90	90 - 200	>200	80
3	Fe	<17000	17000-25000	>25000	50000
4	Ni	<20	20 - 50	>50	100
5	Mn	<300	-	>500	1.000
6	Cd	-	-	>6	0,2
7	Cr	<25	25 - 75	>75	200
8	Cu	<25	25 - 50	>50	70

Source: (Ahmad et al. 2009)

**3.1.4. Physiographic****3.1.4.1. Physiographic**

from the physiographical aspect, study area and its surrounding are included into Java North Coast Plain (bemmelen, 1949). Morphology of such study area can be divided into 2 categories, namely: hill and flat terrain.

**A. Hill.**

This morphological unit is including South Western part of study map. Altitude of this morphological unit is around 6 to 8 Meters above sea level with relatively flat slope and sub-parallel river basin pattern in general.

**B. Flat Terrain**

this unit includes almost the entire part of study area. Altitude is around, but not more than, 6 Meters above sea level. Patterns of river basin in this area are **dendritic** and **anastomatic**, in the anastomatik flow system, meander is formed, which is sign that this area has a charteristic of delta environment. In Indramayu regency, there are two kind of beaches namely Eretan beach and Karang Ampel Beach.

**FIGURE 3.5.****FLAT TERRAIN MORPHOLOGY OF STUDY AREA****3.1.4.2. Stratigraphic**

In the study area and its surrounding, in stratigraphic aspect, quarter-aged rocks can be found. Rocks arrangement from the oldest to the newest in this area is on the age of Pleistosen such as **Conglomerate** and **Sand Rock** tuffan (Qav). Flood sediment at the bottom of holosen-aged alluvium (Qaf), coast sediment (Qac), coast flat sediment (Qbr), river sediment (Qa) and delta sediment (Qad).

For the particular study area, which is part of Regional Geological map, is shown on Figure below. Stratigraphic order in study area from the oldest to the newest is:

- Flood sediment (Qaf)

This sediment is consists of: sandy clay, organic clay, grayish brown to blackish brown, many of reddish tuffan can be found in southern area. Type of contact with base-rocks is erotional

- Coast flat sediment (Qbr)

This sediment is consists of fine-to-rough-sized sand and clay with the existence of mollusca.

- Coast sediment (Qac)

This sediment is consists of **Silt**, clay and sand with fragment of mollusca.

- Delta sediment (Qad)

This sediment is consists of: silt and blackish gray clay with trace of mollusca and other micro-fossils.

- River sediment (Qa)

This sediment is consists of: sand, silt and brown clays.





**FIGURE 3.6.**

**REGIONAL GEOLOGICAL MAP OF STUDY AREA AND ITS SURROUNDING, (HAL OF INDRAMAYU REGIONAL GEOLOGICAL MAP SHEET 1309-04, BY D. SUDANA AND A. ACHDAN AND HALF OF PAMANUKAN SHEET, SHEET NO. 1209-06, BY H.Z. ABIDIN AND SUTRISNO), SCALE 1 : 100.000, PUBLISHED BY CENTER OF GEOLOGY STUDY, BANDUNG)**



**FIGURE 3.7.**

**CLAY, GRAYISH BROWN, MASSIVE, IMPERMEABLE, DOMINATING STUDY AREA**

#### **3.1.4.3. Hidrology**

## A. River Basin (Drainage)

According to its topography, the prospective project site area of PLTU Indramayu 2 x 1.000 MW is a plain or flat area with soil slope of 0 – 2 %. This condition is affecting the drainage system, water inundation will occur during high intensity of rainfall.

According to analysis of flow pattern based on change patterns (A.D. Howard, 1967), observation area can be classified in dendritic pattern. According to water availability in the river, river in observation area is classified as normal/parenial river and periodic/intermittent river. Theoretically, surface water volume of natural river current is affected by river basin. Main surface water current in the prospective project site area of PLTU Indramayu 2 x 1.000 MW is a downstream part of Pamoyanan river basin and Bugel river basin (Figure 3.8.).

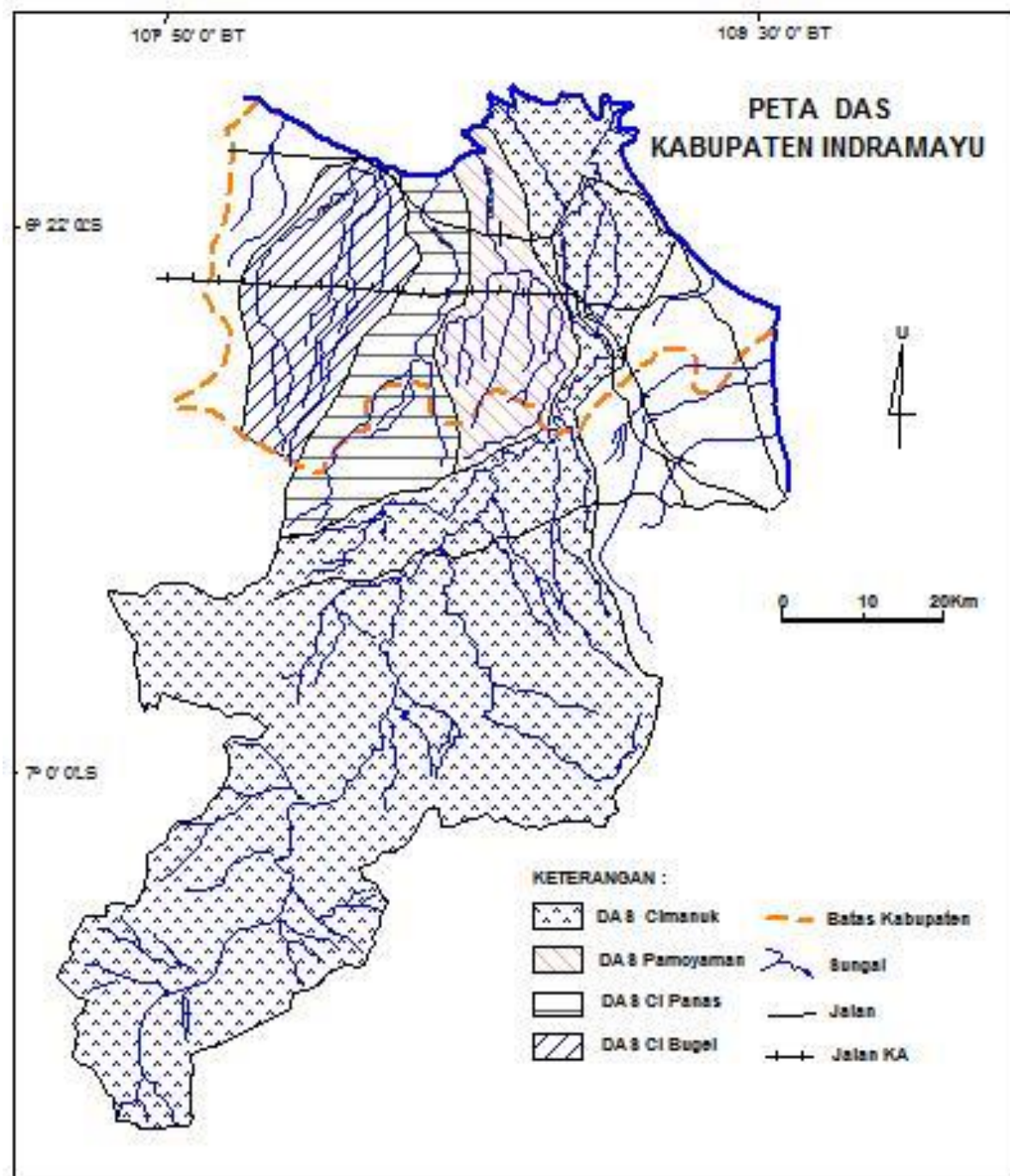
Source of surface water in prospective project site area of PLTU Indramayu 2 x 1.000 MW is originated from primary water source, namely, rainfall from upstream area caught by smaller river basins and flow the water in the smaller rivers.

Almost every river currents around the prospective project site area of PLTU Indramayu 2 x 1.000 MW have been affected by human activity, particularly in relation to irrigation system. Main/the biggest river's current which is passing through this area including Mangsetan River in Northern side, Plawad river in center and Cibugel river in eastern side. Those three rivers are flowing from South to North and emptied into Java Sea.

Surface water **suplesion** that supply surface water into the surrounding area of prospective project site area of PLTU Indramayu 2 x 1.000 MW is also originated from Citarum river which location is quite far, through the Eastern Tarum Canal into the current of Cipunegara river in Subang Regency and then through Salam Darma Dam and Bugis irrigation system to be continued to the western part of Indramayu regency and also through a specialized canal to be sent for agricultural needs and Gas and Oil Industry in Indramayu regency.

Area distribution that is available to surface current, which is originated from rivers in Indramayu regency or river current from other area in general is presented on Irrigation Map (Figure 3.9.).

Prospective area of PLTU Indramayu 2 x 1.000 MW project with the size of 327 Ha is located within the downstream area of Rentang irrigation. Irrigation asset located in the prospective area, inter alia, is tertiary canal and **bangunan bagi**. Such asset is consists of a share building and tertiary canal with the length of  $\pm 1$  km.



**FIGURE 3.8.**  
**RIVER BASIN DISTRIBUTION AND SIZE IN INDRAMAYU REGENCY**

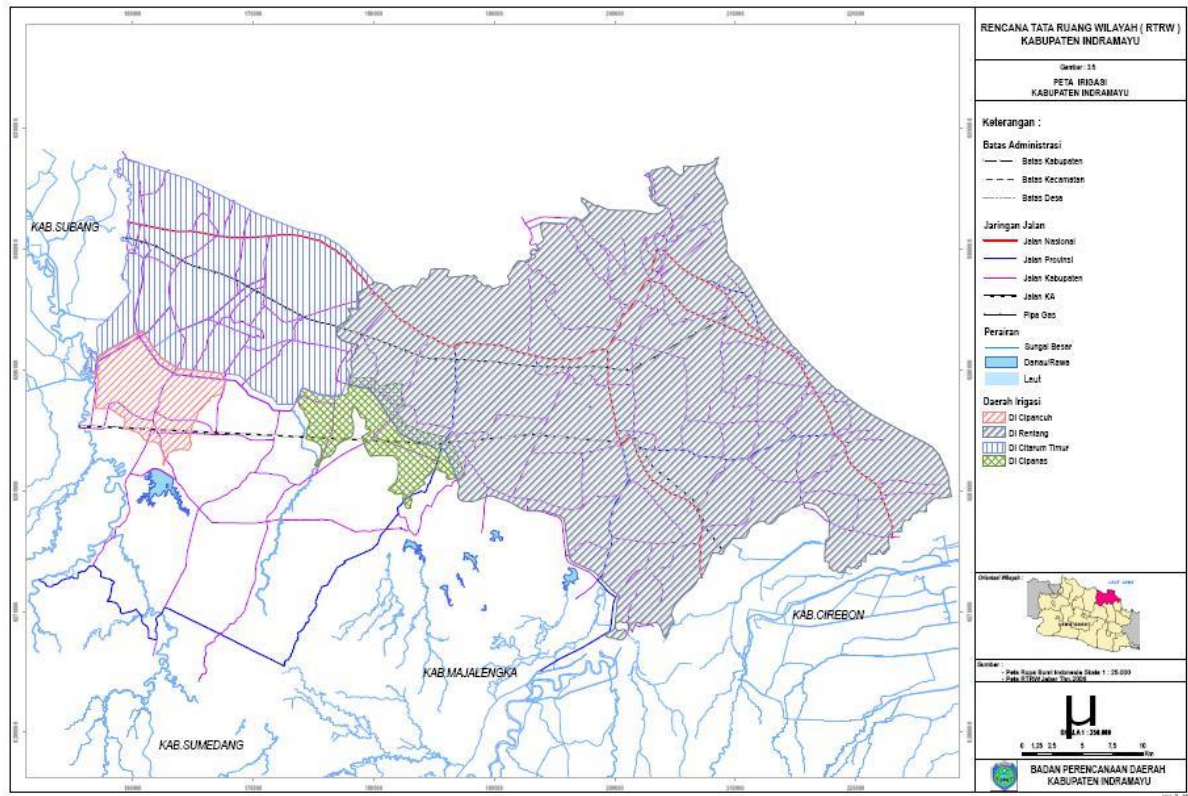


FIGURE 3.9.

### IRRIGATION MAP IN INDRAMAYU REGENCY

#### B. SURFACE CURRENT DEBIT

Surface water in Indramayu regency area is merely a river. The river has the function as rain water collector to be sent to river basin. By comparing average rain fall with river water volume, it can estimated that most of rain fall is absorbed by soil and the rest is flowing as surface water.

Quick survey and monitoring were conducted to identify available current debit around the prospective project site area of PLTU Indramayu 2 x 1.000 MW which is perceived as representative of water stream condition, it was conducted in July 2010. From the conducted survey, it can be concluded that the river Mangsetan in western side, Plawad river in center, and Bugel river in eastern side are still capable of delivering water current. Those three rivers are flowing from South side and emptied into Java Sea.

Result of water current measurement on the 3 points around the prospective project site area of PLTU Indramayu 2 x 1.000 MW shows that stream measurement on location 1 (06° 18' 03" S and 107° 57' 87" E) of Mangsetan river has the width of 7,5 m, 0,6 meter of water depth, water speed of 0,507 m/sec, and current debit of 2,281 m<sup>3</sup>/sec. On the location 2 (06° 17' 18" S and 107° 59' 14" E) Plawad river has 0,75 m width, 0,9 meter water depth, 0,504 m/sec water speed, and current debit of 0,34 m<sup>3</sup>/sec. While measurement result on the location 3 (06° 17' 09" LS and 107° 58' 54 BT) Bugel river has 8,4 m width, 2,0 meters water depth, 0,266 m/sec water speed, and 4,465 m<sup>3</sup>/sec debit.



Result of water sample measurement on those three rivers shows that Bugel river is the highest sediment carrier, 0,163 gram/litre or equal with 956 Tonnes/year, Mangsetan river carrying 0,158 gram of sediment/litre or equal with 474 Tonnes/year, and the fewest is Plawad river with 0,23 gram of sediment/litre or equal with 103 Tonnes/year. Measurement result of carried sediment is presented on Table 3.14.

The prospective project site area of PLTU Indramayu 2 x 1.000 MW is technical irrigation ricefields which water source is originated from irrigation system supplied by East Tarum Channel and Cipunegara River.

To complete the surface water current data in Western Indramayu regency, secondary data collection is obtained from Irrigation Office of Indramayu regency and Perusahaan Jasa Tirta II in Sukra Sub-District. The surface water current data is form of average debit for every 15 days of Salam Darma Dam is presented on Table 3.15.

**TABLE 3.14.**  
**CARRIED SEDIMENT AND RIVER DEBIT MEASUREMENT RESULT AROUND THE PROSPECTIVE PROJECT SITE AREA OF PLTU INDRAMAYU 2 X 1.000 MW**

NO	RIVERS NAME	COORDINATE LOCATION	RIVER CHARACTERISCTIC					
			WIDT H (m)	DEPTH (m)	CURRENT SPEED (m/sec)	DEBIT (m <sup>3</sup> /sec)	SEDIMENT (gram/litre)	SEDIMENT (Ton/year)
1	Mangsetan	06° 18' 03" LS 107° 57' 87" BT	7,50	0,6	0,507	2,281	0,158	474
2	Plawad	06° 17' 18" LS 107° 59' 14" BT	0,75	0,9	0,504	0,340	0,230	103
3	Bugel	06° 17' 09" LS 107° 58' 54" BT	8,40	2,0	0,266	4,465	0,163	956

Source : Consultant's Measurement Result, 2010.

**TABLE 3.15. HALF-MONTHLY AVERAGE DEBIT (1999 -2008) OF SALAM-DARMA DAM THAT FLOWS INTO BUGIS IRRIGATION CHANNEL**

MONTH	½ MONTHLY PERIOD	AVERAGE DEBIT (m <sup>3</sup> /sec)	MONTH	½ MONTHLY PERIOD	AVERAGE DEBIT (m <sup>3</sup> /sec)
Jan	1	245,507	Jul	1	199,64
	2	238,733		2	195,669
Feb	1	182,646	Aug	1	190,437
	2	218,029		2	205,029
Mar	1	196,635	Sep	1	167,793
	2	241,423		2	157,953

<b>Apr</b>	1	251,538	<b>Oct</b>	1	147,16
	2	216,657		2	149,238
<b>May</b>	1	249,773	<b>Nov</b>	1	185,592
	2	234,524		2	231,268
<b>Jun</b>	1	178,976	<b>Dec</b>	1	243,291
	2	183,695		2	236,221

Source : Secondary Data of 1999-2008

### C. Ground Water Resources

In general, the existence of ground water is affected by several factors such as rainfall, width of absorbant area, nature of surface materials, rocks layer, and morphological aspect of an area. Ground water can be categorized into 2 types, free ground water and suppressed ground water. To give a brief picture regarding the situation of ground water resources (Hydrogeology) in Indramayu Regency, Map in the Figure 3.11 is presented below.

#### 1. Free Ground Water :

Commonly known as shallow ground water because it can be easily obtained (by digging into 1 - 20 meters deep). In general, water can be reached in more shallow depth, less than 3 meters, on flat terrain and it took more than 3 meters in the hills area. Ground water surface can reach up from 4 to 10 meters and lays between the breakout of lava sediment and breccia.

#### 2. Suppressed Ground Water :

Lies in the layer between two water-proof rocks layers. In general, ground water quality in the prospective project site area of PLTU Indramayu 2 x 1.000 MW is intruded by sea water due to its location that is adjacent to coastal area. The most critical water quality can be found in Sukra and Patrol Sub-District. However, in general, ground water quality parameters (well water) in land area, after observed and analzed in laboratory, are still within the BML standard.

Ground water resources in the prospective project site area of PLTU Indramayu 2 x 1.000 MW can be described based on Ground Water Potential Map that is extracted from Hydrogeological Map of Cirebon Sheet issued by the Directorate of Geology and environmental management. Aquifer is vastly distributed with mid-level productivity can be found in most of Indramayu regency and generally distributed in coastal area. (Figure 3.12 and Figure 3.13).

#### 1. Acquifer System

Based on morphology, ground water acquifer system in the study area is included in beach deposit alluvium acquifer system. (Figure 3.12) .

#### 2. Ground Water Surface Depth

In general, the depth of shallow ground water in the study area is about 0,6 m to 2,85 m. The data regarding to depth is obtained according to on-field **wells** observation result.

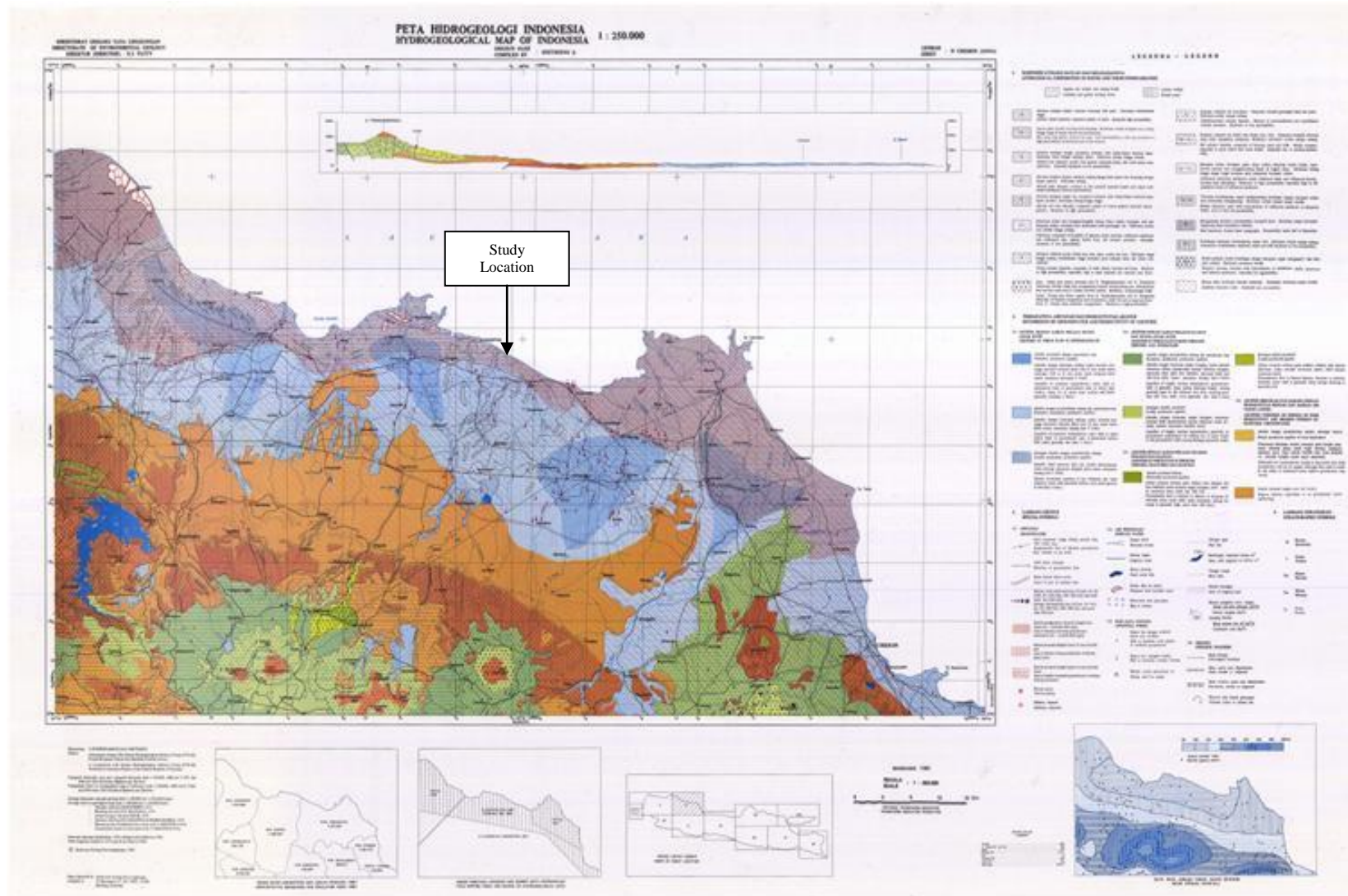


**Figure 3.10.**

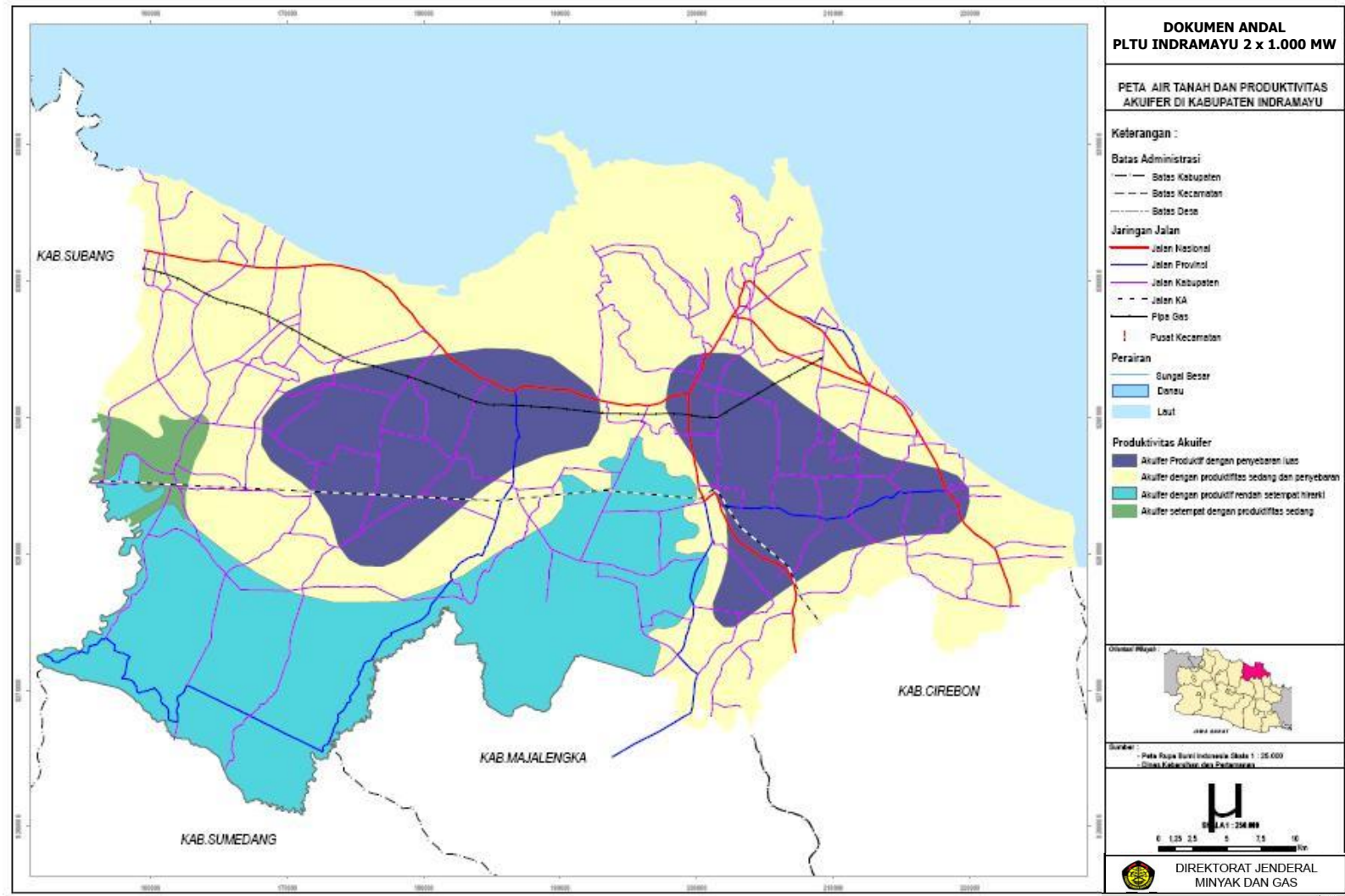
**WELL, GENERALLY NOT SUPPRESSED IN THE BEACH SEDIMENT ACQUIFIER SYSTEM**

**3. Ground Water Current**

In general, the study area has one aquifer layer, namely, unsuppressed aquifer. According to on-field ground water surface observation and measurement result, reconstruction of shallow ground water flow direction has become possible. Current direction of ground water surface in the study area is heading South – North West. This condition is showing the effect of ground water utilization by the resident because the change in shallow ground water flow is a typical of unsuppressed aquifer through inter-pore media.

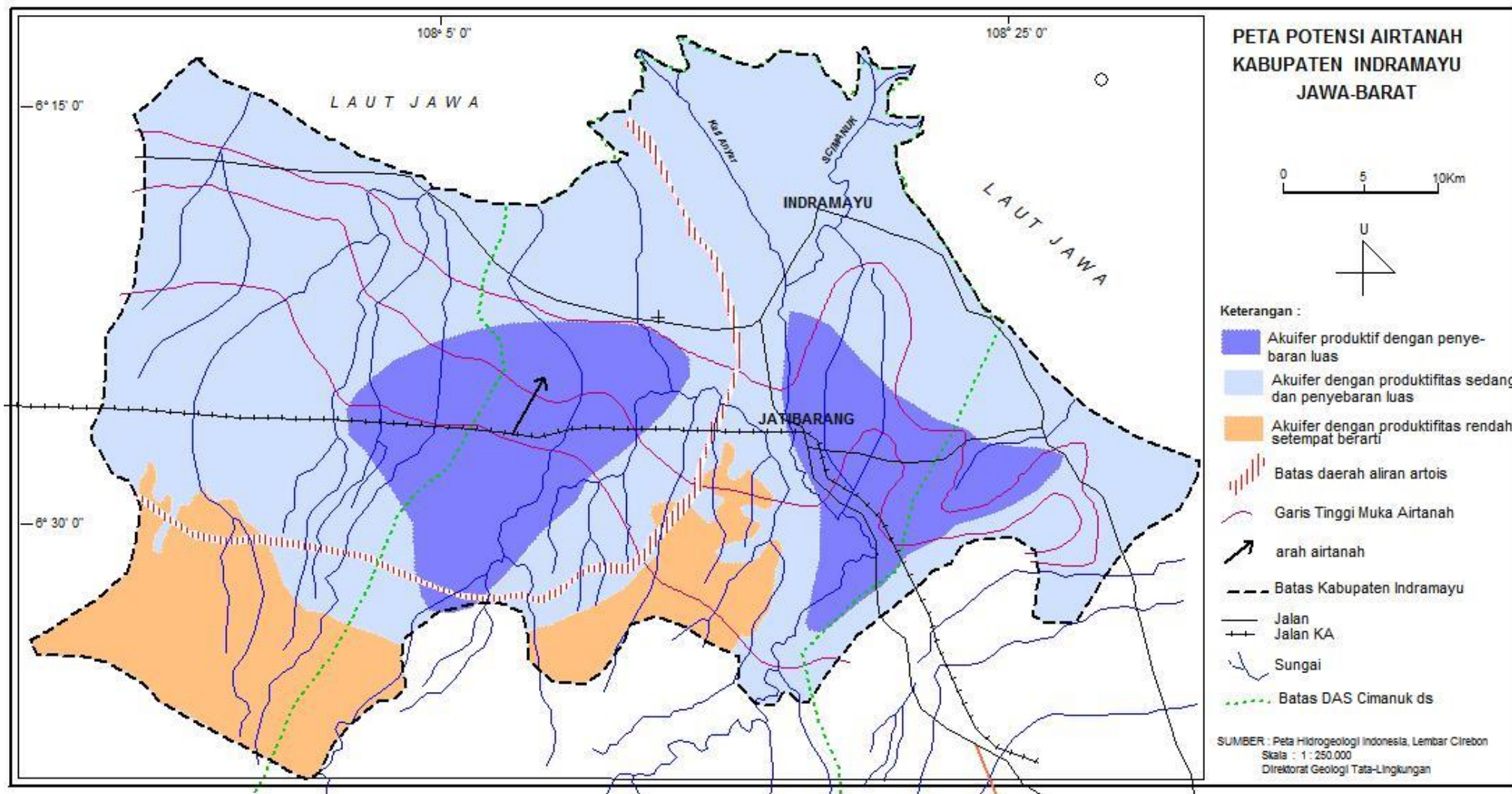


**Figure 3.11.**  
**REGIONAL HYDROGEOLOGICAL MAP OF STUDY AREA**



**FIGURE 3.12.**  
**GROUND WATER AND AKUIFER PRODUCTIVITY MAP IN INDRAMAYU REGENCY**





**FIGURE 3.13.**  
**GROUND WATER POTENTIAL MAP OF INDRAMAYU REGENCY**

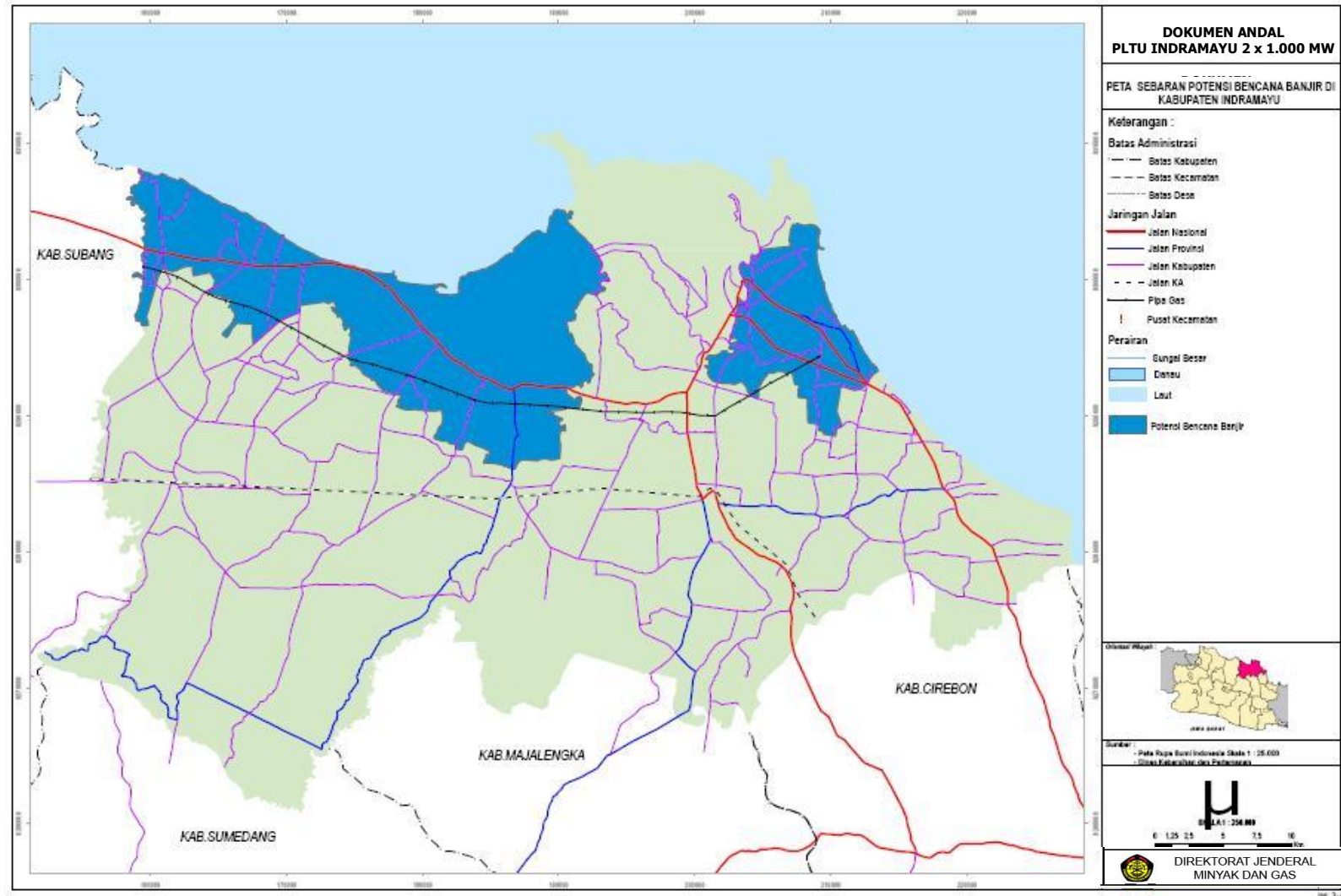


FIGURE 3.14.

FLOOD DISASTER POTENTIAL DISTRIBUTION MAP IN INDRAMAYU REGENCY

#### D. Flood Disaster Potential

Northern part of Indramayu Regency is included within West Java North Shore area, the location of many estuaries, which is perceived as flood potential area. Distribution of area that are potential to flood inundation presented on Figure 3-14.

#### E. Beach Abrasion

Beach abrasion is caused by natural impact and industrial development activities that involved sea water utilization (jetty) and domestic activities (ponds) that caused mangrove destruction. Mangrove area is ecologically known as suitable area for spawning and expansion process of many kind of fish, shrimp, mollusk and many other species and also habitat of many kind of birds, reptiles, mammals, and other animals. Existence of mangrove has the advantage in preventing erosion and also act as filter to reduce sea water pollution. Therefore, mangrove planting is one of the most suitable effort to reduce beach abrasion.

Beach abrasion in Indramayu regency can be seen in Limbangan Village where most of its residential area has been eroded by sea water and Tirtamaya beach, one of tourism object, is now scoured by sea wave. Abrasion has caused trouble for Indramayu residents' daily activity. In 2004, Regional Government of Indramayu Regency recorded that beach abrasion has reached **6.145,50 Hectares**. This abrasion have been occurred in 8 (eight) sub-districts area, with the most severed beach area located in Sub-Districts of Patrol, Sukra, Kandanghaur, Karangampel, Juntinyuat and Krangkeng. The distribution of abrasion event is presented on Map 14.a below. (Regional Development Planning Agency, Spatial Layout Plan, Indramayu Regency). According to the data, the abrasion has been occurring long before the emergence of West Java 3x330 MW Steam Power Plant.

Abrasion is causing land erosion along the beach line and transform them into sea area. Data of abrasion along the beach of Indramayu is presented on table 3.15a as described in the Spatial Layout Plan Report of Indramayu Regency below:



**Table 3.15**  
**Beach Abrasion According to Sub-District in Indramayu Regency of 2004**

No	Location/Sub-District	Coastal Line (Km)	Abrasion Width (Ha)
1	Krangkeng	5,9	293,13
2	Karangngampel	1,1	58,95
3	Juntinyuat	11,5	406,33
4	Balongan	-	201,81
5	Indramayu	5,4	3.900,60
6	Sindang	-	-
7	Cantigi	5,9	-
8	Losarang	16,0	419,34
9	Kandanghaur	12,6	342,87
10	Pasekan	30,6	-
11	Sukra	5,4	-
12	Patrol	7,8	522,47
<b>Total</b>		<b>144,1</b>	<b>6.145,50</b>

*Source: Mining and Environmental Office of Indramayu Regency 2004*

Due to abrasion phenomenon along the north coast line of Indramayu regency, Regional Government has planned prevention effort to undermine the impact of such beach abrasion under the Spatial Layout Plan of Indramayu Regency, such as:

- \* Abrasion prevention through vegetative ways.
- \* Abrasion prevention through the construction of beach protector.
- \* Development of beach protection function and mangrove rehabilitation.
- \* Reclaimed land status organizing by the Regional Government of Indramayu Regency.
- \* Development of smallholder plantation as buffer zone.

**MAP 3.14.a. DISTRIBUTION OF ABRASION**

#### 3.1.4.4. Disaster

West Java, especially Subang-Indramayu area, is prone to land movement that causing land slide, flood, and beach abrasion including earthquake. In general, occurred earthquake is connected with sub-induction area of Southern Java and vast fissure in Sunda strait which is included as the expansion of Sumatran sesar. Therefore, activity around the project site is relatively low.

Earthquake is mainly caused by tectonic activity (tectonic earthquake), almost 90% of the entire earthquake caused by this activity while the earthquake caused by volcanic eruption (volcanic earthquake) is only 7%.

Geologically, Indonesia is sit on 3 layers of earth crust plates. On **subdaction** zone (encounter between two earth plates) earthquake can be occurred near the melted rocks which is later becomes magma and shape a volcano while the horizontal vault (*transcurrent*) only causing earthquake.

On **subdaction zone**, earthquake occurred in various depth, from the shallow (0 - 90 km), middle (90 - 150 km) and deep (more than 150 km) because the subdaction zone is shaping a sharp ramp. This inclination is affected by many factors such as sliding speed, nature of rocks, direction of collision, etc. Generally, inclination is around 45° to 55°. Since the weight of marine crust is heavier than continental crust, the inclination is always heading to the bottom of continental crust. Therefore, the more it head towards continental crust, earthquake location will be deeper, but, when the direction is towards the earth crust collision site, the earthquake will be more shallow.

Other than subdaksi zone, earthquake can also occurred in vault and known as shallow earthquake because the vault is occurred in earth crust within 15 - 50 km deep such as Sumatran Sesar, Jaya Wijaya Mountain, Sorong Vault, Maluku Utara Vault, Sulawesi Tenggara Vault, Palu Koro Vault and Gorontalo Vault.

To picture the impact of earthquake in qualitative way, Modified Mercalli Scale is used and consists of 12 level, from the light earthquake (not sensible) to the earthquake that is causing severe impact.

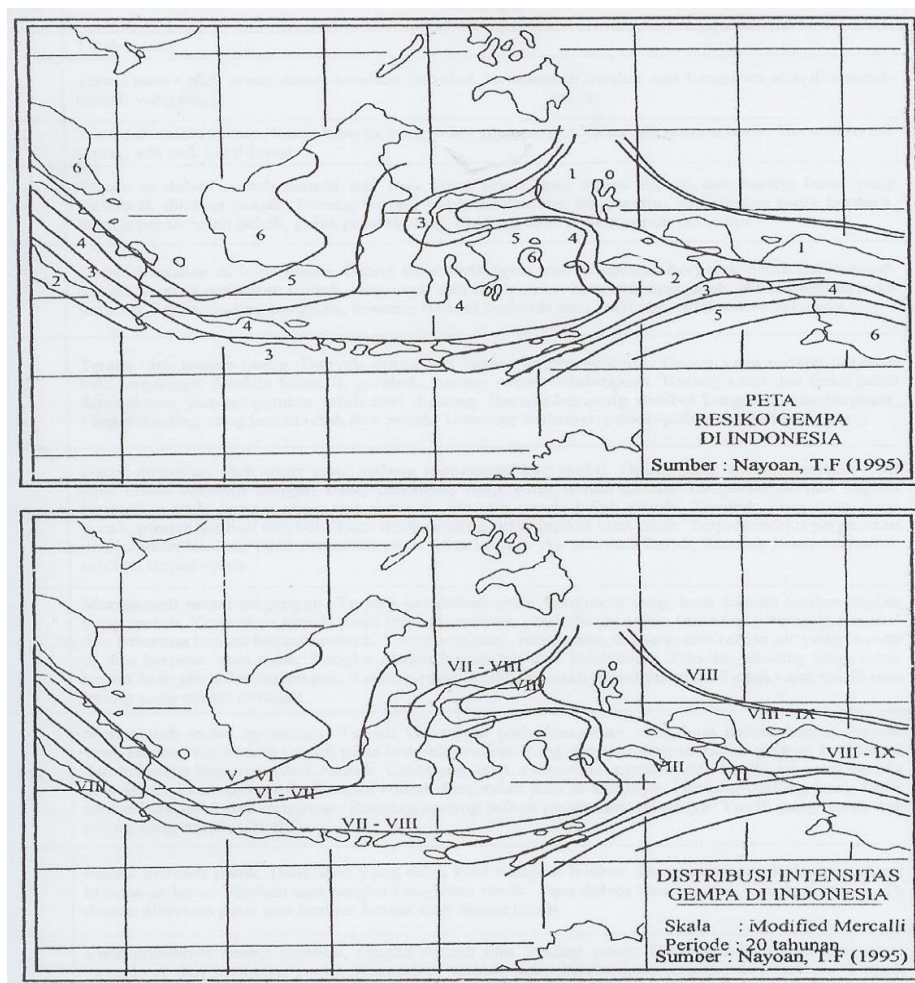
According to the probability of occurred earthquake with certain intensity or known as earthquake risk, Indonesia is divided into 6 (six) earthquake zones (Figure below), where the description is stated in detail under the intensity of Modified Mercalli scale (Table 3.16.) and predicted to occur once every 20 years in average.

**TABLE 3.16.**  
**MODIFIED MERCALLI SCALE**

Scale	Description
I	<b>Not detected</b>
II	Felt by few persons at rest, especially on upper floor.
III	<ul style="list-style-type: none"> <li>- Felt noticeably indoors but not always recognized as earthquake.</li> <li>- Vibration like passing truck.</li> </ul>
IV	<ul style="list-style-type: none"> <li>- Felt indoors by many, like big truck passing or heavy object hitting house wall.</li> <li>- Delicately suspended objects may swing, windows and doors creaking, fragile objects breaking, glass clinging, wall and house frame disturbed .</li> </ul>
V	<ul style="list-style-type: none"> <li>- Felt outdoors.</li> <li>- Persons awoken from sleep, liquid moving and spills a little.</li> <li>- Unstable and small house decoration moving or falling.</li> <li>- Doors open and shut, wall frame move, pendulum clocks may stop or out of order.</li> </ul>
VI	<ul style="list-style-type: none"> <li>- Felt by all.</li> <li>- Many people run and frightened.</li> <li>- Walking person disturbed.</li> <li>- Windows creaking as well as pots and fragile objects.</li> <li>- Small objects and books falling, pictures falls off the wall.</li> <li>- Furniture move and spin.</li> <li>- Wall plester breaking and falling.</li> <li>- Bell tolling, tress shaking</li> </ul>
VII	<ul style="list-style-type: none"> <li>- Can be felt by person driving vehicles</li> <li>- Walking person troubled, chimney breaking.</li> <li>- Ceiling and counstruction of high building breaking.</li> <li>- Fragile objects breaking.</li> <li>- Wall falling, as well as wall plester and wall rocks.</li> <li>- Slight movement and curving on sand deposit and rocks.</li> <li>- Water become muddy, big bell tolling, water irrigation damaged.</li> </ul>
VIII	<ul style="list-style-type: none"> <li>- Driving vehicle becomes troubled,</li> <li>- Strong building damaged due to falling materials.</li> <li>- Damages occurred on the shock-proof walls with some of them falling.</li> <li>- Chimney, monument, tower, and water tank above are spins or falling. House frame moved from it location.</li> <li>- Poorly-built wall falling or thrown.</li> <li>- Tree barks breaking.</li> <li>- Wet soil and steep slope are opened.</li> </ul>
IX	<ul style="list-style-type: none"> <li>- Public panicking.</li> <li>- Poorly-built building collapsed.</li> <li>- Well-built building severely damaged.</li> <li>- Building base and frame are damaged.</li> <li>- Underground pipe broken.</li> <li>- Soil is swelling.</li> <li>- In alluvium area, san and mud are emerging from underground.</li> </ul>
X	<ul style="list-style-type: none"> <li>- Generally every wall, house frame and base are broken.</li> <li>- Wooden building and bridge are broken.</li> <li>- Damaged dams, dikes and ponds</li> <li>- Great land slide occurred.</li> <li>- Water in pool, river and lake is spilling.</li> <li>- Horizontal movement occurred on coast area and other flat terrain.</li> </ul>

Scale	Description
	- Railways bent.
XI	- Underground pipe broken completely. - Railways totally damaged.
X	- Disaster occurred, entire building is collapsed. - Horizon line is disturbed. - Big objects and rocks are moving, some of them thrown.

According to the Indonesian Seismotectonic Map arranged by E.K. Kertapati, A. Soehaimi, A. Djuhana and I. Effendi in 1995 (Puslitbang Geologi – Bandung), observation area is classified as scale 5 (Richter scale) of earthquake risk zone and number VI – VII intensity of modified Mercalli Scale (20 years repetition period).

**FIGURE 3.15.****INDONESIAN EARTHQUAKE INTENSITY DISTRIBUTION AND RISK MAP****3.1.5. Hydrooceanography****3.1.5.1. Batimetri**

West Indramayu beach is classified as shallow water with sandy soil. Maximum depth in open sea is 32,5 km. sea depth on several kilometers from project site is less than ten meters. Morphology of Indramayu beach is categorized as prograding shore line and retrograding shore line. Event of changing coastal line is only temporary. Coastal line is changing from time to time naturally due to wave, wind, tidal period, and current.

Depth contour is almost in line with coastal line and relatively flat when getting close to off shore area.

- Coastal line (0 m) ~ to the distance of 1 km (−6.5 m) inclination: approx. 1/165
- Distance of 1 km (−6.5 m) ~ to 2 km (−9.0 m) inclination: approx. 1/400

- Distance of 2 km (−9.0 m) ~to 3 km (−10.5 m) inclination: approx. 1/700

Batimetri map of Indramayu beach is illustrated below:

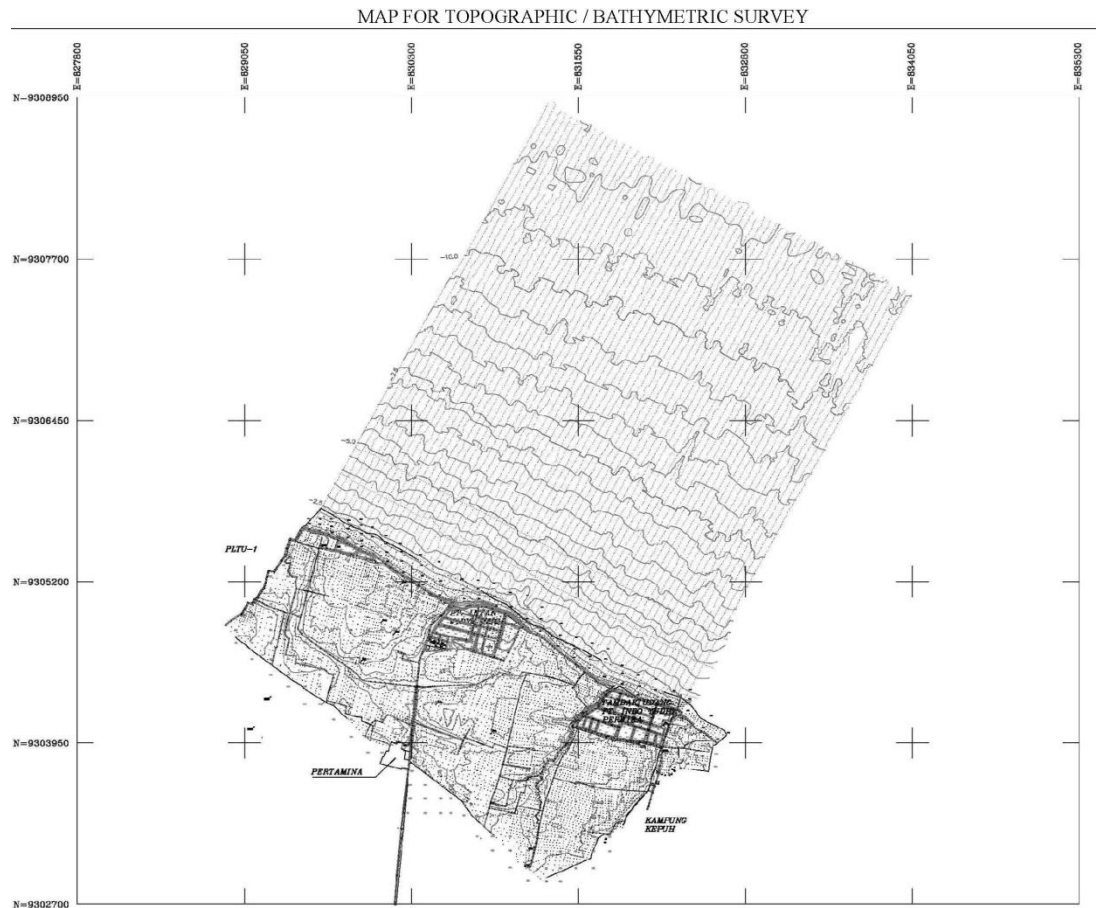


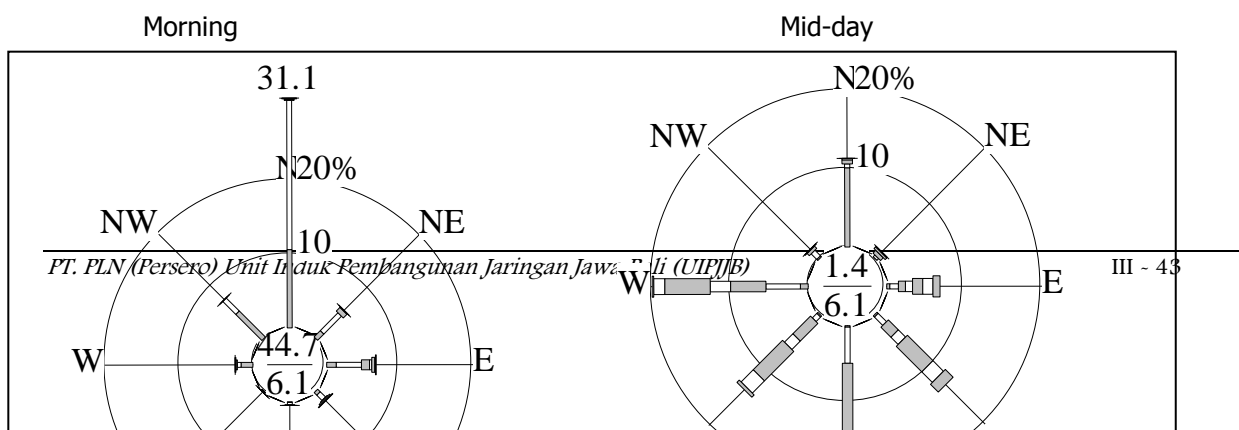
FIGURE 3.16.

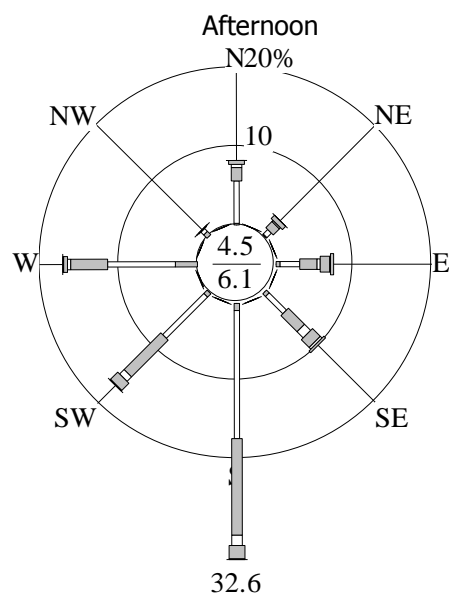
### BATIMETRI MAP OF INDRAMAYU BEACH

#### 3.1.5.2. Oceanography Parameter

##### A. Wave characteritic of Indramayu water

Wave height and period is obtained from wave hindcasting process. Data of wind used is based on the data obtained from Sukamandi Rice Research Center on 2006-2009 period as presented on Table 3.2 and Table 3.3. to ease the visualisation, processed wind data is presented in form of wave rose as presented on Figure 3.17. below:





**FIGURE 3.17.**

**WIND SPEED AND DIRECTION DISTRIBUTION (2006-2010 PERIOD)**

Wave prediction is using SMB (Sverdrup, Munk and Bretschneider) method which procedure is mentioned on Shore Protection Manual (1984). For this purpose, fetch lines were drawn in 50 sectors of destination area. There are 9 main wind directions in fetch calculation. Fetch is wave-making area. Fetch line is illustrating the direction of wave-making based on wind direction.





**FIGURE 3.18.**  
**WAVE HIND CASTING AREA**

Fetch distance for every wind direction is calculated with effective fetch concept using the formula below:

$$F_{eff} = \frac{\sum_{i=1}^n F_i \cdot \cos^2 \theta_i}{\sum_{i=1}^n \cos \theta_i} \dots\dots\dots (4.5.1.1)$$

Where :

- $F_i$  = length of fetch line
- $\theta_i$  = angle between fetch line and direction of the main fetch
- $n$  = amount of fetch direction = 9

In the SPM book (1984), wave hindcasting method is stated in three main equations while the fetch line in prospective project area and it surroundings presented on Figure 3.19.

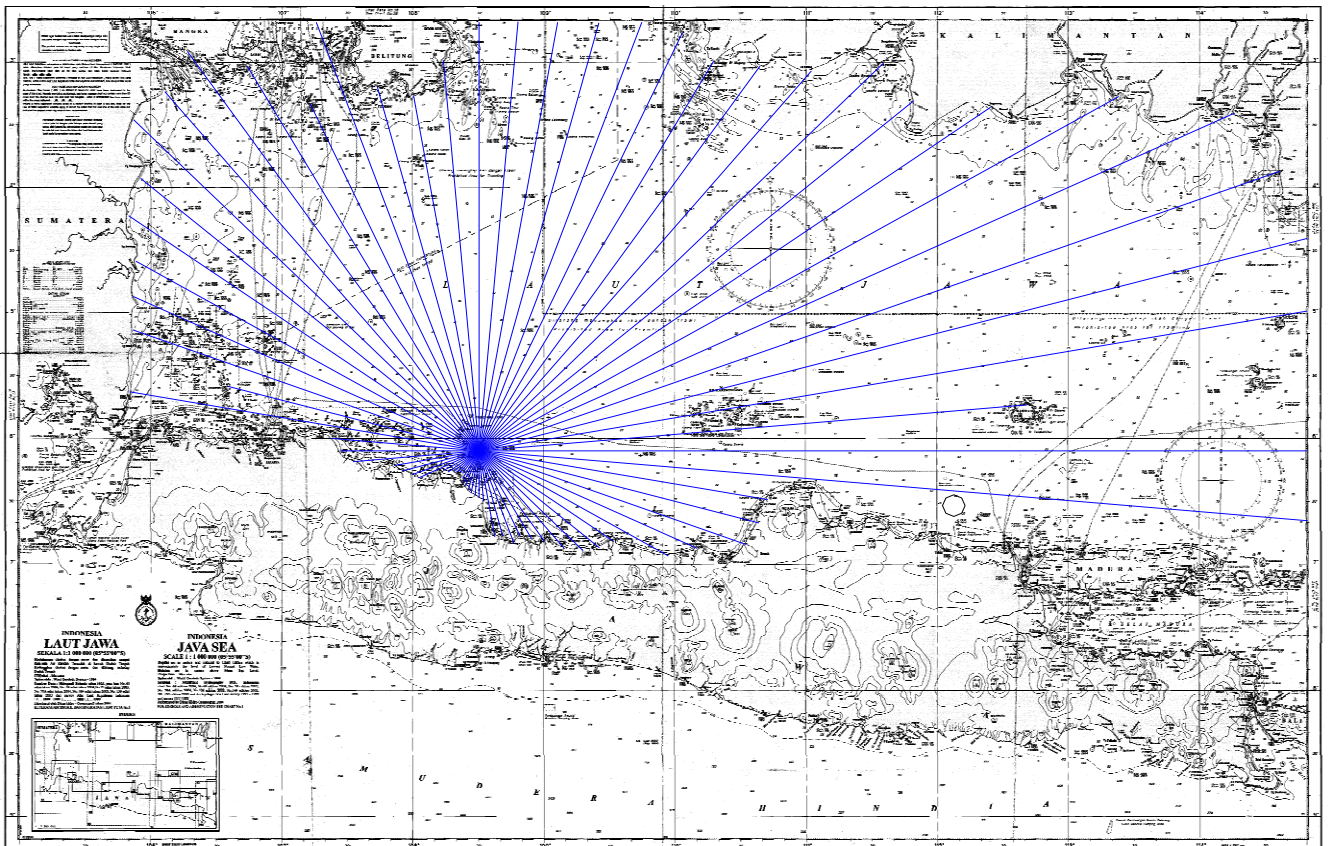
$$\frac{gH_{mo}}{U_A^2} = 0.0016 \left( \frac{gF}{U_A^2} \right)^{\frac{1}{2}} \dots\dots\dots (4.5.1.2)$$

$$\frac{gT_p}{U_A^2} = 0.2857 \left( \frac{gF}{U_A^2} \right)^{\frac{1}{3}} \dots\dots\dots (4.5.1.3)$$

$$\frac{gt_d}{U_A} = 68.8 \left( \frac{gF}{U_A^2} \right)^{\frac{2}{3}} \dots\dots\dots (4.5.1.4)$$

where

- $F$  = fetch length  
 $t_d$  = wind duration  
 $U_A$  = wind stress factor  
 $H_{mo}$  = significant wave height (output)  
 $T_p$  = wave period (output)



**FIGURE 3.19.**

**FETCH LINE IN INDRAMAYU BEACH**

**TABLE 3.17.**  
**FETCH LENGTH IN INDRAMAYU BEACH**

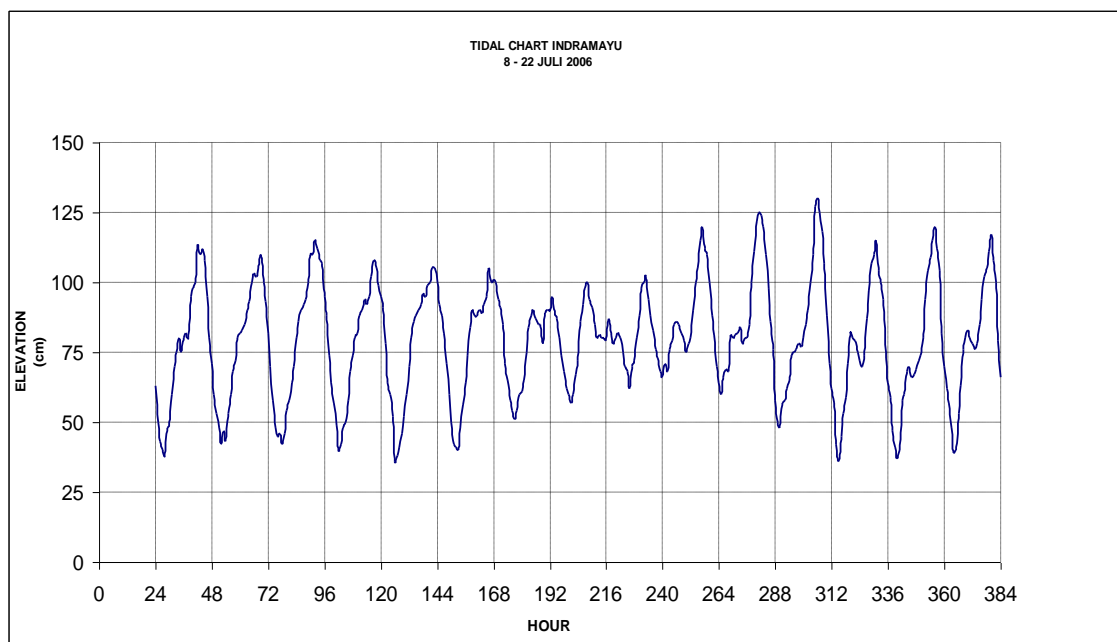
Direction	Fetch (m)	Fetch (km)
NORTH	527.984	527.984
NORTH EAST	494.789	494.789
EAST	368.621	368.621
SOUTH EAST	0	0
SOUTH	0	0
SOUTH WEST	0	0
WEST	52.060	52.060
NORTH WEST	128.749	128.749

## B. Ocean Hydrodynamics

### 1. Ocean Tidal Wave

Information regarding tidal wave is important to predict the elevation of water surface especially the highest and the lowest water surface. Tidal wave is also the main source power of sea water movement. Data measurement is obtained through observation for 15 days long and used for calculating the constituent value. Constituent is used to calculate important elevation of water surface on long term tidal wave fluctuation.

Based on the tidal wave measurement conducted in 2006, tidal wave graphic is obtained and presented on Figure 3.20 below:



**FIGURE 3.20.**  
**TIDAL WAVE MEASUREMENT RESULT OF INDRAMAYU BEACH**

From such measurement, which is using Least Square method, tidal period's constants is obtained and presented on Table 3.18 as follows:

**TABLE 3.18.**  
**CONSTITUENT VALUE OF TIDAL WAVE GENERATOR FORCE IN INDRAMAYU BEACH**

Constituent	M2	S2	N2	K2	K1	O1	P1	M4	MS4	SO
Amplitude (cm)	11	0.1	2.4	0	25	8.4	8.2	0.3	0	78.3
Phase (o)	78.1	-69.39.5	2.14.9	-69.39.5	2.95.2	24.5	2.95.2	0	61.43.8	0

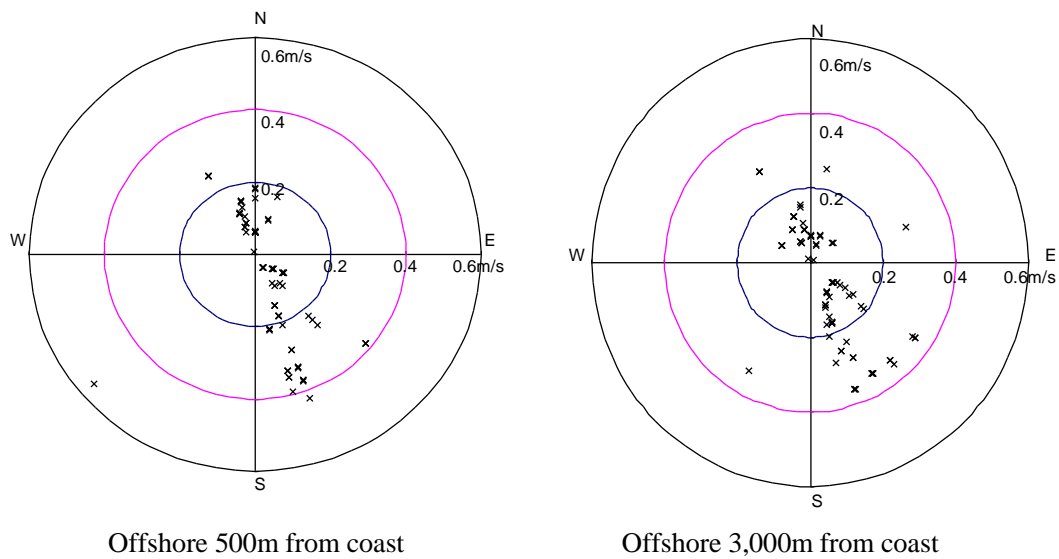
From the calculation of pasut constituent value, it can be stated that the type of tidal wave in Indramayu is categorized as diurnal tide or singular tidal wave which is marked by one tidal period in a day. The calculation also generates important water surface level, namely, Highest water spring (HWS), which is 1,354 metres and mean sea level (MSL) of 0,742 metre as presented in the following table:

**TABLE 3.19.**  
**IMPORTANT TIDAL REFERENCE IN INDRAMAYU BEACH**

No	Important Elevation		Elevation calculated from LLWL (cm)
1	HWS	Highest Water Spring	135,4
2	MSL	Mean Sea Level	74,2
3	LWS	Lowest Water Spring	0

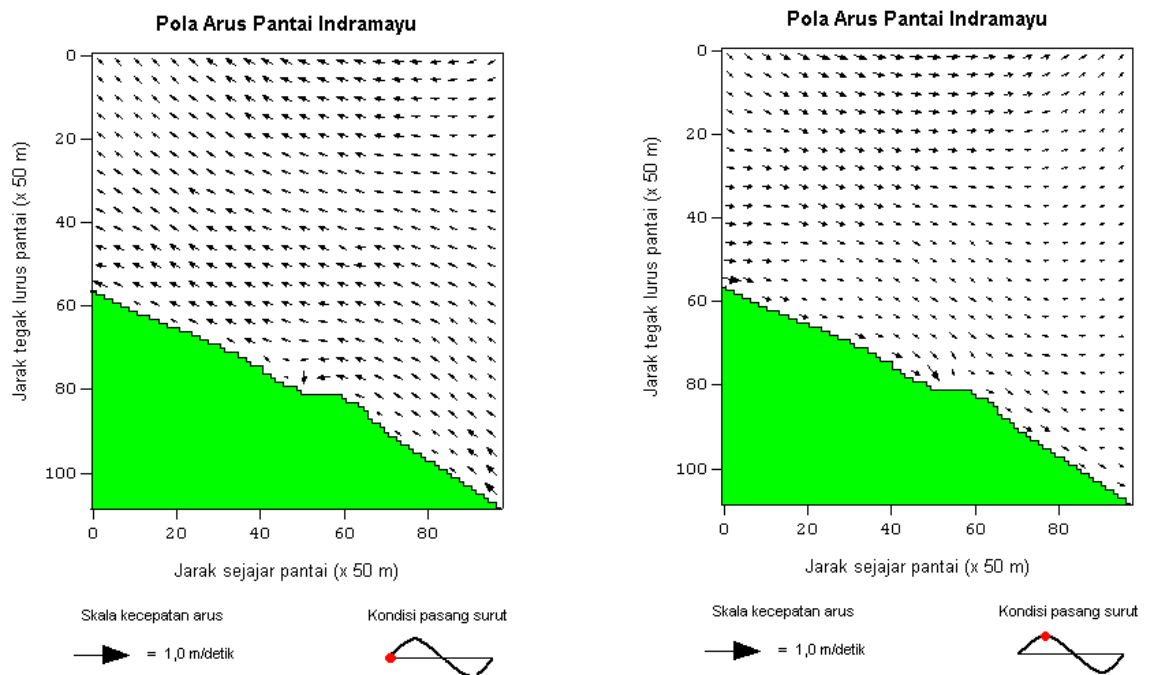
## 2. Ocean Current Pattern

Ocean current pattern will influence cruise and waste transport in the sea. A preliminary survey has been conducted to measure ocean current. The result is presented in Figure 3.21 and 3.22. below in which measurement from the distance of 500 and 3000 metres from the coast line resulted in south east as the dominant wind direction with maximum speed of 0,5 m/s. The wave is dominated by current resulted from high tide rather than tide. Current due to high tide can be 1,5 times bigger compared to current resulted from tide. Current speed are varies between 0,2 to 0,3 m/s. Current from the East to Southeast can reach 0,5 m/s.

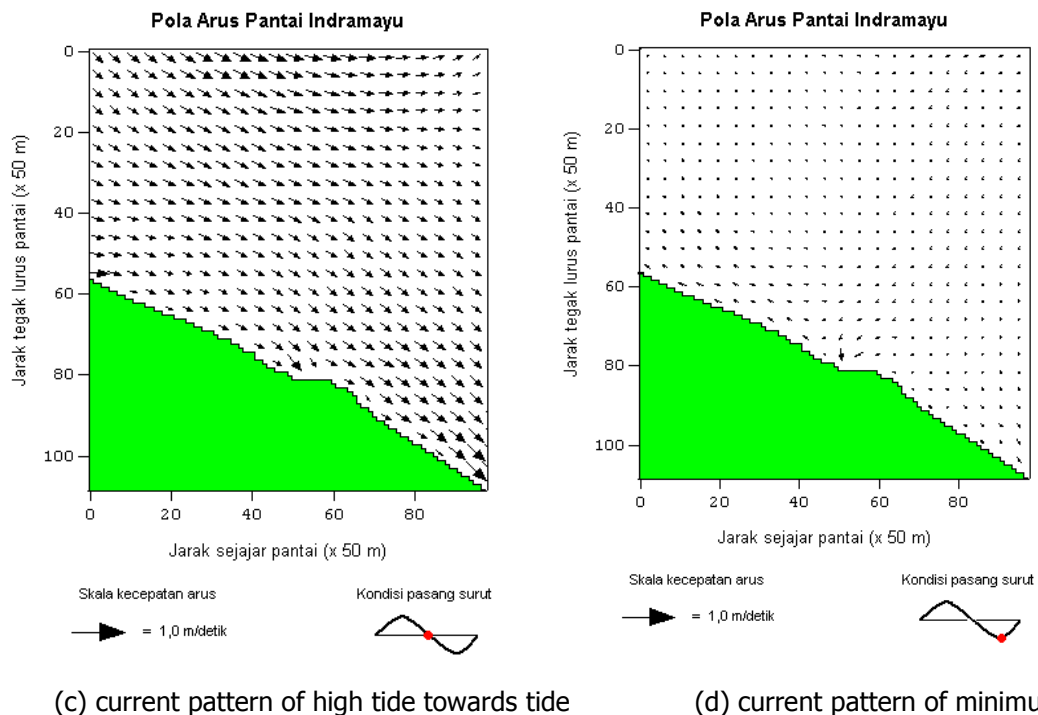


**FIGURE 3.21.**  
**CURRENT DISTRIBUTION, DIRECTION, AND SPEED**

To discover the current pattern due to pasang surut, we developed a model using ECOMSED (HydroQual, 2002) which is a three dimensional hydrodynamics and **carried sediment** model. Simulation was conducted for one cycle of pasang surut, which is maximum spring, spring towards surut, minimum surut, and surut towards spring. The result of the simulation is presented in the following Figure:



high tide



tide

**FIGURE 3.22.**

### **CURRENT PATTERN OF PASANG SURUT**

In general, the current pattern shows a movement in the direction of West-Northwest and East-Southeast, following the pasang surut condition. When it is spring, the current moves to the East and when it is surut, the current moves to the West-Northwest. Both in full moon and neap tide, the current pattern shows movement in the same direction. However, the current speed in Perbani is lower compared to that in full moon. The maximum current speed happens in the condition of pasang surut towards surut, which is 0.36 m/s. However, current speed near the coastline in that condition is very low, which is between 0.05-0.1 m/s. In the condition of pasang surut towards spring, current speed is quite high, which is 0.31 m/s. Current speed near the coastline is also quite high, reaching 0.25 m/s. In the condition of maximum spring and minimum surut, the speed of the current becomes lower, which is between 0.05-0.15 m/s.

### **3.1.6. Land Use and Transportation**

#### **3.1.6.1. Land Use**

The Regency of Indramayu has a total land size of 204,011 Ha. Land use in Indramayu is dominated by land without buildings, which comprises of rice field area consisting of technically irrigated rice field and rainfed rice field with the size of 133,374.85 Ha, equal to 65.38% of the total size of the Regency. Meanwhile, land with buildings (settlement area) has a total size of 23,918.55 Ha or 11.7% of the total size of the Regency.

The Sukra District, which is the future location of the 2 x 1.000 MW PLTU Steam-Power Plant is an area with the total size of 4,465.327 covering 2.18% of the total size of Indramayu Regency. Land use in Sukra District is dominated by agriculture consisting of irrigated rice field with the total size of 3,663.423 Ha (82.04%) of the total District size. The detailed land use in the District is presented in the following Table 3.20.

**TABLE 3.20.**  
**LAND USE IN SUKRA DISTRICT YEAR 2008**

No.	Land Use Type	Size (Ha)	%
1	Settlement	590.180	13.22
2	Mangrove Forest	118.822	2.66
3	Irrigated Rice Field	3,663.423	82.04
4	Fish Pond	42.798	0.96
5	River	37.519	0.84
6	National Road	11.120	0.25
7	Bushes	1.465	0.03
	Jumlah	4,465.327	100.00

Source: *Spatial Layout Plan of Indramayu Regency, 2008.*

#### **A. Spatial Use Plan**

Spatial use plan in Indramayu Regency can be classified into two categories, namely protected area and cultivation area. Protected area consists of:

- Area that provides protection for area below it, which is protected forest area
- Local protection area, which is coast and river bank
- Natural reserve and cultural reserve area, which is coast with mangrove forest

In cultivation area, the plan for land use pattern is as follow:

- Agriculture cultivation area consisting of production forest, wet land food crop, plantation, and land fishery/ponds.
- Non-agriculture cultivation area consisting of settlement, limited industry area, industry development zone, and land allocated for industry.

Land use pattern in an area is determined based on the capacity of the land in the particular area. Therefore, land use in one area in the spatial planning does not change drastically. Thus, land use plan in 1994 as an illustration is still deemed adequate. The complete plan for land use in Indramayu Regency year 1994/1995 is presented in Figure 3.23. and Table 3.21. below:

**TABLE 3.21.**  
**SPATIAL USE PLAN OF INDRAMAYU REGENCY**

No.	Type of Use	Width (Ha)	%
<b>A. Conservation Area</b>			
1	Coastal Line	1.167,5	0,58
2	River Bank	9.505,0	4,75
3	Dam/Lake/Pond Bank	110,0	0,05
4	Mangrove Forest	475,0	0,24
<b>Total</b>		<b>11.257,5</b>	<b>5,63</b>
<b>B. Cultivation Area</b>			
<b>1. Agricultural Cultivation</b>			
1	Production Forest	13.500,0	6,75
2	Wet Land Crop Plant	118.513,0	59,23
3	Plantation	2.850,0	1,42
4	Land/pond Fishery	6.100,0	3,05
<b>Total</b>		<b>140.963,0</b>	<b>70,45</b>
<b>2. Non Agricultural Cultivation</b>			
1	Settlement	43.223,5	21,60
2	Restricted Industrial Area	1.000,0	0,50
3	Industrial Development Zone	3.500,0	1,75
4	Industrial Land Designation	155,0	0,08
<b>Total</b>		<b>47.878,5</b>	<b>23,93</b>
<b>Total</b>		<b>200.099,0</b>	<b>100,00</b>

Source: *Spatial Layout Plan of Indramayu 1994/1995*

## B. Distribution of Development Area

Indramayu Regency, on its development policy, has divided development area into 6 (six) categories, namely:

- SWPP I Indramayu, including Sub-District of Indramayu, Lohbener, Sindang, Balongan, PWK Arahan, PWK Cantigi Wetan with the central area located in Indramayu City.
- SWPP II Karangampel, including Sub-District of Karangampel, Juntinyuat and Krangkeng with the central area located in Karangampel City.
- SWPP III Jatibarang, including Sub-District of Jatibarang, Bangodua, Sliyeg dan Kertasemaya with the central area located in Jatibarang City.
- SWPP IV Losarang, including Sub-District of Losarang, Ckedung dan Lelea with the central area located in Losarang City.
- SWPP V Kandanghaur, including Sub-District of Kandanghaur, Gabuswetan, Bongas dan Kroya with the central area located in Kandanghaur City.
- SWPP VI Haurgeulis, including Sub-District of Haurgeulis, Anjatan dan Sukra with the central area located in Haurgeulis City.

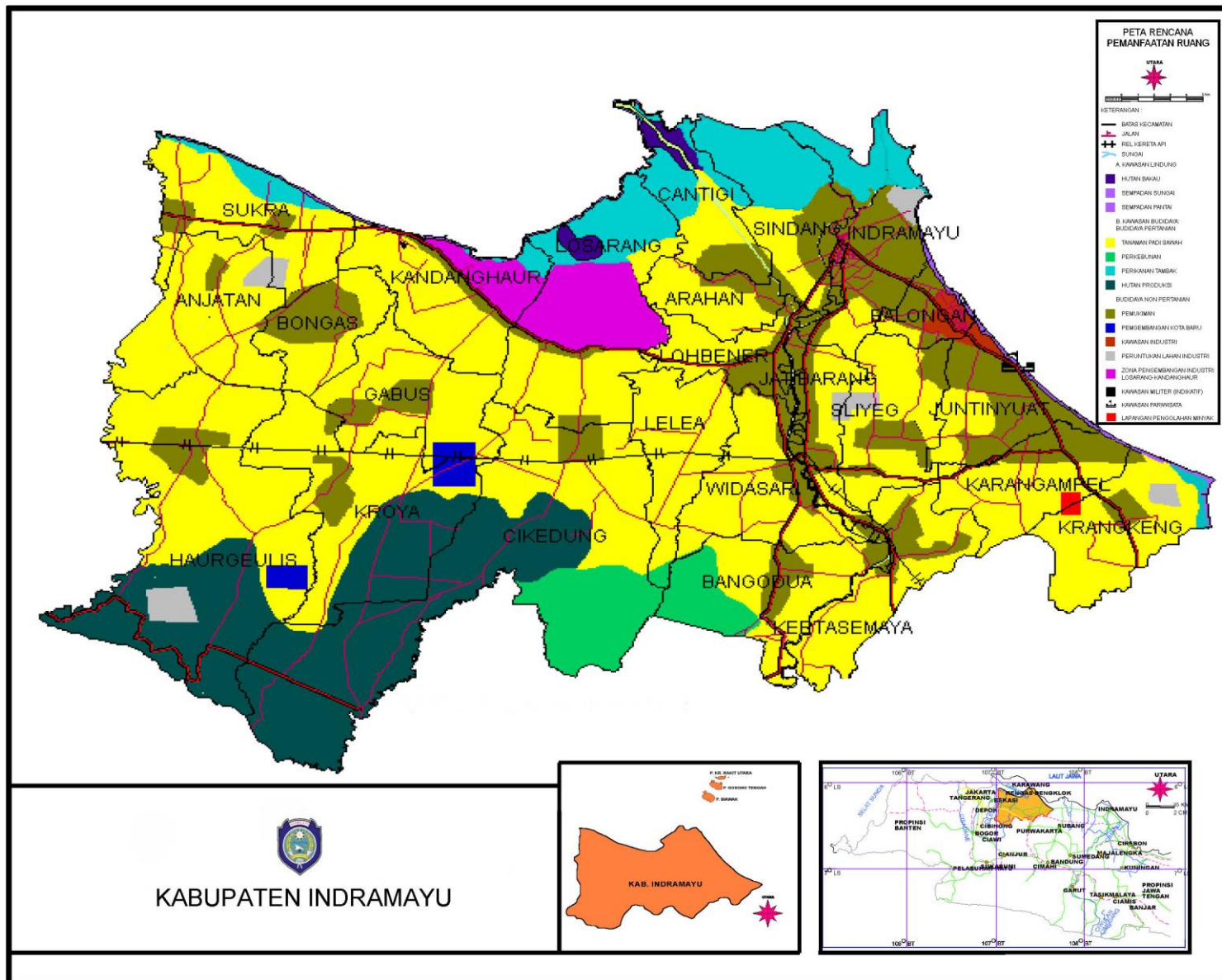


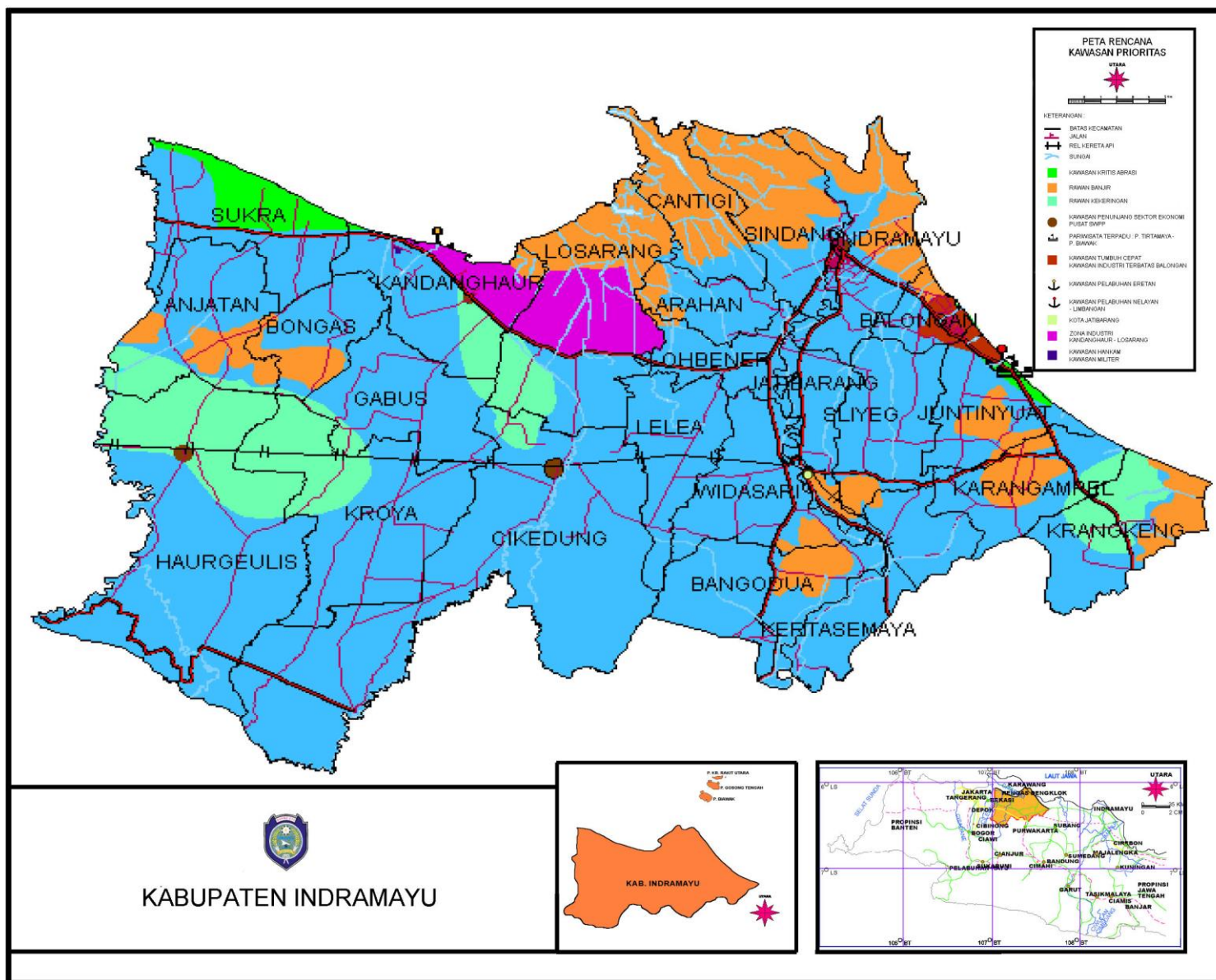
According to such distribution of development area, location of prospective development area of PLTU Indramayu 2 x 1.000 MW is included within development area of SWPP VI Haurgeulis with the central of development area located in Haurgeulis City.

### **C. Mainstay Area Planning**

Mainstay area planning for Indramayu Regency is using a term called priority/specialized area. This area is a strategic area and prioritized for national/regional interest based on the consideration of strategic criteria. Area that includes within priority area is presented in Figure Gambar 3.24. and following description:

- Area with the characteristic of under-developed area.
- Critical area such as damaged beach due to abrasion (wave erosion), agricultural/rice field area that is prone to flood and drought.
- Area that support economic activities such as:
  - City as development center.
  - Tourism site like Tirtamaya beach and Biawak Island
- Fast-growing area, namely:
  - Jatibarang City
  - Balongan Industrial Area
  - Eretan Port Area (Losarang- Kandanghaur Industrial Zone)
- Defense and Security area (military) in form of military settlement or training center that requires space for activities. According to defense and security plan (Military District Command), there are three (3) locations designated for defense and security area, namely, the center of Haurgeulis and Cikedung Sub-Districts and around the Eretan Port.





### 3.1.6.2. Transportation

To identify the impact of project development activity, vehicle volume monitoring is conducted along the road near the prospective project area. This vehicle monitoring is conducted on the entrance road to the project area and divided into 3 location of monitoring points as presented in Map 3. Monitoring is conducted for several days including week-end and business days, monitoring activity conducted for 13 hours every day, from 06.00 a.m to 06.00 p.m and expected to give illustration regarding condition of minimum vehicle volume and vehicle volume during busy time and also to identify the peak hours.

#### A. Vehicle Type

Type of vehicle that is using a route has the ability in affecting the performance of such route. According to the observation, type of vehicles that are using the route consists of bicycle, rickshaw, motorcycle, passengers car, private transport, truck, bus, and tank.

According to the vehicle monitoring, dominant vehicle type as road user around the project area is motorcyle (39 – 84 %), private transport (9 – 25 %), Truck (2 – 25 %) and public transport (1 – 5 %), more detailed explanation can be seen on Table 3.22 to Table 3.27.

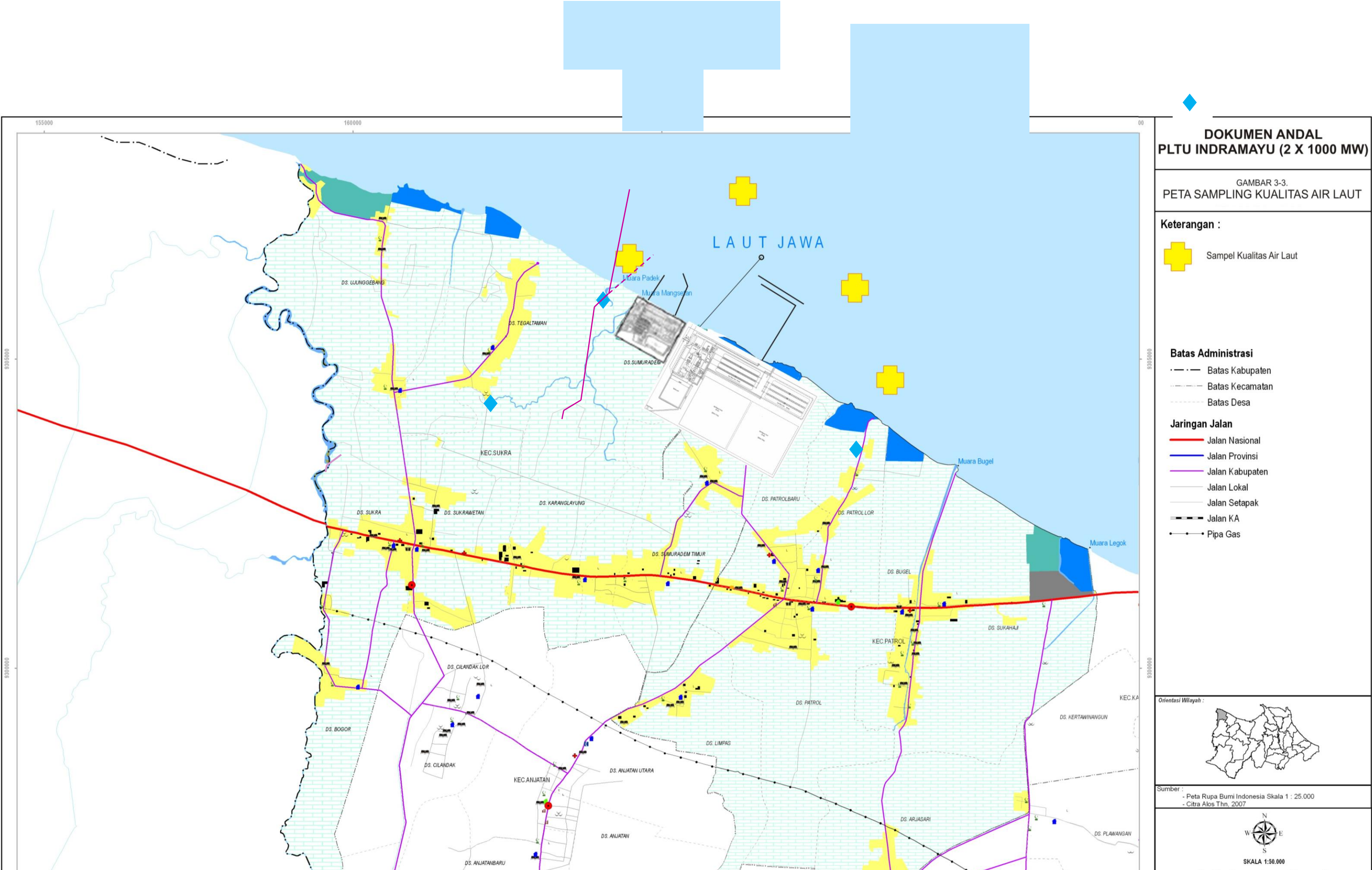
#### B. Vehicle Volume

Vehicle volume in an area, in general, is changing from time to time based on the activities of local residents in such particular area. Such situation is also illustrated by the observation area around the PLTU Indramayu 2 x 1.000 MW installation activity. Based on the traffic observation in the prospective area for PLTU Indramayu 2 x 1.000 MW development activity. According to the three traffic observation points, vehicle volume on such roads are quite busy. Ranked from the highest to the lowest vehicle volume is as follows: (1) Sumur adem Northern Coast Road, (2) Patrol Northern Coast Road, (3) PLTU Indramayu 2 x 1.000 MW Northern Coast Road. Detailed illustration regarding vehicle volume passing by such route per observation hour during business day is presented in Table 3.28.

According to traffic monitoring result on the main road around the prospective project area, it can be identified that morning and evening patterns are showing low vehicle volume while the vehicle volume in the afternoon is evenly distributed, in other words, not a single notable peak hour.

Furthermore, to identify the traffic situation on the main road around the prospective development area for Indramayu 2 x 1000 MW Steam Power Plant, according to traffic observation result, is quite under control. Such situation can be seen on the 0,77 Northern Coast Road which still in the good service level.





**TABLE 3.22.**  
**AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY**  
**IN JL. RAYA SUMUR ADEM NORTHERN COAST ROAD**

Vehicle Type	Total					
	Saturday	%	Sunday	%	Monday	%
Bicycle	79	0,68	122	0,52	124	0,54
Rickshaw	10	0,09	34	0,15	55	0,24
Minibus	146	1,26	582	2,50	644	2,79
Motorcycle	5136	44,26	10177	43,77	11696	50,61
Car	2942	25,35	6109	26,27	4983	21,56
Truck	2504	21,58	4579	19,69	4180	18,09
Bus	530	4,57	1396	6,00	1160	5,02
Tank	244	2,10	222	0,95	253	1,09
Others	14	0,12	32	0,14	14	0,06
<b>Total</b>	<b>11605</b>	<b>100,00</b>	<b>23253</b>	<b>100,00</b>	<b>23109</b>	<b>100,00</b>

Source: On Field Observation

**TABLE 3.23.**  
**AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY IN JL. RAYA PATROL**  
**NORTHERN COAST ROAD**

Vehicle Type	Total					
	Saturday	%	Sunday	%	Monday	%
Bicycle	41	0,42	219	0,87	159	0,65
Rickshaw	50	0,52	170	0,67	154	0,63
Minibus	344	3,56	539	2,14	1021	4,15
Motorcycle	3808	39,41	11840	47,00	11803	47,99
Car	2387	24,71	6360	25,25	5097	20,72
Truck	2434	25,19	4329	17,19	4771	19,40
Bus	431	4,46	1479	5,87	1276	5,19
Tank	163	1,69	235	0,93	282	1,15
Others	4	0,04	18	0,07	31	0,13
<b>Total</b>	<b>9662</b>	<b>100,00</b>	<b>25189</b>	<b>100,00</b>	<b>24594</b>	<b>100,00</b>

Source: On Field Observation

**TABLE 3.24.**  
**AMOUNT OF VEHICLE IN EVERY OBSERVATION DAY IN JL. PLTU SUMUR ADEM**

Vehicle Type	Total					
	Saturday	%	Sunday	%	Monday	%
Bicycle	15	1,43	107	4,29	69	2,12
Rickshaw	0	0,00	0	0,00	2	0,06
Minibus	5	0,48	29	1,16	20	0,62
Motorcycle	883	84,10	2066	82,81	2699	83,00
Car	125	11,90	242	9,70	352	10,82
Truck	15	1,43	34	1,36	75	2,31
Bus	7	0,67	16	0,64	13	0,40
Tank	0	0,00	1	0,04	20	0,62
Others	0	0,00	0	0,00	2	0,06
<b>Total</b>	<b>1050</b>	<b>100,00</b>	<b>2495</b>	<b>100,00</b>	<b>3252</b>	<b>100,00</b>

Source: On Field Observation

**TABLE 3.25.**

**AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW IN SUB-DISTRICT OF SUKRA (SATURDAY)**

No.	Vehicle Type	Observed Road			Total	
		JL. RAYA SUMUR ADEM NORTHERN COAST ROAD (1)	JL. RAYA PATROL NORTHERN COAST ROAD	JL. PLTU SUMUR ADEM	Total	%
1	Bicycle	79	41	15	135	0,6
2	Rickshaw	10	50	0	60	0,3
3	Minibus	146	344	5	495	2,2
4	Motorcycle	5136	3808	883	9827	44,0
5	Car	2942	2387	125	5454	24,4
6	Truck	2504	2434	15	4953	22,2
7	Bus	530	431	7	968	4,3
8	Tank	244	163	0	407	1,8
9	Others	14	4	0	18	0,1
Total		11605	9662	1050	22317	100,0
%		52,00	43,29	4,70	100,00	

Source: On Field Observation

\*Vehicle volume of the one full observation day (13 hours)

**TABLE 3.26.**

**AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW (SUNDAY)**

No.	Vehicle Type	Observed Road			Total	
		1	2	3	Total	%
1	Bicycle	122	219	107	448	0,9
2	Rickshaw	34	170	0	204	0,4
3	Minibus	582	539	29	1.150	2,3
4	Motorcycle	10.177	11.840	2.066	24.083	47,3
5	Car	6.109	6.360	242	12.711	25,0
6	Truck	4.579	4.329	34	8.942	17,6
7	Bus	1.396	1.479	16	2.891	5,7
8	Tank	222	235	1	458	0,9
9	Others	32	18	0	50	0,1
Total		23.253	25.189	2.495	50.937	100,0
%		45,65	49,45	4,90	100,00	

Source: On Field Observation

\*Vehicle volume of the one full observation day (13 hours)

**TABLE 3.27.**  
**AMOUNT OF VEHICLE PASSING BY THE OBSERVED ROAD NEAR THE**  
**PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW**  
**(MONDAY)**

No.	Vehicle Type	Observed Road			Total	
		1	2	3	Total	%
1	Bicycle	124	159	69	352	0,7
2	Rickshaw	55	154	2	211	0,4
3	Minibus	644	1.021	20	1.685	3,3
4	Motorcycle	11.696	11.803	2.699	26.198	51,4
5	Car	4.983	5.097	352	10.432	20,5
6	Truck	4.180	4.771	75	9.026	17,7
7	Bus	1.160	1.276	13	2.449	4,8
8	Tank	253	282	20	555	1,1
9	Others	14	31	0	45	0,1
Total		23.109	24.594	3.252	50.955	100,0
%		45,35	48,27	6,38	100,00	

Source: On Field Observation

\*Vehicle volume of the one full observation day (13 hours)

**TABLE 3.28.**  
**AMOUNT OF PASSENGER CAR UNIT PER HOUR ON THE ROAD NEAR THE**  
**PROSPECTIVE DEVELOPMENT SITE OF PLTU INDRAMAYU 2 x 1.000 MW DURING**  
**MONDAY**

Observation Hour	Traffic					
	Sumur Adem Pantura	%	Patrol Pantura	%	Jalan PLTU Sukra	%
06.00 - 07.00	1114.0		1831.4		432.7	
07.00 - 08.00	1972.5	6,96	2307.6	5,80	302.0	11,11
08.00 - 09.00	1950.4	6,89	1878.0	5,95	107.1	3,94
09.00 - 10.00	2034.5	7,18	2550.2	8,08	98.2	3,61
10.00 - 11.00	2289.1	8,08	2201.6	6,97	122.0	4,49
11.00 - 12.00	2423.4	8,56	2332.1	7,39	272.4	10,02
12.00 - 13.00	2522.4	8,90	2929.5	9,28	144.3	5,31
13.00 - 14.00	2595.1	9,16	3767.0	11,93	240.3	8,84
14.00 - 15.00	2515.7	8,88	2675.2	8,47	104.9	3,86
15.00 - 16.00	2153.9	7,60	2609.5	8,27	98.4	3,62
16.00 - 17.00	2314.5	8,17	2515.6	7,97	214.0	7,87
17.00 - 18.00	3378.6	11,93	2227.8	7,06	461.3	16,98
18.00 - 19.00	1062.1	3,75	1742.2	5,52	119.9	4,41
Traffic Volume during Observation (SMP)	28326.2	100,00	31567.7	100,00	2717.5	100,00



Total SMP/Jam	2179		2428		209	
Road Capacity	3173		3173		2422	
Road Service Level	0,69		0,77		0,09	

Source : On Field Observation

### 3.2. BIOLOGICAL COMPONENT

#### 3.2.1. Flora

##### 3.2.1.1. Condition of Vegetation Within The Location of PLTU Indramayu 2 x 1.000 MW

vegetation in the site location of PLTU Indramayu 2 x 1.000 MW is dominated by cultivated vegetation, namely, paddy (*Oryza sativa*), because most of land located in the site of Indramayu 2 x 1.000 MW steam power plant is mostly ricefields. Beside of ricefield, some other cultivated crops planted by local residents are Shallots (*Allium cepa*), Red Chilli (*Capsicum annum*), **Paria** (*Momordica charantica*), Cucumber (*Cucumis sativus*) and Purple Eggplan (*Cyphomandra betacea*). In ricefield embankment, most of local resident is planting Banana (*Musa paradisiaca*), Corn (*Zea mays*), Cassava (*Manihot esculenta*), Long Bean (*Vigna unguolata*) and wooden trees such as jack fruits (*Artocarpus heterophylla*), Kedondong laki (*Polycias fruticosa*), Turi (*Sesbania grandiflora*) and Kersen (*Muntingia carabora*).



**FIGURE 3.26.**

**VEGETATION IN PROSPECTIVE AREA OF INDRAMAYU 2 x 1.000 MW STEAM POWER PLANT (in the front part of the picture is shallot plants while the back side are paddy and banana plants.)**

Natural vegetation in the project site is dominated by grass varieties such as *rumpit kakawatan* (*Cynodon dactylon*), *rumpit tambaga* (*Ischaemum muticum*) and *Pungpurutan* (*Urena lobata*). Beside of grass variety, there are also tall plants such as *Renghas* (*Gluta renghas*), *Berenuk* (*Crescentia cujete*) and *Kedondong laki* (*Polycias fruticosa*). Near the beach area, mangrove trace is barely seen, but some of beach vegetations are still remain such as *pes-capre* (*Ipomoea pes-capre*),

*jeruju* (*Acanthus ilicifolius*) and *Pedada* (*Sonneratia ovata*) that can be found within the location of shrimp ponds.

Inventory result of flora variety in the site of PLTU Indramayu 2 x 1.000 MW can be seen in Table 3.29.

**TABLE 3.29.**  
**INVENTORY OF FLORA VARIETY IN THE SITE OF PLTU INDRAMAYU 2 x 1.000 MW**

No	Local Name	Scientific Name	Condition				
			Very Rare	Rare	Quite Many	Many	Abundant
Cultivated Crops							
1	Shallot	<i>Allium cepa</i> L.				v	
2	Cucumber	<i>Cucumis sativus</i> L.		v			
3	Red Chilli	<i>Capsicum annum</i> L.				v	
4	Wheat	<i>Sorghum vulgare</i> Pers.	v				
5	Paddy	<i>Oryza sativa</i>					v
6	<i>Paria</i>	<i>Momordica charantia</i>				v	
7	Banana	<i>Musa paradisiacal</i>			V		
8	Cassava	<i>Manihot esculenta</i>		v			
9	<i>Terung panjang</i>	<i>Cyphomandra betacea</i>			V		
10	<i>Waluh putih</i>	<i>Lagenaria siceraria</i>			V		
Other Crops							
1	<i>Akasia</i>	<i>Acacia auriculiformis</i>	v				
2	<i>Cemara laut</i>	<i>Casuarina equisetifolia</i>	v				
3	<i>Jambu air</i>	<i>Syzygium aquaeum</i>		v			
4	<i>Johar</i>	<i>Cassia siamea</i>		v			
5	<i>Randu/Kapuk</i>	<i>Ceiba petandra</i>		v			
6	<i>Kedondong laki</i>	<i>Polycias fruticosa</i>				v	
7	Coconut	<i>Cocos nucifera</i>	v				
8	<i>Talas hitam</i>	<i>Colocasia esculenta</i>				v	
9	<i>Kelor</i>	<i>Moringa oleifera</i>		v			
10	<i>Kembang sepatu</i>	<i>Hibiscus rosa-sinensis</i>		v			
11	<i>Kersen</i>	<i>Muntingia carabora</i>			V		
12	<i>Ki hujan</i>	<i>Samanea saman</i>			V		
13	<i>Lantoro</i>	<i>Leucaena leucocephala</i>			V		
14	Jackfruit	<i>Artocarpus heterophyllus</i>	v				
15	Guava	<i>Psidium guajava</i>	v				

Source : Primary Data, 17-18 Juli 2010

From the photo and data above, it can be perceived that paddy (*Oryza sativa*) is the dominant variety in the site of PLTU Indramayu 2 x 1.000 MW and the others are shallot, *Paria* and Red Chilli. Another popular variety are banana (*Musa paradisiaca*), *Kedondong laki* (*Polycias fruticosa*) and *Talas hitam* (*Colocasia esculenta*).

**TABLE 3.30.**  
**INVENTORY OF NATURAL CROP VARIETY IN THE SITE OF PLTU INDRAMAYU 2 x 1.000 MW**

No	Local Name	Scientific Name	Condition	Remark
----	------------	-----------------	-----------	--------

			Very Rare	Rare	Quite Many	Many	Abundant	
1	<i>Alimusa</i>	<i>Lumosa</i>		v				
2	<i>Bakung</i>			v				
3	<i>Beluntas</i>	<i>Plucea indica</i>			V			
4	<i>Berenuk</i>	<i>Crecentia</i>		v				
5	<i>Jeruju</i>		v					
6	<i>Kacang laut</i>		v					
7	<i>Jukut kakawatan</i>						v	
8	<i>Kangkung air</i>	<i>Ipomoea aquatica</i>				v		
9	<i>Kangkung Bandung</i>					v		
10	<i>Kaso</i>			v				
11	<i>Rumput kejut</i>			v				
12	<i>Pedada</i>	<i>Ariceniasp.</i>	v					
13	<i>Peletekan</i>				V			
14	<i>Pes-capre</i>	<i>Ipomoea pescapre</i>		v				
15	<i>Pungpurutan</i>					v		
16	<i>Rumput lari-lari</i>			v				
17	<i>Rumput Tembaga</i>			v				
18	<i>Renghas</i>		v					
19	<i>Sidagori</i>				V			
20	<i>Seruni</i>		v					

Source : Primary Data, 17-18th of July 2010

according to conducted observation, the beach area is severely damaged, type of plants found along the beach line, instead of mangrove, are cultivated crops such as banana (*Musa paradisiaca*) and grass variety. Beach condition in the site of PLTU Indramayu 2 x 1.000 MW can be seen in picture below.



**FIGURE 3.27.**

**BEACH CONDITION IN THE PROSPECTIVE SITE OF PLTU INDRAMAYU 2 x 1.000 MW DURING OBSERVATION**

**3.2.1.2. Vegetation outside/around the Site of PLTU Indramayu 2 x 1.000 MW**

Vegetation outside the site of PLTU Indramayu 2 x 1.000 MW is not different to the vegetation in the site of PLTU Indramayu 2 x 1.000 MW, ricefield with paddy (*Oryza sativa*) variety, Red Chilli, Shallot and Paria are dominating but outside the site area, it has settlement area along with yard.

The closest settlement to the site of PLTU Indramayu 2 x 1.000 MW is Warakas settlement of Mekarsari Village, this settlement is located in Northern side of the site of PLTU Indramayu 2 x 1.000 MW, distance between the site of PLTU Indramayu 2 x 1.000 MW with Warakas settlement is approximately  $\pm 1$  km. In the west side of PLTU Indramayu 2 x 1.000 MW is Blok Tempel of Tegal Taman Settlement, Sukra, and settlement located in the East side of PLTU Indramayu 2 x 1.000 MW is Patrol Lor Settlement.

According to the result of observation regarding plant varieties in the yard of each settlement, the plant variety is almost similar between one settlement and another. The planted crop is dominated by Mango (*Mangifera indica*), Banana (*Musa paradisiaca*) and Petai (*Parkia speciosa*).

### 3.2.2. Fauna

Observation regarding fauna aspect is conducted in the area of project site and its surrounding, namely, in the area of each vegetation, namely, in the project site, yard vegetation and ricefield. Observed fauna is including the class of mammals, reptiles, amphibi, and aves.

Variety of fauna which is stated in the number of fauna variety identified in observation area is presented in Table 3.31. there are 29 varieties which is consist of 2 varieties of Mammals, 5 varieties of reptiles, 3 varieties of amphibi, and 19 vareities of aves (bird). The compisition and prediction of population for each class variety is obtained from direct observation and interview, trace, voice, food and feces deposit, the result of such observation is presented in Table 3.32.

**TABLE 3.31.**  
**NUMBER OF FAUNA VARIETY IN THE RESEARCH AREA**

No.	Class	Number of Variety
1.	Mammalia	2
2.	Reptilia	5
3.	Amphibia	3
4.	Aves	18
	<b>Total</b>	28

Source: Primary Data, 2010.

**TABLE 3.32.**  
**RELATIVE COMPOSITION AND POPULATION OF FAUNA IN THE RESEARCH AREA**

No	Local Name	Scientific Name	TP	STP	PP 7/99
<b>Class of Mammals :</b>					
1	<i>Codot/kekelawar</i>		<b>V</b>	<b>V</b>	
2	<i>Tikus sawah</i>	<i>Rattus rattus</i>	<b>W</b>	<b>V</b>	
<b>Class of Reptiles</b>					
1	<i>Bunglon</i>	<i>Calotes jubatus</i>	<b>V</b>	<b>V</b>	
2	<i>Ular cobra</i>	<i>Naya sp</i>	<b>W</b>	<b>V</b>	
3	<i>Ular banyu</i>	<i>Natrix piscator</i>	<b>v</b>	<b>V</b>	
4	<i>Kadal</i>	<i>Mabuia multifasciata</i>	<b>v</b>	<b>V</b>	

No	Local Name	Scientific Name	TP	STP	PP 7/99
5	<i>Ular belang</i>	<i>Bungarus sp.</i>	<b>w</b>	<b>W</b>	
<b>Class of Amphibi</b>					
1	<i>Kodok hijau</i>	<i>Bufo sp</i>	<b>v</b>	<b>v</b>	
2	<i>Katak</i>	<i>Rana sp</i>	<b>v</b>	<b>v</b>	
3	<i>Bancet</i>		<b>v</b>	<b>v</b>	
<b>Class of Aves/Bird</b>					
1	<i>Sikatan/</i>	<i>Rhipidura javanica</i>		<b>v</b>	<b>v</b>
2	<i>Blekok</i>	<i>Ardeola speciosa</i>	<b>v</b>	<b>v</b>	
3	<i>Titimplik</i>	<i>Mirafrja javanica</i>	<b>v</b>	<b>v</b>	
4	<i>Sriti/br wallet sapi</i>	<i>Collocalia esculenta</i>	<b>v</b>	<b>v</b>	
5	<i>Ketilang</i>	<i>Pycnonotus aurigaster</i>		<b>v</b>	
6	<i>Cici padi</i>	<i>Cisticola juncidis</i>	<b>v</b>		
7	<i>Tekukur</i>	<i>Streptopelia chinensis</i>		<b>v</b>	
8	<i>Cinenen</i>	<i>Ortithomus sutorius</i>	<b>v</b>	<b>v</b>	
9	<i>Udang kecil</i>	<i>Alcedo sp</i>		<b>v</b>	<b>v</b>
10	<i>Ppeking</i>	<i>Lonchura punctulata</i>	<b>v</b>	<b>v</b>	
11	<i>Gereja</i>	<i>Passer montanus</i>	<b>v</b>	<b>v</b>	
12	<i>Pipit</i>	<i>Lonchura leucogastroides</i>	<b>v</b>	<b>v</b>	
13	<i>Kuntul</i>	<i>Egreta sacra</i>	<b>v</b>	<b>v</b>	
14	<i>Pacikrak, prinjak</i>	<i>Prinia familiaris</i>	<b>v</b>	<b>v</b>	
15	<i>Cinenen kaki merah</i>	<i>Ortithomus sp</i>		<b>v</b>	
16	<i>Layang-layang Asia</i>	<i>Hirundo rustica</i>	<b>v</b>	<b>v</b>	
17	<i>Layang2</i>	<i>Apus affinis</i>		<b>v</b>	
18	<i>Brecet</i>			<b>v</b>	

Source: Primary Data, 2010

Remarks: v = Direct Observation w = Interview  
 TP = Project Site, STP = Aound the Project Site  
 PP 7/99: Status of Conservation, Government Regulation 7 of 1999.

In general, fauna population is relatively low for class of Mammals, reptiles and Amphibi, except for bird varieties, which is quite high in population such as *pipit*, *peking*, *sriti* and *blekok* birds. Among the four varieties, the highest population is *blekok* birds and they live in group.

#### A. Value of Fauna's Habitat

The project site, as described in the previous chapter, is an agricultural cultivation area for ricefield and plantation, especially for the prospective area designated for PLTU Indramayu 2 x 1.000 MW along with it facilities and infrastructures, the surrounding area is categorized as the same. Besides, around the project site, there are other type of land use such as settlement (village) that is located near the location of project site. All of those vegetation type is a habitat (place to live) of fauna, shelter to breed and seeking food, both for mammals, reptiles, aves, amphibi and other class of fauna. This type of vegetation **has an important value as** the habitat for the fauna since it provides food such as leaves, fruits, seeds and also insects, a shelter from bad weather and hunters. In general, area of project site is habitat and food provider, especially for class of aves.

## B. Bird (*Aves*)

### 1. Variety and Composition.

Observation result on birds through inventory and using transek method has shown that there are 18 varieties of birds in the observation area as presented in Table 3.32. Number of variety of birds is quite low because such area is not their natural habitat which is dominated by ricefield, furthermore, observation is conducted during rainy season that could be affecting fauna's activity including birds.

In the project site, the number of variety is lower than around the area of project site, only 12 varieties. This is because the habitat is only consist of ricefields and plantations, while the other habitat is existed around the area of project site, such as house yard and river/estuary vegetation. Composition of bird variety in the area of project site, which is the area of ricefields and plantation, consists of seed-eating birds (*Pipit*, *Gereja* and *Peking* Birds), insect-eating birds such as *Kapinis* and *Sriti*, fish and microorganism-eating birds such as *layang-layang asia*, *Pacikrak*, *Cinenen*, *Cici Padi*, *Titimplik*, *Kuntul* and *Blekak* birds.

There are 18 Birds varieties around the project site, it is larger compared to the number of variety in the project site. Composition of birds variety in this area is different to the project site, with the difference up to 6 varieties, as well as it types and also it habitats, some of them live in house yard and river/estuary habitats. Among them, there are 2 kinds of birds that are categorized as protected, namely, *Kipas (Sikatan)* and *Raja Udang Kecil* birds.

### 2. Population and Distribution

In general, birds variety in the area of project site is low on population. Therefore, standard of population measurement is conducted on limited number unless for some of the variety that live in groups such as **peking** and **pipit** also **kapinis**. Population of birds living in group are relatively higher than the other variety.

According to its distribution, those birds are having limited distribution, for example, *gereja* bird is only live in house yard and plantation, and distribution of some other seed-eating birds that live in ricefield area such as *Pipit* and *Peking* birds. *Raja Udang Kecil* bird is live in near or around river area and other plain waters since they live by eating fish and insects.

## C. Mammals

Mammals variety that lives in the observation area, both in the projects site and around the project site area, are only 2, they are rats and *codot/kelelawar* (see Table 3.32). such result is obtained from direct and indirect observation, *tikus* is recorded through interview (in the location of activity site) while *codot* is observed during arnoon to evening. *Codot* is nocturnal animal, which means that they only active at night. According to the secondary data, there is another kind of mammals recorded, namely, squirrel (Anonymous, 2010)

#### D. Reptiles

There are 5 recorded fauna variety from the class of reptiles, one of them is *ular kobra/dumung* which is directly observed in the area of project site. In ricefield area, cobra acted as predator for paddy pests since one of their main prey is rat. Lizard is also found in several areas, both in the site and around the project site, it was one of the most common animal in the area. Furthermore, ular kadut (*Acrochordus javanicus*) is also recorded to exist within the observation area (Anonymous, 2010)

#### E. Amphibia

There are only 3 recorded varieties from the class of amphibian, they are *Kodok Hijau*, *Katak* and *Bancet*. Those three amphibian are commonly found around and in the project site area, which is dominated by ricefield area.

#### F. Rare or Protected Fauna

In the area of project site, variety of fauna that is protected by law is nowhere to be found, while around the area of project site, there are 2 varieties that are protected by law based on the Government Regulation no 7/of 1999, both of them are from the class of Aves, namely, *Sikatan* (*Kipas*) and *Raja Udang Kecil* birds (see Table 3.34.).

*Sikatan* bird is found outside the project site in the vegetation area of Mangsetan river estuary which is located in the west side of PLTU Jawa Barat, quite far away from the project site and will not be affected by the activity of PLTU Indramayu 2 x 1.000 MW. *Raja udang* bird is also found outside the project site, in the area of Patrol Kepu, near the domestic settlement, which is also quite far away and will not be affected by the development activity of PLTU Indramayu 2 x 1.000 MW.

### 3.2.3. Water Life Forms

#### 3.2.3.1. Ocean Life Forms

##### A. Plankton

Identification result towards ocean plankton has found 48 plankton varieties, consists of 33 fitoplankton varieties and 15 zooplankton varieties (Table 3.34.). Plankton abundance level is around 107.070 – 1.353.120 760 ind/L. The most commonly discovered fitplanktons are *Chaetoceros* sp., *C. dydimus*, *C. Pseudocritinus*, *Coscinodiscus radiatus*, *Rhizosolenia* sp., and *Thalassiothrix* sp. From the variety of zooplankton the most common discovered variety is *Candacia* sp., *Chlamydomon* sp., *Leptocryptus* sp., nauplii, *Oithona*, and *Undinella* sp. Value of plankton diversity index is 0,20 – 0,69.

**TABLE 3.33.**  
**OCEANIC PLANKTON VARIETY AROUND THE PROSPECTIVE SITE FOR PLTU INDRAMAYU 2 X 1.000 MW**

No.	Organism	Station
-----	----------	---------

		1	2	3	4	5
FITOPLANKTON						
1	<i>Bacteriastrum</i> sp.	700	100	1200	9660	1880
2	<i>Bacteriastrum minus</i>	120	2260	3480	3240	4720
3	<i>Biddulphia</i> sp.	220	460	960	2360	1300
4	<i>Biddulphia mobiliensis</i>		120	180	160	60
5	<i>Campylodiscus</i> sp.	140	40	360		
6	<i>Ceratium</i> sp.	640		60	480	40
7	<i>Ceratium fusus</i>	60	680	1020	460	3340
8	<i>Ceratium macroceros</i>		1220	1500	5080	7440
9	<i>Chaetoceros</i> sp.	11320	5060	20700	4100	3920
10	<i>Chaetoceros affinis</i>	520	360	960	1300	1680
11	<i>Chaetoceros curvictetus</i>	280				
12	<i>Chaetoceros dydimus</i>	180	18800	78000	108960	
13	<i>Chaetoceros pseudocrinitus</i>	600	1780	14400	5760	3620
14	<i>Corethron</i> sp.				40	
15	<i>Coscinodiscus</i> sp.		660	2820	1200	780
16	<i>Coscinodiscus centralis</i>				400	100
17	<i>Coscinodiscus radiatus</i>	24740	9940	2700	14020	5240
18	<i>Dytilum</i> sp.	140	400	660	400	1300
19	<i>Dyctyocha</i> sp.	20				
20	<i>Ethmodiscus</i> sp.		240		60	
21	<i>Hyalodiscus</i> sp.	20	120	120	240	80
22	<i>Nitzschia</i> sp.	120			60	140
23	<i>Noctiluca</i> sp.	20			160	20
24	<i>Pelagothrix</i> sp.		120			
25	<i>Peridinium</i> sp.					80
26	<i>Pleurosigma</i> sp.	300	340	420	960	760
27	<i>Rhizosolenia</i> sp.	2220	3840	6720	11780	5320
28	<i>Rhizosolenia delicatula</i>	20	100	120		60
29	<i>Rhizosolenia robusta</i>		140	180	60	740
30	<i>Thalassionema</i> sp.	1340	2700	300	8440	2760
31	<i>Thalassiosira</i> sp.	280		720	480	540
32	<i>Thalassiothrix</i> sp.	52400	245440	1206180	494720	295700
33	<i>Trichodesmium</i> sp.	20				
Total of Fitoplankton		96420	294920	1343760	674580	341620
I.D. Simpson		0.62	0.30	0.19	0.43	0.25
No.	Organism	Station				
		1	2	3	4	5
ZOOPLANKTON						
1	<i>Candacia</i> sp.	2900	680	1080		
2	<i>Centrofages</i> sp.	40	20	360	20	160
3	<i>Cephalodella</i> sp.	20				
4	<i>Chlamydonon</i> sp.	160	140		180	
5	<i>Gryphaea</i> sp.		20	120		
6	<i>Keratela</i> sp.					40



No.	Organism	Station				
		1	2	3	4	5
7	<i>Leprotintinnus</i> sp.	1120	120	1680	60	5740
8	<i>Macrosetella</i> sp.	20				
9	<i>Nauplii</i> sp.	1160	660	1980	5540	3300
10	<i>Onchaea</i> sp.		120	240		
11	<i>Oithona</i> sp.	1100	900	1320	1240	2360
12	<i>Penilia</i> sp.			60		
13	<i>Tintinnopsis</i> sp.	110	1800		60	4380
14	<i>Tintinnopsis radix</i>	280		2520		
15	<i>Undinulla</i> sp.	3740	40		60	4380
<b>Total of Zooplankton</b>		<b>10650</b>	<b>4500</b>	<b>9360</b>	<b>7160</b>	<b>20360</b>
<b>I.D. Simpson</b>		<b>0.77</b>	<b>0.75</b>	<b>0.23</b>	<b>0.37</b>	<b>0.79</b>
<b>Total of Plankton</b>		<b>107070</b>	<b>299420</b>	<b>1353120</b>	<b>681740</b>	<b>361980</b>
<b>I.D. Simpson</b>		<b>0.69</b>	<b>0.32</b>	<b>0.20</b>	<b>0.45</b>	<b>0.33</b>
Location Remarks :						
L1 : 6°16'12.90" S, 107°59'29.00" E    L4 : 6°16'18.41" S, 108°00'15.60" E						
L2 : 6°16'07.60" S, 107°59'48.00" E    L5 : 6°16'45.00" S, 108°00'06.40" E						
L3 : 6°15'50.90" S, 108°00'07.90" E						

## B. Benthos

Benthos variety found in the ocean around the prospective area of PLTU Indramayu 2 x 1.000 MW, inter alia, *Imbricaria* sp, *Nereis* sp., *Pholas* sp, *Gafrarium* sp., *Turritella* sp. Etc. (Table 3.34.). Benthos density in ocean waters around the prospective area of project site is 324 – 999 ind/m<sup>2</sup> and benthos diversity index is approximately around 0,43 – 1,61.

**TABLE 3.34.**  
**OCEAN BENTHOS VARIETY AROUND THE PROSPECTIVE AREA OF**  
**PLTU INDRAMAYU 2 X 1.000 MW**

No.	Organism	Station		
		1	2	3
1	<i>Mitra</i> sp.	18		
2	<i>Nereis</i> sp.	27	18	9
3	<i>Hastula</i> sp.	9		
4	<i>Imbricaria</i> sp.	225		
5	<i>Stombus</i> sp.	9		
6	<i>Pholas</i> sp.	18	9	18
7	<i>Tellina</i> sp.	9	27	9
8	<i>Codakia</i> sp.	9	18	
9	<i>Gafrarium</i> sp.		855	45
10	<i>Paphia</i> sp.		9	
11	<i>Dentalium</i> sp.		18	

No.	Organism	Station		
		1	2	3
12	<i>Turritella</i> sp.		27	587
13	<i>Scylla</i> sp.		9	
14	<i>Placemen</i> sp.		9	
15	<i>Conus</i> sp.			9
16	<i>Nerita</i> sp.			9
<b>Total</b>		<b>324</b>	<b>999</b>	<b>783</b>
<b>I.D. Shannon &amp; Wiener</b>		<b>0,43</b>	<b>1,61</b>	<b>0,87</b>

Location Remarks :

L1 : 6°16'12.90" S, 107°59'29.00" E

L2 : 6°16'07.60" S, 107°59'48.00" E

L3 : 6°15'50.90" S, 108°00'07.90" E

### 3.2.3.2. Plain Water Life Forms

#### A. Plankton

44 varieties of plankton is identified in the river area around the prospective area of project site which is came from fitoplankton and zooplankton type. 21 identified varieties of Fitoplanktons are in great numbers such as *Closterium* sp., *Euglena* sp., *Lemanea* sp., *Oscillatoria* sp., *Spirogyra* sp., and *Synedra* sp. Meanwhile, 23 varieties of zooplankton are also identified with the domination of *Brachionus* sp., *Cyclops* sp., *Nauplii*, and *Rousseletia* sp. Abundance level of plankton in the river is around 3.498 – 9.571 ind/L, with the diversity index between 0,86 – 0,91.

**TABLE 3.35.**

#### **VARIETY OF PLANKTON IN THE RIVER AROUND THE PROSPECTIVE AREA OF PLTU INDRAMAYU 2 X 1.000 MW**

No.	Organism	Station		
		1	2	3
FITOPLANKTON				
1	<i>Ceratium</i> sp.	33		
2	<i>Chaetoceros</i> sp.	33		
3	<i>Closterium</i> sp.	330	66	
4	<i>Coscinodiscus</i> sp.	33		
5	<i>Euglena</i> sp.	561	330	33
6	<i>Fragilaria</i> sp.	132		1155
7	<i>Gyrosigma</i> sp.		33	
8	<i>Lemanea</i> sp.	231		231
9	<i>Lyngbya</i> sp.		33	99
10	<i>Navicula</i> sp.	99	363	
11	<i>Nostoc</i> sp.			33
12	<i>Oscillatoria</i> sp.	759	1320	264
13	<i>Pediastrum</i> sp.			33
14	<i>Peranema</i> sp.			33

No.	Organism	Station		
		1	2	3
15	<i>Phacus</i> sp.	330		
16	<i>Pleurotaenium</i> sp.			33
17	<i>Schizogonium</i> sp			66
18	<i>Spirogyra</i> sp.	165		264
19	<i>Surirella</i> sp.	66	66	132
20	<i>Synedra</i> sp.		924	198
21	<i>Thalassiothrix</i> sp.	231		
Total Fitoplankton		3003	3135	2574
I.D. Simpson		0.86	0.71	0.76
No.	Organism	Station		
		1	2	3
ZOOPLANKTON				
1	<i>Arcella</i> sp.	363	66	99
2	<i>Astramoeba</i> sp.		33	
3	<i>Brachionus</i> sp.	1254	396	33
4	<i>Bryocamptus</i> sp.			99
5	<i>Chilodonella</i> sp.	396	198	
6	<i>Cyclops</i> sp.	1056	561	66
7	<i>Cyprydopsis</i> sp.	66	66	33
8	<i>Diaphanasoma</i> sp.		66	
9	<i>Diaptomus</i> sp.	165		
10	<i>Filinia</i> sp.	495	165	
11	<i>Keratella</i> sp.			33
12	<i>Macrothrix</i> sp.	132	231	33
13	<i>Nauplii</i> sp.	1782	2046	165
14	<i>Notholca</i> sp	33	33	
15	<i>Phylodina</i> sp.	132		
16	<i>Platylas</i> sp.			33
17	<i>Polyartha</i> sp.	198		
18	<i>Rhabdolaimus</i> sp.	133	165	231
19	<i>Rotaria</i> sp.	66	33	
20	<i>Rousseletia</i> sp.	231	429	
21	<i>Tintinnopsis</i> sp.	33		
22	<i>Undinulla</i> sp.	33		
23	<i>Zoothamnium</i> sp.			99
Total Zooplankton		6568	4488	924
I.D. Simpson		0.85	0.75	0.23
Total Plankton		9571	7623	3498
I.D. Simpson		0.91	0.86	0.86

Location Remarks :

L1 : 6°16'12.90" S, 107°59'29.00" E

L2 : 6°16'07.60" S, 107°59'48.00" E

L3 : 6°15'50.90" S, 108°00'07.90" E

## B. Benthos

There are 10 varieties of Benthos identified and benthos with the highest abundance level is *Chironomus* sp., *Macrobrachium* sp., *Melanoides* sp., *M. Terulosa*, *M. Tuberculata*, and *Parathelpusa* sp. Benthos density in sampling location is around 261 – 783 ind/m<sup>2</sup>, with diversity index around 0,43 – 1,61.

**TABLE 3.36.**  
**VARIETY OF BANTHOS IN THE RIVER AREA AROUND THE PROSPECTIVE AREA OF PLTU**  
**INDRAMAYU 2 X 1.000 MW**

No.	Organism	Station		
		1	2	3
1	<i>Anentome</i> sp.		36	
2	<i>Chironomus</i> sp.		54	
3	<i>Fomacea</i> sp.		18	18
4	<i>Lumbriculus</i> sp.		9	9
5	<i>Lymnaea</i> sp.			18
6	<i>Macrobrachium</i> sp.		108	117
7	<i>Melanoides</i> sp.	72		
8	<i>Melanoides terulosa</i>		27	585
9	<i>Melanoides tuberculata</i>	387		
10	<i>Parathelpusa</i> sp.		9	36
<b>Total</b>		<b>459</b>	<b>261</b>	<b>783</b>
<b>I.D. Shannon &amp; Wiener</b>		<b>0,43</b>	<b>1,61</b>	<b>0,87</b>

Location Remarks :

L1 : 6°16'12.90" S, 107°59'29.00" E

L2 : 6°16'07.60" S, 107°59'48.00" E

L3 : 6°15'50.90" S, 108°00'07.90" E

### 3.3. COMPONENTS OF SOCIO-ECONOMIC AND CULTURE

Indramayu Regency is one of Regency that is located in North Coast National Road of Java Island and included within the province of West Java. The area is 204.011 Hectares wide and located on the coordinate position of 107° 52' – 108° 36' East and 6° 15' – 6° 40' South. Administrative borders of Indramayu Regency is as follows:

- North : Java Sea
- West : Subang Regency
- South : Sumedang, Majalengka and Cirebon Regency
- East : Subang Regency

Description of this environmental baseline is limited to the Sub-District and Villages located in the area of Indramayu 2 X 1.000 MW Steam Power Plant project. Location of PLTU Indramayu 2 x 1.000 MW is in Patrol Sub-District (Mekarsari Village, Patrol Lor Village, Patrol Baru Village) and Sumuradem Village in Sub-District of Sukra.

#### 3.3.1. Population

### 3.3.1.1. Number, Development and Structure of Population

Population of Indramayu Regency is increasing from year to year. In 2005, population of Indramayu Regency is 1.760.286 lives, 1.778.396 lives in 2006, 1.795.372 lives in 2007, and 1.811.764 lives in 2008. Therefore, it can be concluded that the growth rate of population in Indramayu Regency in 2008 is 0,86 %. This growth rate is declining compared to the previous year. Detailed description regarding the population of Indramayu Regency and the Sub-District of Sukra and Patrol is presented in the Table 3.37 and 3.38. below:

**TABLE 3.37.**  
**POPULATION OF INDRAMAYU REGENCY 2005 - 2008**

No	Year	Total
1	2005	1.760.286 lives
2	2006	1.778.396 lives
3	2007	1.795.372 lives
4	2008	1.811.764 lives

Source : Suseda of 2008, Central Bureau of Statistics of West Java

**TABLE 3.38.**  
**POPULATION OF PATROL AND SUKRA SUB-DISTRICT 2005 - 2008**

Year	Patrol Sub-District	Sukra Sub-District
2004	*)	92.847
2005	53.167	44.644
2006	53.542	44.940
2007	53.815	45.169
2008	54.235	45.552
Jumlah	214.759	273.152

\*) The Sub-District is not formed yet

Source : Central Bureau of Statistics of West Java 2009

Based on the observation, number of population during 2004 until 2008 in Patrol and Sukra Sub-District is increasing. In 2004, Patrol Sub-District was not formed yet because it is still included within Sukra Sub-District before the Sub-District division in 2005, from 53.167 residents, the number is keep increasing every year and reached 54.235 jiwa in 2008. Similar to the previous Sub-District, in Sukra Sub-District, before the division of Sub-District, the population number is 92.847 lives. Fter the division in 2005, its number of population was reduced to 44.644 lives because the resident was divided into two Sub-Districts. nevertheless, the number is still increasing every year, and in 2008 the population number is reached 45.552 lives.

One of the most important factor which is able to cause socio-economic problem is population density. Population density in an area is depend on number of population and size of the

particular area as well as its area development level especially development in economic sector. Population density in Indramayu Regency in 2008 is 849 lives/km in average. This number is indicated that population density is quite high (Source: Central Bureau of Statistics of Indramayu Regency, 2009).

Increasing population number is not merely caused by fertility and mortality rate, but also affected by migration; which is caused by developed economic activity in particular area. The development of economic activity is always been followed by increasing population number. This population component will be described based on the gender.

Based on the gender-based sex ratio in 2009, which shows the comparison between male and female residents, it can be identified that the number of male residents is more dominant than the female. Detailed description on population number of Patrol and Sukra Sub-District in 2009 is presented in the Table 3.39 below.

**TABLE 3.39.**  
**POPULATION MUBER IN VILLAGES THAT BECOMES PROJECT LOCATION ACCORDING TO GENDER IN PATROL AND SUKRA SUB-DISTRICT, 2009**

Patrol Sub-District	Residents		Total
	Male	Female	
Patrol Lor	2.085	2.075	4.160
Mekarsari	3.252	3.085	6.337
Patrol Baru	3.989	3.873	7.862
Total	9.326	9.033	18.359
Sukra Sub-District	Residents		Total
	Male	Female	
Sumur Adem	2.139	2.292	4.431
Total	2.139	2.292	4.431

Source : Village Profiling of 2009.

The village in Indramayu Regency that are adjacent to the project activity have quite high population number. Based on the gender, as seen on Table 3.25, in Patrol Sub-District, although the difference between the number of male and female residents is not significant, the trend is number of male residents is always higher than female. The opposite can be seen in Sumur Adem Village, the number of female residents is higher than the male, although the difference is not significant.

### 3.3.1.2. Population According to Religion and Education

Education level will indicate the level of ability and skill of the resident. Education level will affect the ability to receive new information, knowledge and innovation. Education level of Sukra Sub-District (Sumur Adem Village) and Patrol Sub-District (Patrol Lor, Mekarsari, and Patrol baru Villages) residents will be presented in Table 3.40.

To identify education level of the residents, based on the Table 3.22, it can be seen that most of residents in age between 18-56; 4,08% in Sumur Adem Village (Sukra Sub-District) and 4,56% in Patrol Lor, Mekarsari and Patrol Baru Villages (Patrol Sub-District), were not finishing the elementary school. In general, 39,19% residents of Sumur Adem Village (Sukra Sub-District) and 50,22% residents of Patrol Lor, Mekarsari, and Patrol Baru Villages (Patrol Sub-District) are only finished the elementary education.

Elementary graduates are dominating the education level in those four villages, this is caused by low level human resources so that the easiest way to get a job is by working as agricultural workers, casual labors or seasonal labors.

**TABLE 3.40.**  
**NUMBER OF POPULATION ACCORDING TO EDUCATIONAL LEVEL IN THE VILLAGE OF PROJECT SITE IN PATROL AND SUKRA SUB-DISTRICT 2009**

SUB-DISTRICT	SUKRA	%	PATROL			Total	%
VILLAGE	Sumur Adem		Patrol Lor	Mekarsari	Patrol Baru		
3-6 Y.O NOT ENTERING KINDERGARTEN	461	7,53	0	0	53	53	0,50
3-6 Y.O STILL IN KINDERGARTEN	48	0,78	115	0	108	223	2,12
7-18 Y.O DID NOT GO TO SCHOOL	0	0	0	0	0	0	0
7-18 Y.O STILL SCHOOLING	920	15,02	0	0	504	504	4,79
18-56 Y.O DID NOT GO TO SCHOOL	0	0	0	0	400	400	3,80
18-56 Y.O DID NOT FINISHED ELEMENTARY SCHOOL	250	4,08	0	0	480	480	4,56
FINISHING ELEMENTARY SCHOOL/EQUAL	2.400	39,19	4.112	908	262	5.282	50,22
12-56 Y.O DID NOT FINISHED JUNIOR HIGH SCHOOL	1.150	18,78	0	0	0	0	0
18-56 Y.O DID NOT FINISHED SENIOR HIGH SCHOOL	600	9,79	0	0	0	0	0
FINISHED JUNIOR HIGH SCHOOL	170	2,78	1.472	60	1013	2.545	24,20
FINISHED SENIOR HIGH SCHOOL	30	0,49	595	30	45	670	6,37
ACADEMY	94	1,53	213	0	0	213	2,025
SCHOLAR	0	0	11	0	10	21	0,19
MADRASAH (ISLAMIC SCHOOL)	0	0	0	125	0	125	1,19
PAKET A	0	0	0	0	0	0	0
PONDOK PESANTREN (ISLAMIC BOARDING SCHOOL)	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>6.123</b>	<b>100</b>	<b>6518</b>	<b>1123</b>	<b>2875</b>	<b>10516</b>	<b>100</b>

Source : Village Profiles (four villages) 2009, survey result

Patrol Lor and Patrol Baru villages have a better educational structure compared to the other village, this can be seen from the higher number of junior-high and senior-high graduates compared to the other two villages (Mekarsari and Sumur Adem). Potential from resident's educational level and number of graduates are perceived as the cause for Patrol Lor and Patrol Baru villages to obtain a better educational structure.

Villages in Patrol Sub-District (Patrol Lor and Patrol baru) have a better and well-distributed educational structure. Its economic structure is also better because those villages are located along the North Coastal Road which is more open to the economic activities. This strong economic aspect is perceived as one of the causes of improved human resources quality as well. Besides of the best economic structure compared to other villages, the resident's characteristic is also different from other villages. Social potential from this human resources characteristic is allegedly affecting each other in the improvement of economic and educational structures, which is better than the other villages. In general, residents of Indramayu Regency are muslim, as can be seen in Table 3.41.

**TABLE 3.41.**  
**POPULATION IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO RELIGION IN**  
**SUKRA AND PATROL SUB-DISTRICT 2009**

SUB-DISTRICT	SUKRA		PATROL					
VILLAGE	Sumur Adem	%	Patrol Lor	%	Mekarsari	%	Patrol Baru	%
MOSLEM	4391	100	4160	100	4892	100	3740	99,71
CHRISTIAN	0	0	0	0	0	0	3	0,08
CATHOLIC	0	0	0	0	0	0	8	0,21
HINDU	0	0	0	0	0	0	0	0
BUDDHA	0	0	0	0	0	0	0	0
BELIEVERS OF GOD THE ALMIGHTY	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>4391</b>	<b>100</b>	<b>4160</b>	<b>100</b>	<b>4892</b>	<b>100</b>	<b>3751</b>	<b>100</b>

*Source : Village Profile (four villages) 2009, Percentages are processed*

From the existing data, there are several villages with 100 % muslim resident, namely, Sumur Adem Village, Patrol Lor Village and Mekarsari Village. Patrol Baru Village is the only village with non-muslim residents which consists of Christian (0,08 %) and Catholic (0,21 %). The existing religion besides Islam are Christian and Catholic. Therefore, Indramayu Regency is always perceived as 'vote concentration' for islamic political parties.

### 3.3.1.3. Manpower

Number of working residents in Indramayu Regency in 2004 is 766.150 lives and increasing in 2005 to 78.442 lives. Meanwhile, number of residents looking for employment in 2004 is 70.170 lives and increasing in 2005 to 70.212 lives. Therefore, there is an increasing number for labor force, from 836.320 lives in 2004 to 855.654 lives in 2005. Number of non-labor force is also



increasing, from 598.080 lives to 604.518 lives. Based on the business sectors, manpower in agricultural sector is still dominating and keep increasing compared to the other sectors. (BPS Provinsi Jawa Barat, 2004-2005).

Indramayu Regency, Based on the business sectors, manpower in agricultural sector is still dominating and keep increasing compared to the other sectors. (BPS Provinsi Jawa Barat, 2004-2005).

### 3.3.2. Socio-Economic

#### 3.3.2.1. Livelihoods

In general, observation village where the prospective project area of PLTU Indramayu 2 x 1.000 MW development took place is dominated by agricultural society. According to survey result in four villages where the project location took place, the economic activity and livelihood of its resident as farmer (landlord, tenant farmer and average agricultural workforce) in Sumur Adem Village is 48,25 %, 86,79 % in Patrol Village, 93,63 % in Mekarsari Village, and 11,25 % in Patrol Baru Village. High percentage of residents worked in agricultural sector is indicate the dependency of local residents to their natural environment as an economic source. Domination of the resident who are worked in agricultural sector is also connected to the fact that Indramayu Regency is one of the biggest rice producer, Indramayu is also known as rice granary of West Java.

Based on the Table 3.42. it can be seen that the resident who is working in agricultural sector, landlord and tenant farmer in Sumur Adem Village is only 32,58 % while the rest of 47,47 % is working as agricultural work force. In Patrol Sub-District, particularly in Patrol Lor Village, landlord and tenant farmer are only 9,65 % while the rest of 77,14 % is worked as agricultural work force. In Mekarsari Village, landlord and tenant farmer are only 24,10 % while the rest of 69,33 % is worked as agricultural work force. Number of landlord and tenant farmer is far less than the number of agricultural work force, agricultural work force itself is them who did not own any land as productive asset, majority of landlord is peasant, while the rest, the minority of the entire farmer is big farmers or land lord, them who own a vast portion of the land. In Patrol Baru Village, number of landlord and tenant farmer is in opposite with the other villages which are included in the project location of PLTU Indramayu 2 x 1.000 MW, in Patrol Baru village, landlord and tenant farmer is 10,38 % while the rest of 0,87 % worked as agricultural work force.

**TABLE 3.42.**  
**POPULATION IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO JOB IN SUKRA AND PATROL SUB-DISTRICT 2009**

SUB-DISTRICT	SUKRA		PATROL					
VILLAGE	Sumur Adem	%	Patrol Lor	%	Mekarsari	%	Patrol Baru	%
FARMER	1304	32,58	321	9,65	275	24,10	538	10,38
PONDS FARMER	0		15	0,45	0	0	0	

SUB-DISTRICT	SUKRA		PATROL					
VILLAGE	Sumur Adem	%	Patrol Lor	%	Mekarsari	%	Patrol Baru	%
AGRICULTURAL WORK FORCE	1900	47,47	2565	77,14	791	69,33	45	0,87
MIGRANT LABORS	310	7,74	0	0	0	0	5	0,10
CIVIL SERVANT	73	1,82	52	1,56	11	0,96	10	0,20
CRAFTMAN			27	0,81	6	0,53	0	0
TRADER	55	1,37	182	5,47	22	1,93	0	0
TAILOR			11	0,33	15	1,31	0	0
VENDORS	0		0	0	0	0	20	0,39
PASTORALIST	0		0	0	0	0	35	0,68
MECHANIC	5	0,12	0	0	0	0	35	0,68
DOCTOR	0		0	0	0	0	0	0
MIDWIVE	0		0	0	0	0	2	0,04
SCAVENGER	325	8,12	0	0	0	0	0	0
HOME ASSISTANT	0		0	0	0	0	6	0,12
ARMY/POLICE	3	0,07	7	0,21	6	0,53	4	0,08
RETIREE	5	0,12	9	0,27	2	0,18	3	0,06
SERVICE	0		12	0,36	3	0,26	0	0
MID-SMALL ENTREPRENEUR	15	0,37	0	0	0	0	17	0,33
WORKSHOP OWNER			17	0,51	0	0	0	0
TRAINED SHAMAN	0		0	0	0	0	2	0,04
STATE-OWNED-COMPANY WORKER PEGAWAI BUMN	0		0	0	0	0	1	0,02
PRIVATE-SCHOOL TEACHER	5	0,12	0	0	0	0	9	0,17
OTHER ENTREPRENEUR	3	0,07	0	0	0	0	4387	84,61
ARTIST	0	0	0	0	0	0	1	0,02
PRIVATE-COMPANY WORKER	0		107	3,21	10	0,88	50	0,96
PUBLIC-COMPANY WORKER	0	0	0	0	0	0	15	0,29
NOTARY	0	0	0	0	0	0	0	0
CASUAL LABOR	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>4003</b>	<b>100</b>	<b>3325</b>	<b>100</b>	<b>1141</b>	<b>100</b>	<b>5185</b>	<b>100</b>

Source : Village Profiling Survey (twenty-four Villages) of 2009, Processed Percentage

The highest percentage for non-agricultural job of local residents in Sumur Adem is Pemulung for 8,12 % and migrant labor for 7,74 %. In Patrol Village, the highest percentage for non-agricultural job, compared to the other type of job, is trader for 5,47 %. In Mekarsari Village, the highest percentage for non-agricultural job is not identified since the amount is averagely

balanced while in Patrol Baru Village the highest percentage for non-agricultural job, compared to the agricultural sector, is other entrepreneur business for 84,91 %.

From the table of Sumur Adem, it can be concluded that working as farmer and agricultural work force are the main livelihood of residents of Sumur Adem and it is supported by a vast amount of agricultural land. Moreover, being a migrant labor (Indonesian Work Force Working Abroad) is a dominant choice especially for female residents of Sumur Adem Village. This is caused by its promising salary, compared to the domestic salary, with the requirement of mediocre skills and educational level, it is also caused by the rare job opportunity in Sumur Adem village or domestic area.

Table of Mekarsari village shows that working in agricultural sector as agricultural work force and farmers are the most dominant choice for Mekarsari residents, whereas 791 of the resident is worked as agricultural k force and 275 of them worked as farmer. This is caused by vast and productive agricultural area in Mekarsari Village (twice harvesting periods every year). Besides, the agricultural activity is supported by the availability of technical irrigation for irrigation system. Type of planted crops in Mekarsari Village is Ciherang-variety paddy and various secondary crops such as shallot, paria, long bean, cucumber, etc.

Beside of agricultural sector, working as migrant labor is also the most chosen job especially for female residents of Mekarsari Village. This is caused by its promising salary, compared to the domestic salary, with the requirement of mediocre skills and educational level, it is also caused by the rare job opportunity in Sumur Adem village or domestic area.

Survey of village profile according to livelihood is dominated by agricultural sector, this activity is also supported by questionnaire instrument that is distributed to the resident around the project of PLTU Indramayu 2 x 1.000 MW which is showed in Table 3.43.

**TABLE 3.43.**  
**MAIN LIVELIHOOD OF RESIDENTS IN THE VILLAGE OF PROJECT LOCATION ACCORDING TO JOB IN SUKRA AND PATROL SUB-DISTRICT 2009**

Main Livelihood	Total	Percentage
Landlord	56	43,1
Tenant / Lease Farmer	18	13,8
Pastorialist	3	2,3
Agricultural Work Force	28	21,5
Factory Labor	1	0,8
Civil Servant /Army / Police	1	0,8
Village Government Officer	1	0,8
Private-Company Worker	2	1,5
Entrepreneur	8	6,2
Trader	2	1,5
Ojek Driver	1	0,8

Consturction Labor	2	1,5
Driver	1	0,8
Rickshaw Man	1	0,8
Shop Owner	4	3,1
Unemployed	1	0,8
<b>Total</b>	<b>130</b>	<b>100,0</b>

Source : On Field Survey Result of 2010, processed

Residents worked in agricultural sector for their livelihoods (78,4 %) are still dominating , compared to the other type of livelihood, another main livelihood after the agricultural sector is business person/entrepreneur (6,2 %).

Based on the Table 3.44. and 3.45, it can be perceived that the local residents are still relying on agricultural sector for their main source of income, from the entire residents who worked in agricultural sector, only 0,8 % of them is land owner.

**TABLE 3.44.**

**AMOUNT OF OWNERSHIP OF TECHNICAL IRRIGATION RICE FIELD (m<sup>2</sup>) IN THE SUB-DISTRICT OF SUKRA AND PATROL 2009**

Width of Rice Field (m <sup>2</sup> )	Total	Percentage
0	103	79,2
10000	1	0,8
11200	1	0,8
15000	1	0,8
21000	1	0,8
2800	1	0,8
29400	1	0,8
3000	1	0,8
30000	1	0,8
3500	4	3,1
4200	4	3,1
42000	1	0,8
5160	1	0,8
5600	1	0,8
7000	6	4,6
7520	1	0,8
9800	1	0,8
<b>Total</b>	<b>130</b>	<b>100,0</b>

Source : On Field Survey Result of 2010, processed

**TABLE 3.45.**

**AMOUNT OF OWNERSHIP OF HALF-TECHNICAL IRRIGATION RICE FIELD (m<sup>2</sup>) IN THE SUB-DISTRICT OF SUKRA AND PATROL 2009**

Width of Rice Field (m <sup>2</sup> )	Total	Percentage
0	111	85,4
10000	1	0,8
1750	2	1,5
21000	1	0,8
2300	1	0,8
2800	1	0,8
28000	2	1,5
3500	4	3,1
4200	1	0,8
5600	1	0,8
7000	5	3,8
Total	130	100,0

Source : On Field Survey Result of 2010, processed

### 3.3.2.2. Sources of Livelihood

#### A. Sumur Adem

The people of Sumur Adem village are farmers and they get their livelihood from planting rice and various kinds of secondary crops (*palawija*) such as eggplant, cucumber, onion, and long bean in between rice planting. The village uses technical irrigation system so that the productivity of rice cultivation is high. In a year, there can be two rice harvests.

Some of the rice fields in Sumur Adem Village are owned by the people of the village themselves, but there are also rice fields that are owned by the people of the neighboring villages. The land used for planting rice and *palawija* is private land cultivated by the land owner themselves, with the help of farm labours. Some farmers rent land from land owners that also live in Sumur Adem Village. Land rent in the village varies from 5 million rupiah/*bau* (7,000 m<sup>2</sup>/year) for land located near the sea and 9-10 million rupiah/*bau* (7,000 m<sup>2</sup>/year) for land that is not located near the sea. It depends on the quality of the land (the assumption is that the further away from the sea, the higher the quality). There is no special relation in the prevailing rent system. Who bids faster at a higher price will get the lease. Besides the rent system, there is also result-sharing system, which is similar to the system in Mekarsari Village, which is the nearest neighboring village.

In Sumur Adem Village, some farmers plant paddystraw mushroom and cauli flower. Paddystraw mushroom farmers are managed and trained by the managers of Mitra SADAR (Prima Sejati) cooperative. Unlike other plants, paddystraw mushroom is cultivated in a room called *Kumbung* (mushroom house). In this way, the mushroom can be cultivated anytime, is not affected by seasons, and does not have a specific harvest season. Rather, it depends on the time of the planting. The initial seed money to cultivate paddystraw mushroom is around one million rupiah, which is used to build *Kumbung* with the size of 4 x 6 m<sup>2</sup> and buy mushroom seeds, which are called *Trigoclerma*.

Paddystraw mushrooms can be harvested two months after planting. From one *Kumbung* with the size of 4 x 6 m<sup>2</sup>, a farmer can gain up to 2 quintals of mushrooms in one harvest. Usually, the mushrooms are distributed through collectors/dealers that come to the cooperative, which acts as the organization that manages and buys the yield from the farmers. Collectors usually buy the mushrooms at a price of Rp 15,000-/kg.

## B. Patrol Lor

Based on village land use in Patrol Lor Village Profile year 2010, 52% of the total size of the village is dedicated for rice field cultivation, which uses technical irrigation. With *bengkok* land and *titi sara* land, which are also dedicated for rice field cultivation, the total land allocated for rice cultivation is 59% of the total size of the village. Practically, this illustrates the dominant/general livelihood of the community. This is in line with the main professions held by the people in Patrol Lor Village, namely farmers and farm labours. There are no fisherfolks at all in the village although the village is located on the seaside. This is because geographically, there is no estuary that can be used to anchor a boat or ship. Nevertheless, because it is located near Eretan Village, there are several Patrol Lor villagers that become fishermen.

With regards to rice cultivation, in general the farmland cultivated by the people of Patrol Lor Village is customary land (land owned by the people), which is individually-owned. The people obtain and came to own the land by buying or inheriting it. Farmland in Patrol Lor Village is managed through a rent system, with an average price of more or less 9-10 million rupiah/year for one *bau* (7,000 m<sup>2</sup>) of land. There is also result-sharing system (*Maro*) with the following details: the harvest income is subtracted with the initial capital, then the remaining profit is divided in two. The initial capital can come from the tiller or the land owner. The initial capital is used to buy fertilizers, seeds, pesticides, and pay farm labours' wage. Meanwhile, the cost of rice planting (*tandur*) and tractor rent are borne by the tiller. There is also pawning system. The mechanism is as follow: a person/land owner who wants to pawn his farmland/rice field, when he needs money, will pawn his land/rice field to another person who has the money based on an agreement that lasts for 2 years. After 2 years, if he does not yet have the money to pay the other person back for the ownership of his land, based on a written agreement between the parties, which is mediated by the village government, the arrangement can be extended for another 1-2 year.

Besides the abovementioned systems, the general rice cultivation method is cultivating one's own land with the help of farm labours to do basic works with the following cost: tractor rent cost: Rp 400,000/*bau*, rice planting cost: Rp 400,000/*bau* and labour wage to plant rice, give fertilizer and pesticide: Rp 25,000-30,000 for half a day (7 am to 12 am) and labour wage per day (7 am to 5 Pemohon): Rp 40,000.

Control and ownership of land in Patrol Lor Village is not limited to men. Women can also have access to and control farmland/rice field as long as she has the means to buy it and or right to

inherit it. In general, there are no communal land, except for *bengkok* land and *titi sara* land. Unlike crops grown in Mekarsari Village, in Patrol Lor Village, there is an inclination to plant rice of the Ciherang variety. According to information obtained from the Village Secretary/Record Keeper of Patrol Lor Village, Mr. Bsr, at the moment most of the rice fields in Patrol Lor Village are owned by people from the neighboring villages such as Mekarsari and Sumur Adem Villages; some are even owned by people from the cities such as Jakarta.

### C. Mekarsari

Rice field in Mekarsari Village is usually planted with rice and secondary crops (horticulture) such as onions, chillies, long beans, cucumbers, bitter gourds, and eggplants. The people cultivate their land themselves with the help of farm labours. Some farmers rent land from land owners that also live in the village to grow rice or secondary crops. Land rent price varies between Rp 5,000,000/*bau* (7,000 m<sup>2</sup>)/year for *bengkok* land (it is cheap because it is located near the sea) and Rp 9,000,000 to Rp 10,000,000/*bau* (7,000 m<sup>2</sup>)/year for private land. It depends on the quality of the land (assuming that the further away from the sea, the higher is the quality). There is no special connection in the prevailing rent system. Who bids faster at a higher price will get the lease.

Besides the rent system, there are also pawning and result-sharing systems in managing farmland. In pawning system, the general rule that currently applies in Mekarsari Village is as follow: the land is pawned for a minimum period of 2 years until the land owner can pay the land back. The pawning price for 1 *bau* of land (7000 m<sup>2</sup>) is Rp 50,000,000-. The pawning agreement is usually known by the village government, in written form, and cannot be transferred to another party. However, there are also agreements that do not involve the village government and are only based on the pawn receipt.

The result-sharing system in managing farmland varies according to the types of crops grown and the initial agreement For onions, the result-sharing system is as follow:

#### 1. *Merenem*

- 5 parts for the land owner that is also the one who puts up the initial capital
- 1 part for the tiller (if he only tills the land that has already been developed into *tegalan* to plant onions)

#### 2. *Maro*

- 5 parts for the land owner that is also the one who puts up the initial capital 1 part for the tiller (if he starts from a flat land that has not already been built into *tegalan*)

#### 3. *Mertelu*

- 3 parts for the land owner + to buy seeds
- 2 parts for the tiller (working from a flat land)
- Note: the cost of pesticides and fertilizers are borne together by the land owner and tiller with 50:50 proportion.

For land to plant rice and secondary crops (besides onions), the result-sharing system is as follow:

**1. Maro**

- 1 part for the land owner
- 1 part for the tiller
- Note: after the profit is subtracted by the initial capital put up by the land owner or the tiller.

**2. Result-sharing for rice field and field crop also includes the following system:**

- 5 parts for the capital owner
- 1 part for the land owner that is also the tiller

**1. Rice Field**

Rice field cultivation in Mekarsari village consists of 2 harvest seasons in a year for every rice/paddy variety. The paddy planted is generally of Ciherang variety due to various good reasons according to farmers in Mekarsari. The first planting season (*rendeng*/rainy season) usually starts in December and the second planting season (*gadul*/dry season) usually starts in June.

When starting a paddy planting season, a farmer usually needs Rp 2,500,000 to Rp 3,000,000 to plant rice on a land with the size of 1 *bau* or 7.000 m<sup>2</sup> from planting to harvesting with the following detail:

- Tractor rent cost to plough the land Rp 400,000.00
- Land cultivation involving 5 male farm labours with a daily wage of Rp 50,000.00 per day, usually for two days of work
- Rice planting (*tandur*) involving 12 female farm labours with a daily wage of Rp 25,000,000/day for one day of work
- Fertilizers such as Urea, TSP, NPK, Chalk, and Voska
- Urea 2 quintal : 320,000.00
- TSP 2 quintal : 460,000.00
- Voska 1 quintal : 130,000,00

---

• Total : 910,000.00

- Pesticides and medicines to fertilize leaves

- Puradan 20 boxes : 320,000.00
- Prapatom 1 bottle : 460,000.00
- Virtako 1 bottle : 130,000.00



- 
- Total : 775.000,00

- *Rambet*/Weeding, usually by 10 female farm labours with a daily wage of Rp 25,000- for two work days.

Harvesting usually uses *grabagan* (all-in) system with the cost of Rp 400,000-. Besides, there is also result-sharing system called *merenem*, in which 1 part for farm labours and 5 parts for the land owner/tiller.

From a rice field with the size of 7,000 m<sup>2</sup>, a farmer usually can obtain 6-6.5 tons of wet grain with the sale price of Rp 220,000,- to Rp 250,000,-/quintal. Dry grain is usually sold at Rp 300,000,- to 350,000,-/quintal. This difference in price is caused by reduction in weight of 25 kg per quintal between wet grain and dry grain. Harvest yield is different in the dry season and rainy season. In the dry season, harvest yield can reach 6-6.5 tons/*bau* while in the rainy season (*rendeng*), the yield is usually only 4.5-5 tons/*bau*.

Usually, farmers in Mekarsari Village do not sell all of their yield, but keep some of it for their own consumption and save them as seeds. In average, paddy harvest in Mekarsari Village is two times a year. After the second harvest, the rice field is planted with secondary crops such as red onions, cucumbers, chillies, long beans, and eggplants.

## **2. Secondary crops/ *palawija***

Meanwhile, secondary crops/horticultural plants such as onions, eggplants, cucumbers, bitter gourds, long beans, and *sabrang* (lombok/green chillies) are grown in the period between October and December. If the land is only planted with horticultural plants, they are grown all year.

## **3. Red Onions**

Red Onion is usually the first priority of plant grown after rice. This is because the harvest yields better income compared to other plants, although the production cost is also higher.

Especially for red onions, there are at least two versions of growing method. In the first version, after one time of planting, it is replaced by other horticultural plants. The second method allows planting red onions up to three times in a row.

The first method is suggested by Ak, one of the farmers in Mekarsari Village. According to him, red onions should only be planted once and after that, it must be replaced by other plants to restore soil fertility. If red onion is planted more than once, the subsequent yield will be of low quality because the soil fertility has decreased. Therefore, it must be replaced with other horticultural plants.

The second method is suggested by Cmd. According to him, there is no problem with planting red onions up to three times in a row. The result is the same. To maintain soil fertility, we must give the right mix of fertilizers.

When growing onions, the land must be ploughed manually by human labour using a hoe to develop sets in the land of 1.5-2 m in length. The distance between the sets is usually 50 cm, made in the form of small sewer with a depth of 40-50 cm, which functions as water retainer to make it easy to water the onions. The distance between one onion plant to another is about 15 cm and the number of land sets for a land with the size of 3,000 m<sup>2</sup> is around 1,500 sets so that if we plant two onion seeds in one hole, for a land with the size of 3,000 m<sup>2</sup> we need around 600,000 onion seeds/100-150 onion seedlings.

The cost of growing onion on a land with the size of 3,000 m<sup>2</sup> is approximately 7.5 million rupiah from the beginning until harvesting. To fertilize the soil, farmers usually use UREA, TS, NPK, and chalk that are mixed together and then spread out on the land. After the soil is fertilized, the land is planted with onion seeds by female farm labours. The planting process can take up 4-5 days using 10-12 female farm labours paid Rp 25,000-/day. Meanwhile, male farm labours are used when ploughing the land or developing sewers and land sets as the media of growing onions. This process can take up 1-2 weeks using 12 male labours with a daily wage of Rp 50,000 per day.

Approximately 3 days after the planting, usually farmers begin treatment by giving fertilizers to the soil and spray the plants with pesticides and leaves fertilizer such as: herbal, Trubus, starban, prapaton, and US Station, which function as leaves fertilizers. Meanwhile, for pesticides, farmers usually use prapaton, US stasion, which kill leaves worms and larva that live in the soil. Farmers usually treat the onions by giving fertilizers when the plants are 1 week old, 21 days old, and 37 days old. Spraying is done minimum 2 times per week until harvesting. Watering is done twice a day, at around 9 am and 4 pm.

From a land with the size of 3,000 m<sup>2</sup> we can get 4-4.5 tons of onions. Usually, collectors come to the village and buy them at a price of Rp 13,000,000-Rp 14,000,000 with *tebas/borongan* system. The collectors buy them at Rp 9,500- per kilo for wet onions and Rp 13,000- for dry onions.

#### **4. Cucumber**

Farmers usually grow cucumbers right after onions because the soil is still fertile so that they do not have to buy more fertilizers. Besides, the medicines and pesticides used to grow cucumbers are the same, namely herbal, Trubus, starban, prapaton, and US Station. Production cost to grow cucumber is not very high, only to buy seeds and pesticides. For a land with the size of 3000 m<sup>2</sup>, we need 10 cans of seeds that are sold in fertilizer and seed stores. In Mekarsari Village, 1 can of seeds is sold at the price of Rp 25,000/can. Overall, we need Rp 250,000 for

seeds and pesticides, 1 bottle per each usage totaling 4 bottles from planting to harvesting. From planting to harvesting, it takes only two months. After 2 months, in the period of the next 30 days, farmers harvest cucumber once every 2 days, totalling 15 times of harvest, with harvest yield of 2 tons per harvest. However, from the 6<sup>th</sup> harvest onwards, the yield decreases, only up to 1 ton/harvest. The price of cucumber at the market is Rp 2,500 per kilo. However, collectors usually buy from the farmers at a price of Rp 1,500-2,000 per kilo.

## 5. Distribution of Agricultural Products

With regards to distribution of agricultural products in Mekarsari Village, farmers sell their harvest yield to collectors/middlemen. The system is relatively free, meaning that a farmer can sell his agricultural products to different collectors using auction method. In this case, there is a process of bargaining between farmers and collectors. Collectors that offer the highest price tend to get the products, grains or vegetables.

Collectors usually specialize themselves as vegetable collectors or rice collectors. If he is a rice collector, he will know in detail information regarding quality of grains and the most recent market price. It is also the case with vegetable collectors. That way, they can get maximum profit. Profit gained by a rice collector is relatively smaller than that of a vegetables collector, but the loss risk is also smaller.

Usually, the mechanism of buying harvest yield from the farmers is as follow:

- There is an involvement of middlemen or small time collectors in selling harvest yield, whether for onions, cucumbers, or other plants. The role of the collectors is to show (bring) big collectors (buyers) to the site of harvest. The small collector is tasked with supervising the process of harvest and the weighing of the yield. For the work, he is usually paid Rp 25,000 per quintal by the second collector.
- If a farmer sells his harvest yield independently, not via a middleman, he must send it to the central market in Jakarta, Cirebon, or Bandung by renting 1 unit of truck at a price of Rp 1,000,000 plus gas, depending on the distance to the destination. If the destination is too far, usually the driver asks for more money, around Rp 100,000 to 200,000. One truck is usually rented by several farmers that want to market their yield directly. However, this is rarely done because according to the farmers, the difference in profit is not significant. Besides, selling harvest yield to middlemen is faster and easier because everything is taken care of by them.

## D. Patrol Baru

The wage of farm labours in this village varies from Rp 25,000 to Rp 30,000 per day without meal, drink, and cigarettes. If they get meal, drink, and cigarettes, the wage is only Rp 15,000/day. These farm labours do not have regular income because they do not get a job everyday. Therefore,

the level of welfare of farm labours, which constitutes the majority of the villagers, is very low. Rice field can only be harvested twice a year with an average productivity of 6 tons/ha. The most recent price of grain is quite good, namely Rp 2,500,- per kg so that farmers' income is around Rp 12,500,000/ha. Minus production cost of more or less Rp 3,000,000/ha, they can get a net profit of Rp 9,500,000 per 6 months. This is quite big compared to the average income of farm labours that is less than Rp 500,000/month.

Youth in Indramayu Regency are relatively reluctant to work in agriculture sector. Most prefer staying unemployed rather than working as a farm labour. Because it is difficult to gain livelihood in the village, the majority of women in this village go abroad to become migrant workers. These women are in average elementary school graduates. Economic factor becomes the dominant factor that causes these young women to go abroad to become migrant workers rather than continuing their education to a higher level.

Male youth usually have a higher level of education (High School). Unemployment among male youth is quite high. An informant, a village officer, estimates that 40% of the villagers that are unemployed are youth. The high level of unemployment is caused by low interest of the youth to work in agriculture sector because of low absorption of workers and low wage. It is also because opportunities to work abroad are bigger for women rather than for men. This is because requirements for men are more complicated, and also more expensive. Investment to become an Indonesian Foreign Worker (TKI) is up to 30-40 million rupiah. It is much more expensive compared to investment to become a Woman Foreign Worker (TKW), which is only 700 thousand-5 million rupiah. Opportunity to work in the Middle East is bigger for women because the investment is lower, but the salary is also smaller. Working in Asian countries requires bigger investment, but the wage is also much higher.

### **3.3.3. Social-Cultural Aspect**

#### **3.3.3.1. Communities Around the Prospective Area of PLTU Indramayu 2 x 1.000 MW**

The development of PLTU Indramayu 2 x 1.000 MW is planned to take place in Sumur Adem Village in District of Sukra, and Patrol Lor, Mekarsari, and Patrol Baru Villages in District of Patrol. With regards to Sumur Adem Village, some of the land in this village will be taken over in the project development plan.

Patrol Lor Village is also a prospective site of PLTU Indramayu 2 x 1.000 MW. The distance between the project location and settlement area in Patrol Lor Village is more or less 2.5 km. A small part of the land (more or less 25 ha), according to information received, may be taken over, which is land controlled by a shrimp pond company PT Indonusa, which has been operating since 1984. Patrol Lor Village will practically be impacted by this project if it is implemented. Meanwhile, most of the prospective location of the project in Mekarsari Village is productive agriculture land owned by the villagers. Besides, there is also a shrimp pond owned by PT Intan Widya Nisa and a permanent

house standing on a land owned by the Ministry of Public Work near the irrigation channel. In the North, which is directly adjacent to Java Strait, we can see abrasion taking place. The distance between the location of the project and settlement area is 0.5-1 km. Practically, when this project is implemented, there will be land acquisition or land use change on a great scale (from agriculture to Power Plant) in Mekarsari Village. Besides, the frequency and volume of vehicles going in and out of the village will increase significantly. In general, Mekarsari Village will become a "busy" village.

Patrol Baru Village is one of the villages which rice field area is also included in the development plan of PLTU Indramayu 2 x 1.000 MW so that this village becomes one of the villages that will be directly affected by the plan to develop PLTU Indramayu 2 x 1.000 MW although at this moment the communities have not felt any negative or positive impacts from the development and expansion plan.

Based on the explanation regarding the prospective sites, the development of PLTU Indramayu 2 x 1.000 MW is closely related to the communities that live in those areas. The majority of Sumur Adem villagers are student of pesantren (religious boarding school) or *santri*. In this area, community figures from a religious background are dominant so that this block is often called religious /*santri* zone that tends to be fanatic in nature. There are also farmers in this area. Other villages such as Patrol Lor, Mekarsari, and Patrol Baru, are more dominated by farmers.

Social activities in the villages that are the prospective sites of PLTU Indramayu 2 x 1.000 MW run quite well. Customary activities (Mapag Sri and Sedekah Bumi) as well as religious activities are held regularly by the communities. Collective and communal work in general is rare, but among farmers it is still observed, especially in the dry season. If something bad happens to a community member, every neighborhood group (RT) has their own mechanism to collect money from other villagers. Other activities that are often held by the communities are parties (*hajatan*) and religious event (*pengajian*).

Institutionally, community figures that are followed by the communities are rare, both from a religious and official background. Informal figures or leaders among farmers are more dominant compared to those with a formal background (religious figures or village officials). Because of this, there is no social institution in the village that has a dominant and significant influence on the life of the community, except for particular matters.

### **3.3.3.2. Social Institutions**

In the villages that were studied, social institutions of the community develop formally and informally. Formal social institutions are usually made by the village government such as neighborhood groups (RT/RW), Village Consultative Assembly (BPD) and so on. Meanwhile, informal social institutions usually develop traditionally such as collective work, women's lottery club (*arisan*), and so on.

Based on interviews with informants in the villages, the official governmental institutions play an important role in the life of the villagers. This also shows that the communities still have faith in formal institutions established by the government and think that they are important. Besides, the communities also put their trust in religious institutions and other social institutions.

### 3.3.3.3. Perception of the Communities

The picture regarding perception of the communities in the prospective locations of PLTU Indramayu 2 x 1.000 MW development includes characteristics of the communities, social economic conditions, social-cultural conditions, health, and their responses to the plan of PLTU Indramayu 2 x 1.000 MW development.

Concerns conveyed by communities living around the prospective locations of PLTU Indramayu 2 x 1.000 MW development are as follow: increased air and soil pollution due to emissions discharged by chimneys that contain air pollutants that can damage the communities' health, increased noise, diminishing size of land owned by the communities, diminishing productivity of rice field around the location of PLTU Indramayu 2 x 1.000 MW and increased unemployment. The communities' concerns regarding the risks that they may experience in the future are shown in Table 3.46.

**TABLE 3.46.**  
**RISKS PERCEIVED BY THE COMMUNITIES**

Description	Frequency	%
Diminishing/loss of land as a source of livelihood	3	4.1667
No idea	15	20.8333
Air and soil pollution etc	6	8.3333
Land around the project becoming less productive/unproductive	4	5.5556
Air pollution, buildings becoming pests house, diminishing/loss of agricultural land	1	1.3889
Unemployment	1	1.3889
Loss of livelihood	6	8.3333
Pollution	4	5.5556
Diminishing agricultural land	2	2.7778
No idea	29	40.2778
Disqualified	1	1.3889

Source :Primary Data 2010 (processed)

Perception of the communities regarding benefits of the development of PLTU Indramayu 2 x 1.000 MW consists of benefits that may be felt individually or communally at the village level. Benefits directly related to the communities are economic sources of livelihood in the form of employment of the communities by the project and business opportunities. Public benefits that are expected to be

gained by the whole community are electricity supply, development and rehabilitation of village infrastructure.

**TABLE 3.47.**  
**BENEFITS PERCEIVED BY THE COMMUNITIES**

Description	Freq	%
Good electricity supply	6	4.6
Many villagers will be employed by PLTU Indramayu 2 x 1.000 MW project	5	3.8
No benefits	23	17.7
Area around the project will attract many people	5	3.8
Improved supply of electricity	10	7.7
Development of village infrastructure	4	3.1
Area around the project will attract many people and will bring business opportunities	12	9.2
Will bring work opportunities	10	7.7
No idea/yet	13	10.0
Able to get work opportunities	3	2.3
Do not know	29	22.3
No benefits	10	7.7
Total	130	100.0

Source :Primary Data 2010 (processed)

**TABLE 3.48.**  
**EXPECTATIONS REGARDING THE DEVELOPMENT OF PLTU INDRAMAYU 2 x 1.000 MW**

Description	Freq	%
Hopefully there will be no risks	2	1.5
Health insurance	1	.8
Adequate land compensation	33	25.4
Employed by the project	30	23.1
Guarantee of the communities' welfare due to loss of livelihood	7	5.4
Compensation done without any middleman	4	3.1
Development of village infrastructure	1	.8
Rehabilitation of public facilities	11	8.5
Get work opportunity in PLN	5	3.8
Seed money for the communities to start a business	2	1.5
Want to become permanent workers	1	.8
Developed immediately	1	.8
Will employ many workers from among the communities around the project	7	5.4
Communities around the project become workers, road access built, irrigation fixed	1	.8
Road access fixed and health insurance	1	.8

Description	Freq	%
Communities around the project become prosperous, communities become employees	1	.8
No expectations	1	.8
No idea	20	15.4
Disqualified	1	.8
Total	130	100.0

Source :Primary Data 2010 (processed)

### 3.4. COMMUNITY'S HEALTH COMPONENT

The research location is a community settlement area near the prospective location of PLTU Indramayu 2 x 1.000 MW. This location became a sample because the prospective location of PLTU Indramayu 2 x 1.000 MW is rice field area and the settlement will also be affected by the development. Environmental health of this location is quite good. Health condition can be seen from the community's houses in the prospective location of PLTU Indramayu 2 x 1.000 MW. Around 92.3% of houses in the location are made of bricks and only 7.7% are made of half-brick. The floor condition is also good, only 2.3% of the houses have earthen (soil) floor and it can be seen in the table and picture below.

**TABLE 3.49.**  
**TYPES OF HOUSE FLOOR**

Floor Type	Freq	%
Soil	3	2.3
Plastered	44	33.8
Tiles	50	38.5
Ceramic	33	25.4
Total	130	100.0



**(a)**



**(b)**



**FIGURE 3.28.****HALF-BRICK HOUSE-PLASTERED FLOOR (a), BAMBOO HOUSE-EARTHEN FLOOR (b)**

Houses in the research location obtain clean water for their daily needs (eat and drink) from wells and abandoned wells (38.5%), drink water company or PDAM (36.2%), bottled water for drinking purposes (7.7%) while some buy clean water (16.9%). But in general, for bathing and washing, they usually use water from wells as shown in the following table.

**TABLE 3.50.****WATER SOURCES FOR BATHING AND WASHING****Sumber Air Mandi/Cuci Musim Kemarau**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sumur gali	45	34.6	34.6	34.6
	Sumur Bor	50	38.5	38.5	73.1
	Mata air	3	2.3	2.3	75.4
	PDAM	32	24.6	24.6	100.0
	Total	130	100.0	100.0	

In the dry season, 2.3% of the communities use the wells to obtain water. Water from the wells is pumped up by an electric pump that they call 'sanyo.' However, not every household has their own well. Those who do not have their own well usually use common well pumped using their own sanyo. For communities who obtain water from manual well, the well is drilled deeply on the ground. However, in the settlement area that becomes the sample location, the drilling is usually done near a pond or a place to dump dirty water (sewer) as shown in the figure below.

**(a)****(b)****FIGURE 3.29.****COMMUNITY WATER SOURCE-DRILLED WELL (LEFT) AND MANUALLY-DUG WELL (RIGHT)**

The communities that obtain clean water from drilled well usually get water from shallow well, which water, despite clean-looking, does not meet health requirements. These wells are also

built not far or so close from the septic tank. To fulfill daily needs of water, some of the communities get water from a pond using sanyo. This water is clearly not healthy and does not meet the requirements of healthy water. The water is a bit turbid because it is surface water, which is not healthy. Water condition can be seen in the table below.

**TABLE 3.51.**  
**CLARITY OF WATER ACCORDING TO COMMUNITY**

Water Clarity Level	Freq	%
Very clear	37	28.5
Quite clear	87	66.9
Clear enough	5	3.8
Rather turbid	1	0.8
Total	130	100.0

**TABLE 3.52.**  
**WATER QUALITY-ODOR LEVEL**

Water Odor Level	Freq	%
Odorless	116	89.2
A little smelly	2	1.5
Smells a little like dirt	12	9.2
Total	130	100.0

**TABLE 3.53.**  
**WATER TASTE**

Rasa air	Jumlah	Persentase
Tasteless	92	70.8
A bit flat	5	3.8
A bit salty	33	25.4
Total	130	100.0

The quality of water to fulfill daily needs of the community does not yet meet health requirements. This is reflected in the fact that only 28.5% water is clear. Although odorless, some still tastes flat and salty. This can be understood because the location of the research is near the sea and the communities obtain water from drilled and dug well in which there is a possibility of sea water intrusion.



**FIGURE 3.30.**  
**COMMUNITY WATER SOURCE-A POND**

Not every household has a water closet, although 86.2% of the households have it. Those who do not have it go to the rice field, river (3.6%) or a pond (0.8%) near their houses. Those whose houses are near water channel even build a closet in the channel. Those whose houses are near the river build a closet in the river.



**FIGURE 3.31.**  
**CLOSET IN THE RIVER (LEFT), CLOSET IN A WATER CHANNEL (RIGHT)**

Some of them go to public closets (4.6%). This condition is not healthy for the environment. Even when they use family closets, the management system of the feces uses a septic tank or more like a hole in the ground (*cubluk*) although they use squat toilet. This septic tank or *cubluk* is located not far from or very close to their drilled well.



**FIGURE 3.32.**  
**SEPTIC TANK NEAR DRILLED WELL**

This results in their water being very polluted.

Communities in this area do not have wastewater channel. Wastewater from bathing and washing is thrown away just like that at the back of the house. This wastewater flows everywhere and even makes a puddle around the house. Some are lucky because they have water channel behind their house so that the wastewater can be thrown away directly to the channel. The puddle of wastewater at the back of the house or at the sides turns black and very smelly.

**TABLE 3.54.**  
**DIRTY WATER/WASTEWATER DISPOSAL**

Wastewater disposal	Freq	%
To sewer	87	66.9
To pond	5	3.8
To rice field	1	0.8
To the river	33	25.4
To septic tank	4	3.1
Jumlah	130	100.0

Wastewater dump like in the picture below can be seen everywhere in the settlement area.



**FIGURE 3.33.**  
**DIRTY WATER/WASTEWATER CHANNEL**

Water in the irrigation channel that cuts across the settlement area is also used by children to bath. This water is very turbid and not fit for bathing or for anything. This irrigation channel also contains so much rubbish. Perhaps the community uses this irrigation channel to dump their garbage.





**FIGURE 3.34.**  
**IRRIGATION CHANNEL FILLED WITH RUBBISH**

**TABLE 3.55.**  
**RUBBISH DISPOSAL**

Rubbish disposal	Freq	%
To waste bin	1	0.8
To the river/sewer/water channel	12	9.2
In the yard/garden	20	15.4
To the sea	1	0.8
Burnt/buried	1	0.8
Burnt	95	73.1
Total	130	100.0

The community dumps solid garbage everywhere, most often at the side or the back of their house. The backyard is especially filled with garbage.



**FIGURE 3.35.**  
**COMMUNITY WASTE DISPOSAL SITE**

The condition of environmental health in this area, which is not conducive for the community's health, is because many villagers build animal houses very near to their house. Besides goats, they also raise chickens. The poultry house is attached to the wall of the house. They also

raise ducks and the house is also attached to the wall of the house, either at the side or the back of the house.



(a)



(b)

**FIGURE 3.36.**

**Poultry House (a); Duck House (b)**

**FIGURE 3.37.**

**GOAT HOUSE**

From Community Health Center in every district, we obtained data regarding health facilities to see the scope of health service, data regarding physical environment to gain knowledge about the degree of the community's environmental health and data regarding diseases in the community. The most common diseases in this area can be seen in the Community Health Center report concerning the 10 most common diseases. This gives us a picture regarding the most reported diseases in the community, which become the main focus of treatment as shown in Table 3.56 and Table 3.57.

**TABLE 3.56.**

**MAIN DISEASES IN THE COMMUNITIES IN SUKRA DISTRICT**

No	Name of Diseases	Frequency
1	Acute Nesofaringtis (Common old)	14,738

No	Name of Diseases	Frequency
2	Musculoskeletal System and Tissue Disease	10,481
3	Gastritis	7,543
4	Skin & Subcutaneous Tissue disease	5,653
5	Influenza	4,443
6	Hypertension	4,050
7	Diarrhea & Gastroenteritis	2,170
8	Headache	1,624
9	Conjunctivitis	1,075
10	Pneumonia	1,041

Source: Profile of Sukra Community Health Center year 2008

**TABLE 3.57.**  
**MAIN DISEASES IN THE COMMUNITY OF PATROL DISTRICT**

No	January-May 2010	Frequency
1	Paratyphoid fever	598
2	Typhoid fever	671
3	Diarrhea and Gastroenteritis	556
4	Shigelosis; unspecific Dysentery Balsile	137
5	Amubiasis, Amoeba dysentery	126
6	Pertusis, Acute Cough	58
7	Leprosy I/T (MB)	40
8	Leprosy B/L (PB)	6
9	Lungs Tuberculosis BTA (+)	5
10	Food poisoning caused by other bacteria	4

Source: Report LB 1 January-May 2010, Patrol District Community Health Center

#### 3.4.1. Health Resources

Health resources that can be accessed by the communities in Sukra and Patrol Districts consist of Community Health Center, Medical Center, Pharmacy, Drug Store, Doctor Practice, Midwife Practice, and nurses. However, not every villager can access the Community Health Center because of their limited service. The villagers are used to buying medicines in the pharmacy or general stores to cure common diseases symptoms such as headache, gastritis, and so on. Data regarding health resources in every district is presented in Table 3.60.

**TABLE 3.58.**  
**COMMUNITY HEALTH FACILITIES IN SUKRA DISTRICT**

No	Health Facilities	Number
1	Assisting Community Health Center	3
2	Community Health Center with hospitalization service	1
3	Midwife Center	5
4	Medical Center	1

5	Pharmacy	1
6	Drug Store	1
7	Doctor Practice	2
8	Private Midwife Practice	10

Source: Community Health Center in Sukra District, 2005

Health facilities in Patrol District consist of district Community Health Center located in Patrol Village, which is quite near from Patrol Baru Village. This Community Health Center has health staff consisting of: general practitioner, midwife, and other staff. Besides the Health Center, in Patrol Baru Village there is also a medical center for mother and children managed by a private foundation. Besides the Community Health Center, the community seeks medical attention in the village midwife and health counselor in the village. Some go to the doctor practice in Patrol and Sentot Hospital also in Patrol.

### 3.4.2. Condition of Environment Sanitation

For drinking and bathing/washing/cleaning, most of the villagers use water from the regional drinking water company (PDAM), drilled well, dug well, and or buy packaged clean water. However, there are many households that do not yet have a water source and in fulfilling their daily needs they buy water or take water from the neighbours' well.

Water needs for cooking/drinking and bathing/washing/cleaning are presented in the Table 3.59 below:

**TABLE 3.59.**  
**WATER SOURCES FOR DRINKING/COOKING IN THE DRY SEASON**

Description	Frequency	Percent	Valid Percent	Cumulative Percent
Dug well	14	10.8	10.8	10.8
Drilled well	36	27.7	27.7	38.5
Water source	1	.8	0.8	39.2
PDAM	47	36.2	36.2	75.4
Bottled water	10	7.7	7.7	83.1
Bought clean water	22	16.9	16.9	100.0
Total	130	100,0	100,0	

Source: Primary Data 2010 (processed)

**TABLE 3.60.**  
**WATER SOURCES FOR DRINKING/COOKING IN THE RAINY SEASON**

Description	Frequency	Percent	Valid Percent	Cumulative Percent
Dug well	15	11.5	11.5	11.5



Description	Frequency	Percent	Valid Percent	Cumulative Percent
Drilled well	35	26.9	26.9	38.5
Water source	1	0.8	0.8	39.2
PDAM	47	36.2	36.2	75.4
Bottled water	10	7.7	7.7	83.1
Bought clean water	22	16.9	16.9	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)

**TABLE 3.61.**

**WATER SOURCE FOR BATHING/WASHING IN THE DRY SEASON**

Description	Frequency	Percent	Valid Percent	Cumulative Percent
Dug well	45	34.6	34.6	34.6
Drilled well	50	38.5	38.5	73.1
Water source	3	2.3	2.3	75.4
PDAM	32	24.6	24.6	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)

**TABEL 3.62.**

**WATER SOURCE FOR BATHING/WASHING IN THE RAINY SEASON**

Description	Frequency	Percent	Valid Percent	Cumulative Percent
Dug well	44	33.8	33.8	33.8
Drilled well	54	41.5	41.5	75.4
Water source	1	.8	.8	76.2
River	1	.8	.8	76.9
PDAM	30	23.1	23.1	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)

Bathroom and toilet for the communities are very important because their existence and cleanliness support the health of the communities. The tables below show bathroom and toilet facilities in the communities of Sumur Adem, Patrol Lor, Mekarsari, and Patrol Baru Village.

**TABLE 3.63.**

**TOILETS AND BATHROOMS**

Description	Frequency	Percent	Valid Percent	Cumulative Percent
Private inside the house	114	87.7	87.7	87.7
Private outside the house	9	6.9	6.9	94.6

Public	7	5.4	5.4	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)

**TABLE 3.64.**  
**WASHING FACILITIES**

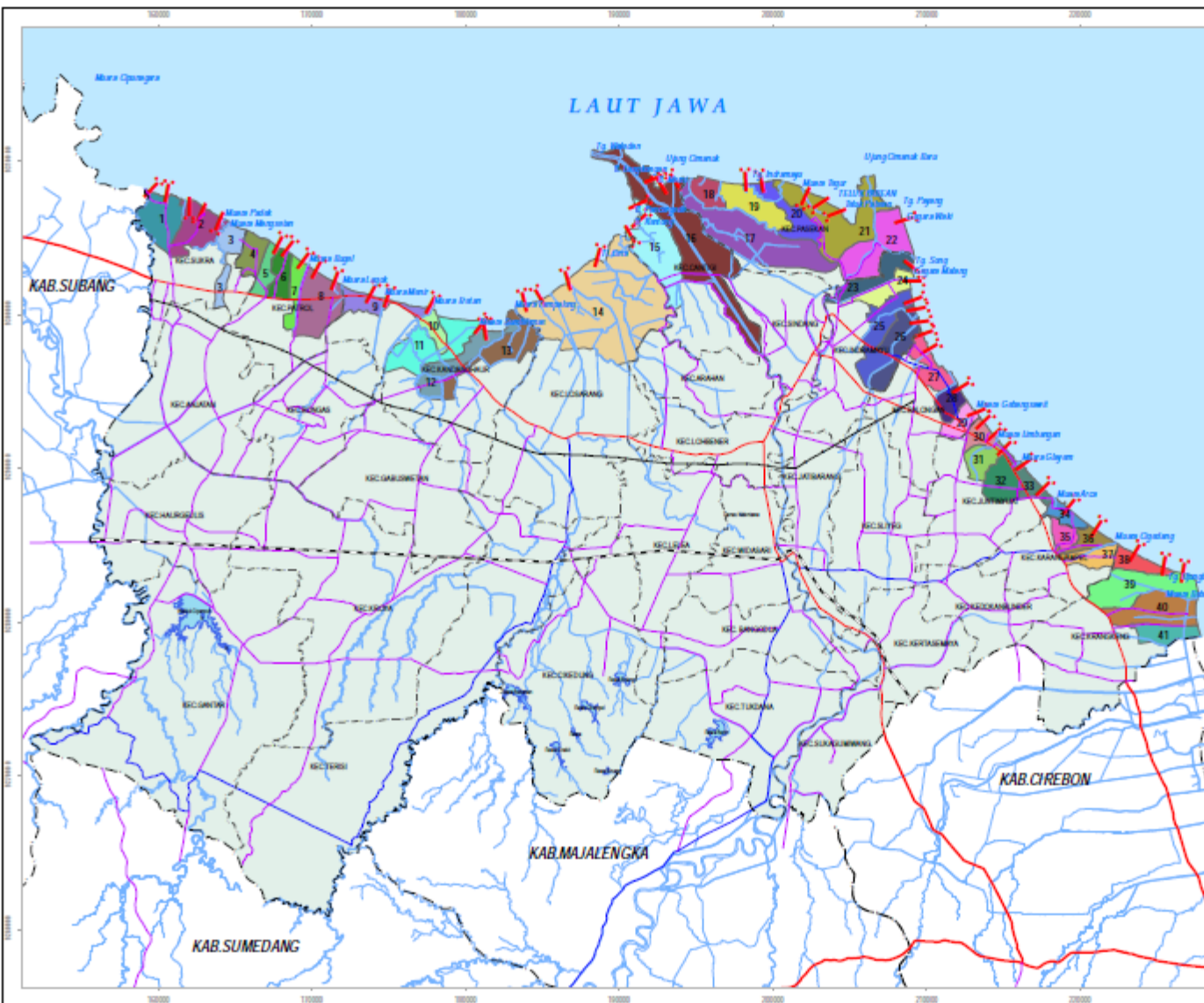
Description	Frequency	Percent	Valid Percent	Cumulative Percent
Private inside the house	113	86.9	86.9	86.9
Private outside the house	10	7.7	7.7	94.6
Public	7	5.4	5.4	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)

**TABLE 3.65.**  
**TOILETS**

Keterangan	Frequency	Percent	Valid Percent	Cumulative Percent
Private inside the house	112	86.2	86.2	86.2
Private outside the house	6	4.6	4.6	90.8
Public	6	4.6	4.6	95.4
The River	5	3.8	3.8	99.2
Pond	1	.8	.8	100.0
Total	130	100.0	100.0	

Source: Primary Data 2010 (processed)



# Spatial Plan of Indramayu Regency

Figure 3.4  
MAP OF ABRASION LOCATION IN INDRAMAYU REGENCY

## Keterangan :

**Batas Administrasi**  
 - - - - - Batas Kabupaten  
 - - - - - Batas Kecamatan

**Jaringan Jalan**  
 - - - - - Jalan Nasional  
 - - - - - Jalan Provinsi  
 - - - - - Jalan Kabupaten  
 - - - - - Jalan KA  
 - - - - - Pipe Gas

**Perairan**  
 - - - - - Sungai Besar  
 - - - - - Derasul Rawe  
 - - - - - Laut

**Legend**  
 Administrative Borders  
 Regency Borders  
 District Borders

**Road Network**  
 National road  
 Provincial Road  
 Regency Road  
 Railway  
 Gas Pipe

**Water**  
 River  
 Lake/Swamp  
 Sea

## Desa Yang Terkena Abrasi

1. DA. LAMPUR	16. DA. CIPAHAYU	31. DA. LAMPUR
2. DA. LAMPUR	17. DA. CIPAHAYU	32. DA. LAMPUR
3. DA. LAMPUR	18. DA. CIPAHAYU	33. DA. LAMPUR
4. DA. LAMPUR	19. DA. CIPAHAYU	34. DA. LAMPUR
5. DA. LAMPUR	20. DA. CIPAHAYU	35. DA. LAMPUR
6. DA. LAMPUR	21. DA. CIPAHAYU	36. DA. LAMPUR
7. DA. LAMPUR	22. DA. CIPAHAYU	37. DA. LAMPUR
8. DA. LAMPUR	23. DA. CIPAHAYU	38. DA. LAMPUR
9. DA. LAMPUR	24. DA. CIPAHAYU	39. DA. LAMPUR
10. DA. LAMPUR	25. DA. CIPAHAYU	40. DA. LAMPUR
11. DA. LAMPUR	26. DA. CIPAHAYU	41. DA. LAMPUR
12. DA. LAMPUR	27. DA. CIPAHAYU	42. DA. LAMPUR
13. DA. LAMPUR	28. DA. CIPAHAYU	43. DA. LAMPUR
14. DA. LAMPUR	29. DA. CIPAHAYU	44. DA. LAMPUR
15. DA. LAMPUR	30. DA. CIPAHAYU	45. DA. LAMPUR



Projeksi: UTM  
 Skala: 1:250,000  
 Data: Tahun 2010  
 Sumber: BPS, Dinas PUP, dan Dinas Lingkungan Hidup Kabupaten Indramayu



REGIONAL PLANNING AGENCY OF INDRAMAYU REGENCY

## **CHAPTER IV SCOPE OF STUDY**

### **4.1. SIGNIFICANT IMPACT STUDIED**

Significant impacts studied refer to the EIA Terms of Reference approved by the Environmental Office of Indramayu Regency No. 660.1 / 473 / KLH. The significant impacts studied are obtained from the evaluation of potential impacts through the process of identifying potential impacts and scoping.

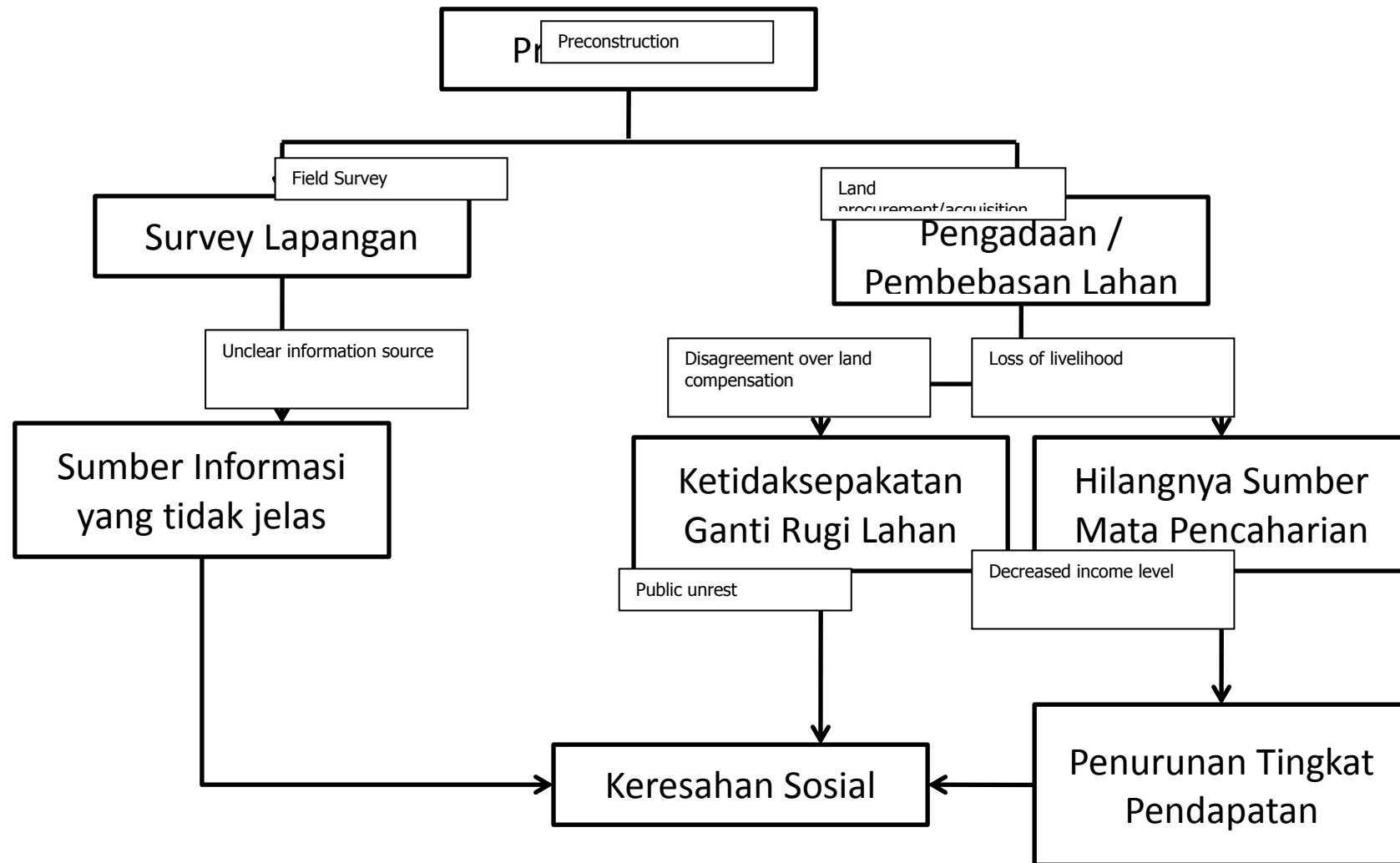
#### **4.1.1. Potential Impacts**

Identification of potential impacts is derived from a series of activities namely understanding of the component of activities, field observations and results of brainstorming and discussions with experts, the initiator and the relevant communities. From such series of activities, potential impacts that may arise are then inventoried regardless of the size or importance of the impact.

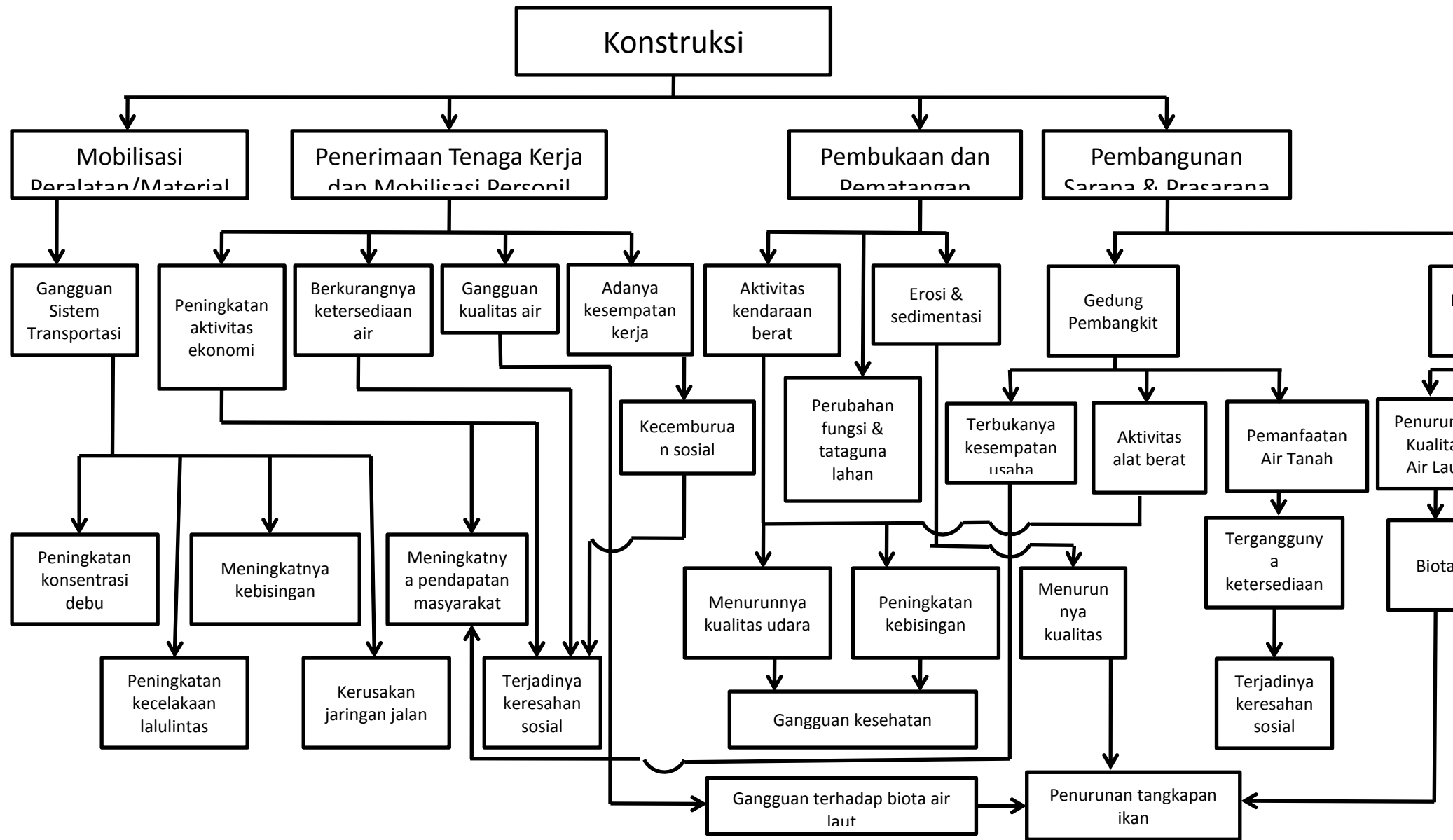
The potential impacts identification method is performed by using the matrix of interaction between components of activities and environmental components affected at any stage of activities (pre-construction, construction and operation) as shown in Table 4.1. In addition, the identification of potential impacts is also performed by using the method of flowchart as presented in Figure 4.1. through Figure 4.4.

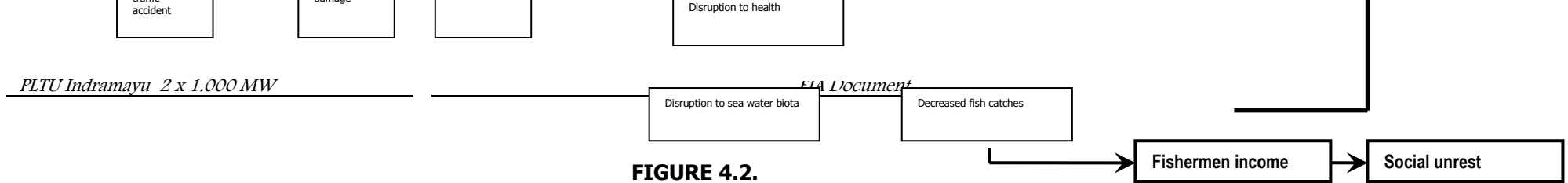
**TABEL 4.1.**  
**MATRIX OF IDENTIFICATION OF POTENTIAL IMPACTS AT PRECONSTRUCTION,**  
**CONSTRUCTION AND OPERATION PHASES OF THE CONSTRUCTION OF PLTU**  
**INDRAMAYU 2 X 1000 MW**

Environmental Components	A		B					C							Remarks
	1	2	3	4	5	6		7	8	9	10	11	12	13	A = Preconstruction B = Construction C =Operation  1. Survey 2. Land Acquisition 3. Worker Recruitment and Personnel Mobilization 4. Tool and Equipment Mobilization 5. Land Preparation 6. Construction of facilities and infrastructure a. Generator house b. Jetty 7. Recruitment of workers 8. Coal loading and unloading (jetty) 9. Operation of Coal Storage System 10. Operation of Generator 11. Operation of Cooling Unit 12. Storage of Coal 13.Operation of water and liquid waste treatment
						a	b								
PHYSICAL AND CHEMICAL															
Air quality			X	X	X	X				X	X			X	
Noise level			X	X	X	X									
PHYSIOGRAPHY															
Topography					X										
Soil stability					X										
HIDROLOGY															
Water run off					X	X									
Surface water quality				X											
Ground water quality															
HYDROOCEANOGRAPHY															
Abrasion							X		X						
Accretion							X		X						
Seawater Quality							X		X	X	X	X	X	X	
SPACE, LAND AND SOIL															
Land allocation					X										
Spatial layout plan					X										
TRANSPORTATION SYSTEM															
Land traffic volume					X										
Sea traffic volume							X		X						
BIOLOGY															
Land flora and fauna					X	X					X				
Sea water biota										X		X	X	X	
SOCIOCULTURAL															
Social process: Public unrest	X	X	X					X							
ECONOMY															
Employment and business opportunity			X			X	X	X							
Income level			X			X	X	X		X		X			
Fish catch							X			X		X			
Public health															
Illness pattern			X	X	X	X								X	
B3 Waste															
B3 Waste Potential														X	



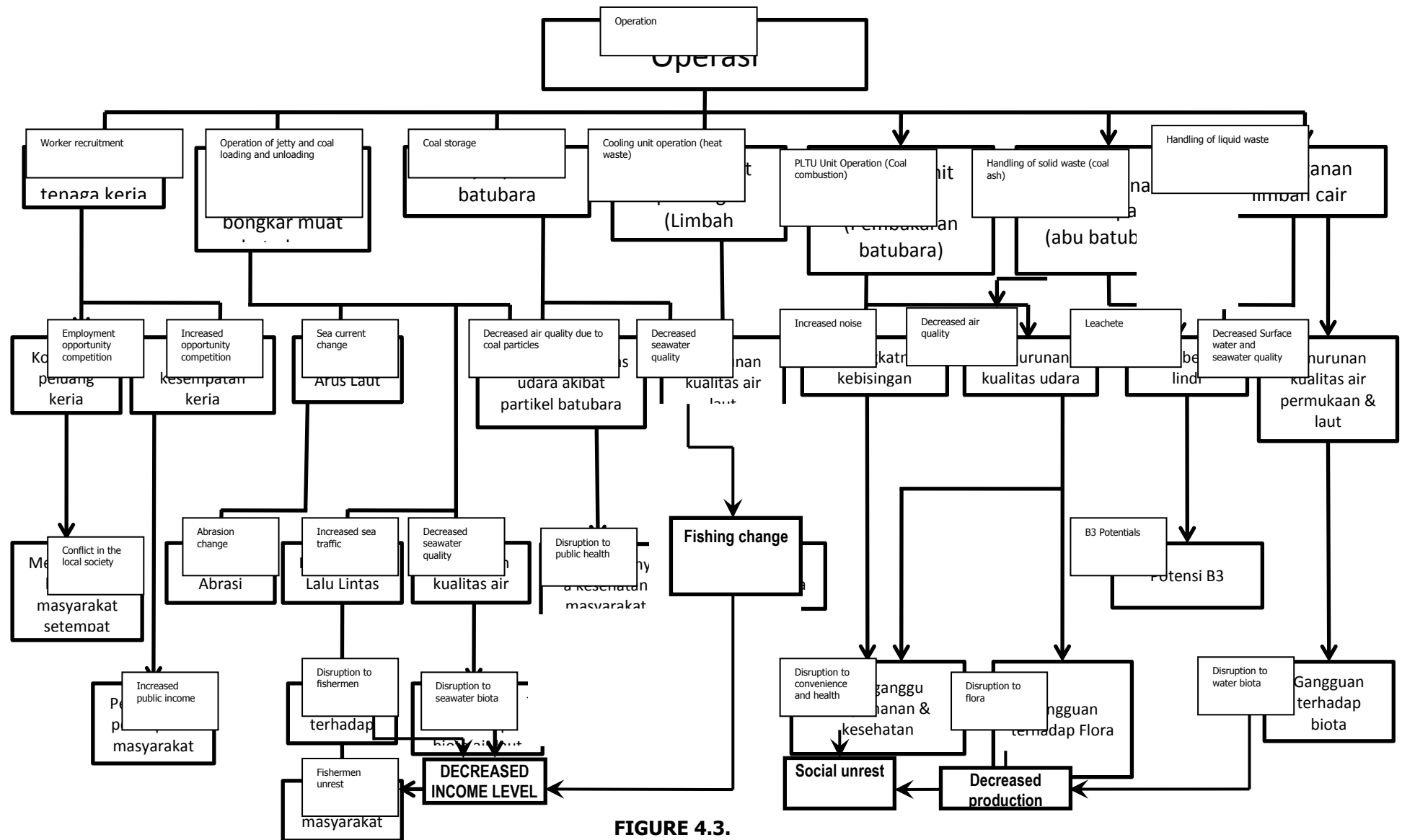
**FIGURE 4.1.**  
**IDENTIFICATION OF POTENTIAL IMPACTS AT PRECONSTRUCTION PHASE**



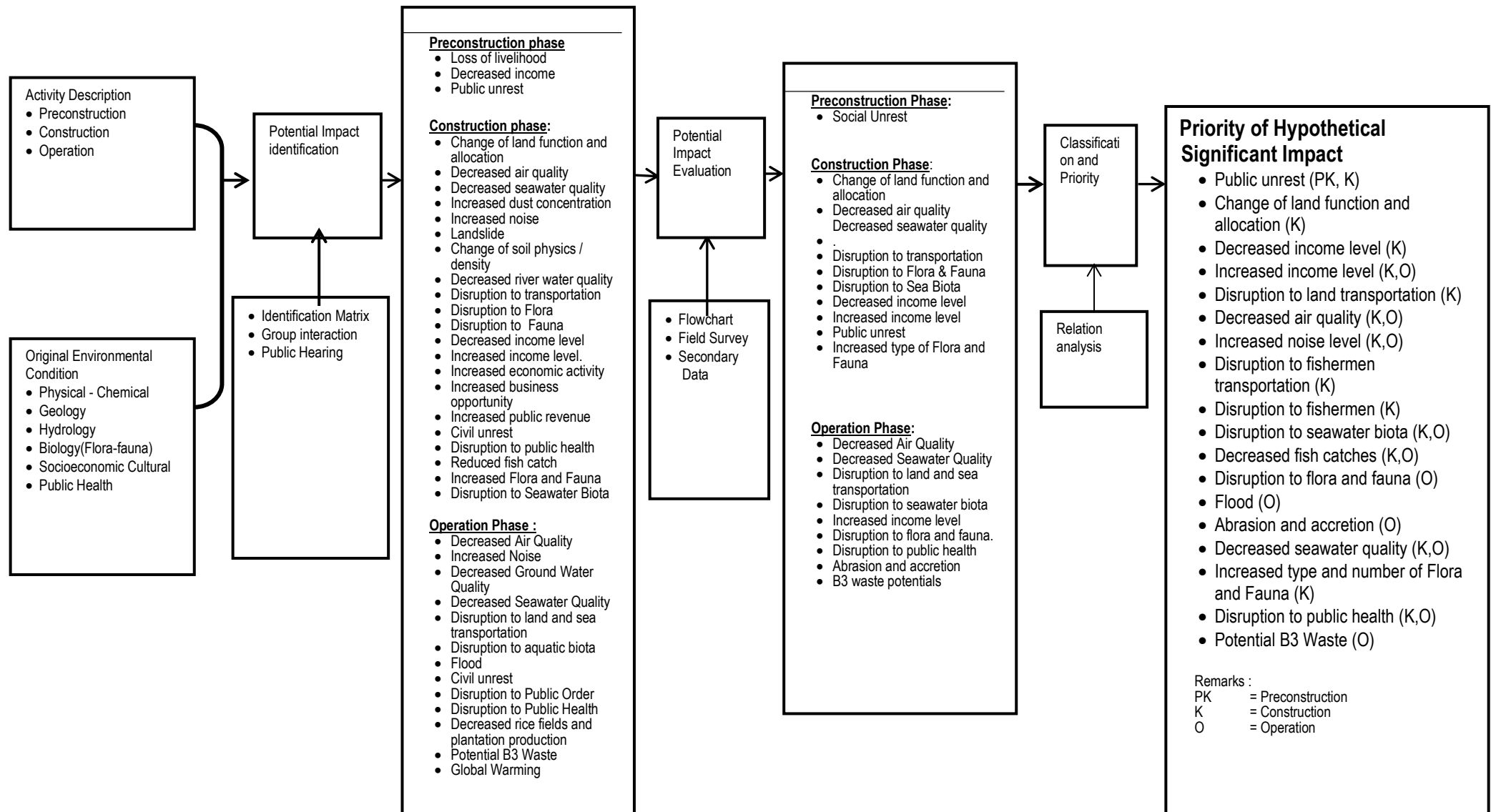


**FIGURE 4.2.**  
**IDENTIFICATION OF POTENTIAL IMPACTS AT CONSTRUCTION PHASE**





**FIGURE 4.3.**  
**IDENTIFICATION OF POTENTIAL IMPACTS AT OPERATION PHASE**



**FIGURE 4.4.**  
**FLOWCHART OF SCOPING PROCESS**

#### 4.1.2. Hypothetical Significant Impact

Evaluation of potential impacts aims to eliminate impacts deemed insignificant or irrelevant, in order to obtain a set of hypothetical significant impacts while focusing is aimed at organizing large and significant impacts into several groups.

Evaluation of potential impacts is prepared based on field observations (environmental baseline studies) and discussion (consultation) with experts, the initiator and related agencies with regard to various suggestions, comments, and feedback from the public considered directly affected by the project activity. From the above study, some potential impacts at **each stage of development are considered significant** by the following considerations:

##### 1. Public Unrest

###### - Preconstruction

Land acquisition will involve the buying and selling of land between the local people and PT. PLN and the land price will be different. If the local people and PT. PLN cannot reach an agreement on the compensation value, several land owners will speculate the land prices and will lead to escalated anxiety of land owners. This impact, if not managed properly, will hinder other construction activities. Under these conditions, land acquisition is a significant impact that should be analyzed in the study.

###### - Construction

At the time of mobilization of personnel and recruitment of workers, the estimated number of personnel required is 1400 workers. Differences in skills and education between the local population (mostly farmers and farm workers) and newcomers may lead to smaller opportunity for local residents to gain employment. Such differences can lead to social tension around the project site that can result in public unrest.

##### 2. Increased Employment Opportunities

###### - Construction

Recruitment will lead to an impact in the form of opening of employment opportunities. During the peak construction phase of PLTU Indramayu 2 x 1,000 MW, the workers required are approximately 1400 employees with certain levels of expertise. Several local workers have fairly high opportunity with regard to the type of construction work.

##### 3. Decreased Income Level

###### - Preconstruction

Acquisition of about 328 hectares of land will result in a number of rice field workers and farm workers lose their jobs. Given the fairly extensive land acquired, the impact of land acquisition on decreased level of income of laborers is significant.

#### **4. Increased Income Level**

##### **- Construction**

Activities of workers in the construction activities in the form of mobilization of personnel in the construction of facilities and infrastructure that reaches thousands of workers need massive transportation, housing, and consumption services. This will increase the existing non-formal economic activity and there is a great opportunity that it (significantly) will increase public income level.

#### **5. Change of Land Allocation**

##### **- Construction**

Construction of PLTU Indramayu 2 x 1000 MW will permanently change land use in the area of 328 ha from rice field into industrial land. This causes permanent changes in the function and land use.

#### **6. Decreased air quality**

##### **- Construction**

Preparation activities of 328 ha of land will require around 6.5 million ton of soil or piled up sand. The piled up sand is taken from a designated place and has been given the permission. The piled up soil is transported using heavy vehicles (trucks) by road. At the time of mobilization, the piled up sand will result in particulate emission from vehicles and dust from scattering from the truck. Given the high number of vehicles and daily frequency, the dust emission is high as well. The dust emissions can reduce the air quality along the piled up soil path and the project site.

##### **- Operation**

Concentration of polluting gases and particulates in the atmosphere will increase due to the chimney emissions resulting from the operation of PLTU Indramayu 2 X 1000 MW. Although PLTU Indramayu 2 x 1000 MW will use precipitator and FGD to clean PM10 and SOx, NOx polluting gases from the coal combustion smoke, as the emissions during operation are continuous, it can cause a significant decrease in air quality. Ash coal in the coal ash storage area will be scattered and cause decreased air quality.

#### **7. Increased noise level**

##### **- Construction**

Mobilization of heavy equipment and materials with as many as 50 vehicles / hour, land clearing and preparation, as well as infrastructure construction can lead to increased noise levels around the path of the mobilization of tools and materials. The noise level generated by the heavy equipment can reach 110 dBA at a distance of about 1 meter.

## **8. Flood**

### **- Construction**

Clearing and preparation of 328 ha of land will change the characteristics of the land surface from rice field into solid land. This change will increase the water runoff during the rainy season or tides and may cause flood.

## **9. Disruption to Flora (Decreased Plant Productivity)**

### **- Operation**

Air polluting gas due to the operation of PLTU Indramayu 2 X 1000 MW may cause disruption to the flora such as rice and fruit crops due to chlorosis and necrosis at SO<sub>2</sub> concentrations of more than 0.5 ppm. The fly ash that falls in agricultural areas can be suspended and causes disruption of the plant growth. Coverage of dust on the leaves of plants will lead to inhibition of the photosynthesis process that affects the level of production.

## **10. Increased type and number of Flora and Fauna**

### **- Construction**

The construction activity predicted to have an impact on flora and fauna components is the construction of facilities and infrastructure such as the planting of green open space (RTH) on vacant land in the construction phase, which consists of plants for protecting the roads, fruit trees and ornamental plants and grasses. The impact is a positive impact namely increased diversity of types and populations of plants and availability of habitat of fauna, which at the project site only consisted of some kinds of similar plants, will be more diverse with more than 20 types around the site. The impact of increased types and populations of plants in the project site in the construction phase is a positive (+) impact, because the number of types and populations of plants grow which can provide a habitat for the animals and improve its other ecological function namely for generating oxygen and binding carbon and certain polluting gases from PLTU Indramayu 2 x 1000 MW.

## **11. Decreased Seawater Quality**

### **- Construction**

Land preparation activities in the dredging process may result in increased turbidity of sea water from 6.5 million cubic meters of piled up soil. It is predicted that the water runoff also contains sludge that significantly degrades the quality of sea water. Decreased quality of sea

water can also be caused by jetty construction activities.

- **Operation**

The impact of operation of PLTU Indramayu 2 x 1000 MW on decreased seawater quality is caused by the activities of PLTU Indramayu 2 x 1000 MW that comes from the water-cooling system (material water) in the form of heat waste. If the sea water temperature change is extreme ( $> 3^{\circ}\text{C}$ ) and it happens continuously, it can cause changes in the chemical composition of the sea water.

## **12. Disruption to Seawater Biota**

- **Operation**

Heat waste water from the cooling system operating system can cause increased sea water temperature which can cause disruption to productivity and even death of plankton and benthos, especially benthic animals with low level of mobility.

## **13. Decreased Fish Catch**

- **Operation**

Leachate from coal stockpiling activities when discharged directly into the water can harm aquatic biota communities namely plankton and benthos and disrupt fish populations (basic fish and crustaceans) in the vicinity of the activity site.

Changes in the composition of plankton and benthos in the waters around the coolant outlet can result in reduced variations in natural feed. The decreased fish feed composition can drive away fish to look for more suitable locations resulting in decreased fish catches.

## **14. Disruption to Fishermen**

Construction of jetty will block cover the marine transport pathways in the vicinity of the jetty site about 2 km to the sea – causing disruption of transportation along 2 km. It can disrupt the mobility of particularly fishing boats departing eastwards returning to Kampung Eretan.

## **15. Decreased Public Health**

- **Construction**

Scattering dust particles into the air from the mobilization of piled up material will result in decreased air quality. Exposure to dust can cause respiratory disease.

- **Operation**

Emission of polluting gases, SO<sub>x</sub>, NO<sub>x</sub> and particulates can be found during the continuous operation of PLTU Indramayu 2 x 1000 MW. Exposure to both gases and particulates inhaled for a long time can cause respiratory problems. Results of recording of level of public health in

various health centers in the area of PLTU Indramayu 2 x 1000 MW indicates that the number of people suffering from ARI is greater than other diseases. Therefore, this activity has the potential to affect public health.

## **16. B3 Waste Potential**

### **- Operation**

Operation of PLTU Indramayu 2 x 1000 MW will generate coal ash / fly ash and bottom ash around 201,624 tons / year. The coal ash will be collected in the ash disposal area occupying an area of  $\pm 1,364,000$  million m<sup>3</sup>. Other B3 waste generated are derived from supporting chemicals in small quantities for example, used lubricating oil, transformer oil, etc.

## **17. Disruption to Traffic Flow**

### **- Construction**

#### **a. Increased traffic volume**

Disruption of traffic flow during the construction phase comes from the mobilization of tools and materials. The mobilization of tools and building materials, construction of facilities and infrastructure across the highway and marine waters in high quantities may potentially cause traffic disruption. During the construction there will be changes of composition of types of vehicles that can disrupt the traffic flow significantly.

#### **b. Damage to road network**

Mobilization of tools and materials will pass through the Pertamina-PLTU Jawa Barat pathway resulting in damage to roads and bridges. The roads of PLTU Jawa Barat (4 km) belong to regency class (gravel) and mobilization of tools and materials can cause damage to the roads.

#### **c. Sea Transportation**

Construction of jetty is expected to significantly disrupt the fishing voyage.

### **- Operation**

#### **a. Sea Transportation**

During the operation of PLTU Indramayu 2 x 1000 MW there will be increased marine vessel traffic increased by 2 times from the present state due to the activities of coal transportation. This increase is significant for sea transport, especially for fishermen.

## **18. Abrasion and Accretion**

### **- Operation**

Erosion and accretion changes in the jetty activity are caused by currents parallel to the shore

generated by waves in the Java Sea. Based on the EIA study of PLTU 3 x 330 MW Jawa Barat (to the west of PLTU Indramayu 2 x 1000 MW), increased abrasion and accretion are studied using Genesisi model and wave climate forecasting with simulation. It is predicted that the abrasion and accretion will take place along 2.5 km from Ujung Gebang with the average annual abrasion of 9566 m (73.99%). The dominant abrasion direction is towards the east and accretion is to the west of the breakwater.

#### **4.2. STUDY AREA AND STUDY TIME LIMIT**

The boundary of the study area of the construction of PLTU Indramayu 2 x 1000 MW is as shown in Figure 4.5, namely:

##### **4.2.1. Project boundaries**

The project boundaries to establish the space and horizon of the studies of PLTU Indramayu 2 x 1000 MW are set based on the land physical boundaries used including land use of up to 328 hectares that will be used as the construction site of the main building of PLTU Indramayu 2 x 1000 MW, its supporting facilities and coal storage yard.

##### **4.2.2. Administrative Boundaries**

Administratively, PLTU Indramayu 2 x 1000 MW is located in Sumuradem Village, Sukra District, Indramayu Regency. Sumuradem village's boundaries are as follows:

- North : Java Sea
- West : PLTU 3 x 300-400 MW Sumuradem Village
- South : provincial highway (*Pantura*)
- East : Irrigation and shrimp farms.

##### **4.2.3. Ecological boundary**

Ecological boundary is the area of spread of impacts of PLTU Indramayu 2 x 1000 MW by the waste transportation medium (dispersion of spread of wastewater and exhaust gas from the chimney). Land area ecological border is associated with the distribution of air quality, while for water area, the ecology study border is taken up to  $\pm$  4-5 km of the coastline by considering the possibility of the spread of hot water as due to blow down of the operation of the cooling unit in the event of damage to the cooling tower and the area of coal unloading at the jetty along 2 km.

##### **4.2.4. Social Boundary**

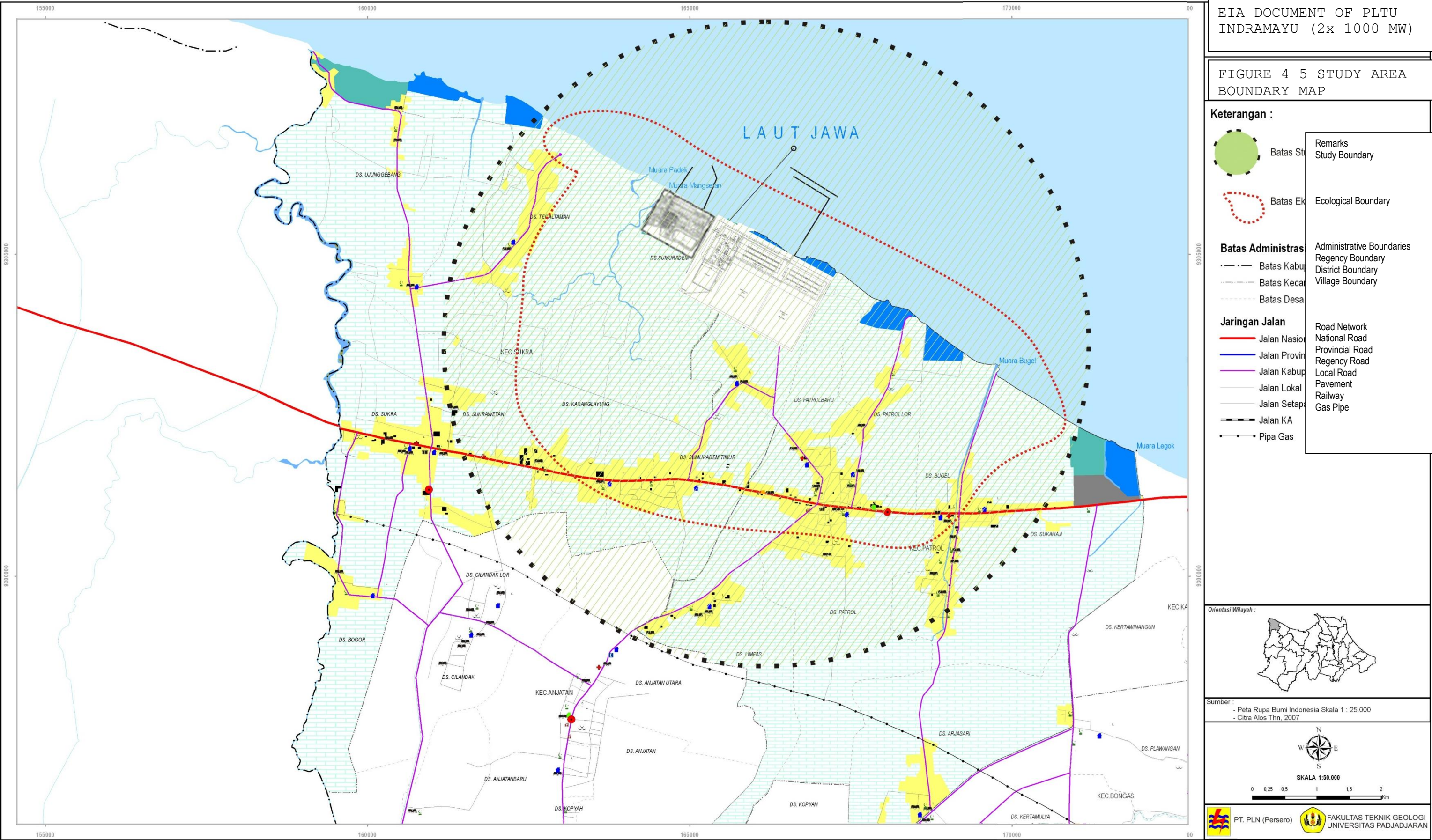
The social boundary that will be directly related to the activities of PLTU Indramayu 2 x 1000 MW includes groups of people who live in Sumuradem Village and Patrol Village, Sukra District, Indramayu Regency.

The study area boundary is the resultant of the boundaries described above and shown in



Figure 4.5.







## CHAPTER V

### SIGNIFICANT IMPACT FORECAST

Significant impact forecast is found after deep observation and discussion between PT. PLN (Persero), resource persons, related institutions and representative communities and those directly affected by the action plan of Indramayu 2 x 1,000 MW steam Power Plan (PLTU Indramayu 2 x 1000 MW).

Each impact is tested based on the criteria of significant impact according to Decree of the Head of BAPEDAL No. 056 of 1994 which includes the number of people affected, distribution of area of impact, duration of the impact, intensity of the impact, many other components affected and reversibility or irreversibility of the impacts.

Based on the criteria of impacts, the interests of significant impacts or insignificant impacts are considered. Furthermore, the impact properties including the classification of impacts are qualified which include negative or positive impacts

#### 5.1. PRECONSTRUCTION PHASES

##### 5.1.1. Land Acquisition

Land acquisition activities include buying and selling activities between land owners and PT. PLN as the initiator of PLTU Indramayu 2 x 1000 MW.

##### 1). Public Unrest

In general, difference in land value as believed by the public and the initiator always occurs in the process of land acquisition. The owners will assess the land price higher because the land is technical irrigation agricultural and ponds land that has high economic values while the value of land offered by the initiator (PT. PLN) is lower and will follow the existing regulations. If no agreement is reached in the land price negotiation process, it can cause tension and unrest among landowners. The unrest is the negative effect that hinders the implementation of the project which will spread beyond the area of the project site resulting in derivative impact of public disorder. Based on this study, land acquisition activities have **significant negative impacts (NP) to public unrest.**

##### 2). Decreased Income Level

Land acquisition activities for PLTU Indramayu 2 x 1,000 MW lead to the loss of assets that are the sources of livelihoods. The prospective land for PLTU Indramayu 2 x 1,000 MW includes wetland, shrimp farms and 1 house belonging to the community. Loss of wetland and farms belonging to residents will result in the loss of livelihoods and reduced sources of income from

the land. The loss of land is expected to have **negative impacts** because the land productivity is quite high and most people do not have other land outside the project site plan of PLTU Indramayu 2 x 1,000 MW besides the loss of jobs of people who work in the shrimp ponds to obtain economic resources.

The public income expected to be lost from the agricultural rice sector with an average yield of 6 tons / season and grain price of around Rp. 300,000, - / quintal is approximately Rp. 18,000,000, - / ha / season while the productivity of crops other than rice, including onion reaches 10-12 tonnes / ha / season. With the selling price of wet onions around Rp. 9,500, - / kg, the economic value of onion crop is around Rp. 9,500,000, - up to Rp. 11,400,000, - / ha / season.

In addition to land-owning farmers, there are also tenants or farm laborers who work on farms that may be affected. They usually earn between To 15,000, - and Rp. 30.000, - / day. Based on the total agricultural production of rice and pulses and the farm laborers revenue that will be lost, the impacts of land acquisition on the income of the people are **significant negative impacts (NP)**.

## 5.2. CONSTRUCTION PHASE

### 5.2.1. Recruitment of Labor and Personnel Mobilization

The manpower needed for the construction and operation of PLTU Indramayu 2 x 1,000 MW consists of labors and skilled workforce. The employment opportunities are open to the surrounding people and migrants according to their expertise.

#### 1). Increased Employment Opportunities

Recruitment and mobilization of workforce will result in the opening of employment opportunities. During the peak construction phase of PLTU Indramayu 2 x 1,000 MW, the labors required are approximately 1,400 labors with certain skill levels, which consist of 1106 local labors and 138 migrant labors. Based on the skills, the labors can be classified as supervisors, plumbing staff, electricians, mechanics, blacksmiths, carpenters, foremen, labors, personnel and so forth. Construction workforce needs will be met by the contractor appointed by PT. PLN with regard to the potential of local labors available. Meanwhile, to support the operation of PLTU 2 x 1,000 MW Indramayu will require manpower with various specifications according to the needs of around 200-250 workers with certain skills. Based on the data from Indramayu Regency BPS, the number of job seekers in Indramayu is increasing every year. For example, in 2004 the number of job seekers in Indramayu regency were 16,170 (BPS, 2005) increased by almost 200% to some 42,612 job seekers in 2008 (BPS, 2009). Based on the data, absorption of 1,106 local labors can reduce the number of job seekers by 2.6%. Moreover, activities of recruitment and deployment of workforce are expected to deliver multiplier effects for the community around the

location of the activities. Communities around the location of activities that cannot work and are not absorbed in development activities of PLTU Indramayu 2 x 1,000 MW have the opportunity and chance to work in the informal sector for instance by opening new businesses, such as rice stalls, beverage stalls, garage, leased house, working as housemaids and providing other services. Therefore, the creation of employment opportunities for the local workforce in the construction activity is a **significant positive impact (PP)**.

## 2). Increased Income Level

The opening of employment opportunities for 1,106 local workers during the construction phase may also increase the income of the local workforce. The construction period, namely the stage of activities of land preparation takes about one year, while the activities of civil construction, mechanical, and electrical will last about 3 years. The wage received by local workforce with laborer skills (based on the amount of wages of the existing power plant) is Rp. 39,000 / day. Based on that sum, during the land preparation phase, workers can only earn Rp. 1.17 million, - / month or about Rp. 14.04 million, - / year. When calculated as a whole period of construction activity for four years with 1,106 local workers, the total wages that can be obtained is Rp. 62,112,960,000, -. Under these conditions, the impact of construction activities on the income of the people around the project is a **significant positive impact (PP)**.

## 3). Public Unrest

In addition to positive impact in the form of opening of employment opportunities for local people, recruitment of labors in the construction phase also causes social unrest as a result of jealousy because of differences in employment opportunities and income. Differences in employment opportunities and income levels between local and migrant workers are caused by differences in the level of expertise and acquired by local and workers. The existence of public unrest may hamper the sustainability of the project. Therefore, public unrest impact constitutes a **negative impact**.

Recruitment activities lead to the opening of employment opportunities for about 1,106 local workers for the development activities. Demands of special expertise in the field of electricity have lead to non-optimum absorption of local workers because the local population around 38% (Sukra District Sumuradem Village, Patrol Lor) are largely farmers and farm workers. Therefore, only a small proportion of local residents can participate besides the income level of local workers that is less than migrant workers because the skill level does not meet the criteria for a job in PLN. Such differences can lead to a negative perception, conflict and ultimately leads to public unrest.

Based on the aforementioned explanation, impact of the recruitment of workers to public unrest is a **significant negative impact (NP)**.

## 5.2.2. Mobilization of Equipment and Materials Activities

### 1). Decreased Air Quality

The path of mobilization of tools and materials from both onshore and offshore sources is the Cirebon – Jakarta path (Figure 5.1) and transported by large vehicles. Under the action plan, the mobilization of tools and materials during the construction is estimated at about 350 trips (one way) per day with the details as presented in Table 5.1. below:



**FIGURE 5.1**  
**PATH OF MOBILIZATION OF EQUIPMENT AND MATERIALS**

**TABLE 5.1.**  
**TOTAL VEHICLES DURING THE CONSTRUCTION PHASE**

Time	Wagons	Trucks
6:00 ~ 7:00	20	50
7:00 ~ 8:00	20	50
8:00 ~ 9:00	20	50
9:00 ~ 10:00	20	50
10:00 ~ 11:00	20	50
11:00 ~ 12:00	0	0
12:00 ~ 13:00	0	0
13:00 ~ 14:00	0	0
14:00 ~ 15:00	20	50
15:00 ~ 16:00	20	50
16:00 ~ 17:00	20	50
17:00 ~ 18:00	20	50
18:00 ~ 19:00	20	50

Source : Analogy Data

Mobilization of equipment and materials will increase the intensity of traffic on the track of Cirebon - Jakarta. Vehicles will emit particulates, nitrogen dioxide (NO<sub>2</sub>) and so forth causing decreased air quality. Vehicle emission factors of large tonnage (60 km / hr) are shown in Table 5.2.

**TABLE 5.2.**  
**EMISSION FACTORS**

Pollution Type	Nitrogen Oxyde	Particulate
Emission Factors (g/km/vehicle)	3.454	0.966

Source: NOx total emission control standard manual, Japan (2000)  
Prediction manual of SPM pollutant, Japan (1997)

Based on the emission factors, the total emissions per hour of nitrogen oxides is 0.121 g // hours and PM<sub>10</sub> is 0.034 g / h. The results of calculations using the Gauss Line Model (PU Puslitbang Jalan, 1999) with the wind speed of 2 m / sec, mobilization of equipment and material can increase the concentration of NOx and ground level particulate at respectively 2.44 and 0.3 µg/m<sup>3</sup>. After 100 meter trip, the addition of concentration of NOx and particulates is respectively 0.127 and 0.035 µg/m<sup>3</sup>.

Based on the results of background concentration ground level in the region passed by the mobilization (PLTU Road), the concentrations of NOx and particulates (see Table 3.5.), the concentration of air pollutants in ambient air in the roads for the mobilization of equipment and materials still meet the quality standards pursuant to PPRI No. 41 of 1999, Based on the explanation above, the exhaust emissions of vehicles for transporting equipment and materials do not add significant pollutants along the path (settlements).

Dust from the transported materials such as piled-up soil, sand and friction between tires of vehicles and the road can also cause decreased air quality. The estimated distribution of dust as a result of these activities is analyzed by the Stoke law.

$$v = \frac{gd^2(\rho_1 - \rho_2)}{18\eta}$$

Where v = settling velocity cm / sec, g = acceleration due to gravity (1,000 cm / s<sup>2</sup>), d = particle diameter of 0.01 cm, r<sub>1</sub> = particle density 1 (g / cm<sup>3</sup>), r<sub>2</sub> = air density 0.0012 (g / cm<sup>3</sup>) and air viscosity η = 170.8 x 10<sup>-6</sup> g / cm / sec, then the particle settling velocity (Vt) is 0.32 m / sec, If the height of the dust on the truck is assumed to reach 10 meters, then the time required by the dust to reach the surface of the soil is 32 seconds at the wind speed at the location of the activities of 2.5 m / sec, then the distance of distribution of the dust can reach 108 meters,

Based on the description above, the increase in the concentration of SO<sub>2</sub>, CO and NOx gas is very low or the Maximum Pollutant Addition (TPM) is less than 10% of the Environmental Quality Standard (BML) of each pollutant gases, but the distribution of dust can reach 64 meters from the road. Based on the activity plan and activities similar to the transportation of piled-up soil by trucks, the contractor will require the covering of the tailgate and watering to reduce particulate emissions. However, in the previous activities (construction of PLTU Jawa Barat 3 x 330 MW), there are still dust scattered that disturb the people resulting in protests. Therefore,

mobilization of equipment and material is a **significant negative impact (NP)** on air quality (dust).

## 2). Increased Noise Intensity

Mobilization of heavy equipment and material transport with as many as 50 vehicles / hour can lead to increased noise levels around the mobilization path. The noise levels that occur can be calculated using the Kadarsa equation (2002) as follows

$$\text{Leq (5 m)} = 25,734 + 5,819 \log x_1 + 17,362 \log x_2 + 2,333 \log x_3$$

Re : - Leq = equal continuous noise level (dBA)  
 -  $x_1$  = vehicle current (total vehicle per hour)  
 -  $x_2$  = average speed (km/hour)  
 -  $x_3$  = Total heavy equipment (%)

The calculations show that the mobilization of heavy equipment emits approximately 72 dBA (60 km / h) noise into Jalur Pantura and 64 dBA at a distance of 5 meters at Jalan Pertamina (40 km / h). The paths used for mobility are the northern coast of West Java road and the road of PLTU Jawa Barat 3 x 330 MW.

Jalur Pantura is a busy street so that the mobilization of equipment will not be a problem for the society and there is no settlement along the PLTU Jawa Barat 3 x 330 MW road so it will not interfere with the public.

Based on this explanation, the impact of increased noise intensity from the mobilization of equipment and materials is an **insignificant negative impact (NTP)**.

## 3). Decreased Public Health

Scattering dust particles into the air from the mobilization of piled up material will cause a decrease in air quality. Exposure to dust can cause respiratory disease. If the primary impact of a decrease in air quality is not well managed and seen from the number of people affected and duration of the impact, mobilization of equipment and material will lead to an impact in the form of respiratory. The diseases caused by the activity are sensitive impacts. Based on these considerations, the increased concentration of dust due to the mobilization of piled up soil in preparation of land on health is categorized as a significant negative impact.

### 5.2.3. Land Preparation Activities

The main activities of land clearing and preparation for the infrastructure and facilities of PLTU Indramayu 2 x 1,000 MW is vegetation clearing and piling up of 318.5 ha (2450 m x 1300 m) of land at an altitude of about 2 m.

## 1). Ambient Air Quality



Heavy equipment used in land clearing and preparation emits air pollutants which can cause the increase of concentration of air pollutants in the atmosphere. The emission factors of land maturation activities are presented in Table 5.3. The calculation of estimated contribution of pollutant gases in the air uses Gaussian distribution, wind speed of 2 m / sec, source height of 2 meters in the project site area resulting in the increased gas pollutants as follows:

**TABLE 5.3.**  
**EMISSION FACTORS OF POLLUTING GASES SO<sub>2</sub>, NO<sub>2</sub> (M<sub>3</sub>N/H)**

No	Equipment	Power (kW)	Quantity (unit)	Fuel consumption (kg/h/unit)	SO <sub>2</sub> Emission Factor (SO <sub>2</sub> ) (m <sup>3</sup> N/h/unit) *	Nitrogen Oxide (NO <sub>2</sub> ) factors (m <sup>3</sup> N/h/unit)*
1	Backhoe	93	96	14.4	0.020	0.201
2	Dump truck	246	204	11.1	0.016	0.150
3	Crawler crane	110	384	8.7	0.012	0.113
4	Truck crane	169	48	7.1	0.010	0.089
5	Mobile crane	116	120	8.4	0.012	0.109
6	Prime mover	110	48	15.7	0.022	0.222
7	Excavator	162	168	24.6	0.034	0.371
8	Concrete Mixer	213	144	10.6	0.015	0.142
9	Concrete pump	166	120	11.6	0.016	0.157
10	Compressor	55	312	9.6	0.013	0.127
11	Generator	190	336	27.3	0.038	0.417
	Total		1980	149.1	0.208	2.098

**TABLE 5.4.**  
**ESTIMATED INCREASE OF AIR POLLUTION FROM LAND PREPARATION ACTIVITIES**

Parameter	Unit	Concentration		Quality Standard
		Initial Level	Increase	
SO <sub>2</sub>	µg/m <sup>3</sup> (1 hour)	tt-6.8	0.05	230
NOx	µg/m <sup>3</sup> (1 hour)	tt-14.5	1.3	150

Based on the table above, the pollutant gas emission from land preparation activities do not significantly degrade air quality and categorized as an **insignificant negative impact (NTP)**.

## 2). Increased Noise Level

The use of heavy equipment on land maturation activities generates noise at the project site with the noise intensity of each machine as follows:

**TABLE 5.5.**  
**NOISE INTENSITY OF HEAVY CONSTRUCTION EQUIPMENT**

No	Equipment	Unit	Noise Intensity (L <sub>OE</sub> )
1	Bulldozer	dB(A)	110
2	Excavator	dB(A)	105
3	Staking machine	dB(A)	105
4	Crane	dB(A)	105
5	Backhoe	dB(A)	100
5	Generator	dB(A)	100
5	Compressor	dB(A)	88

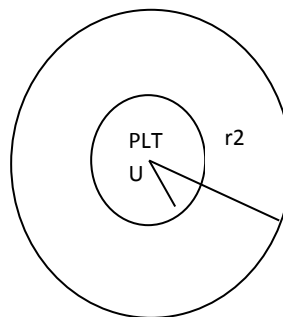
6	Forklift	dB(A)	88
7	Mixer truck	dB(A)	88
8	Water pump	dB(A)	88
9	Cement mixer	dB(A)	88

Source : Calculation of similar activity

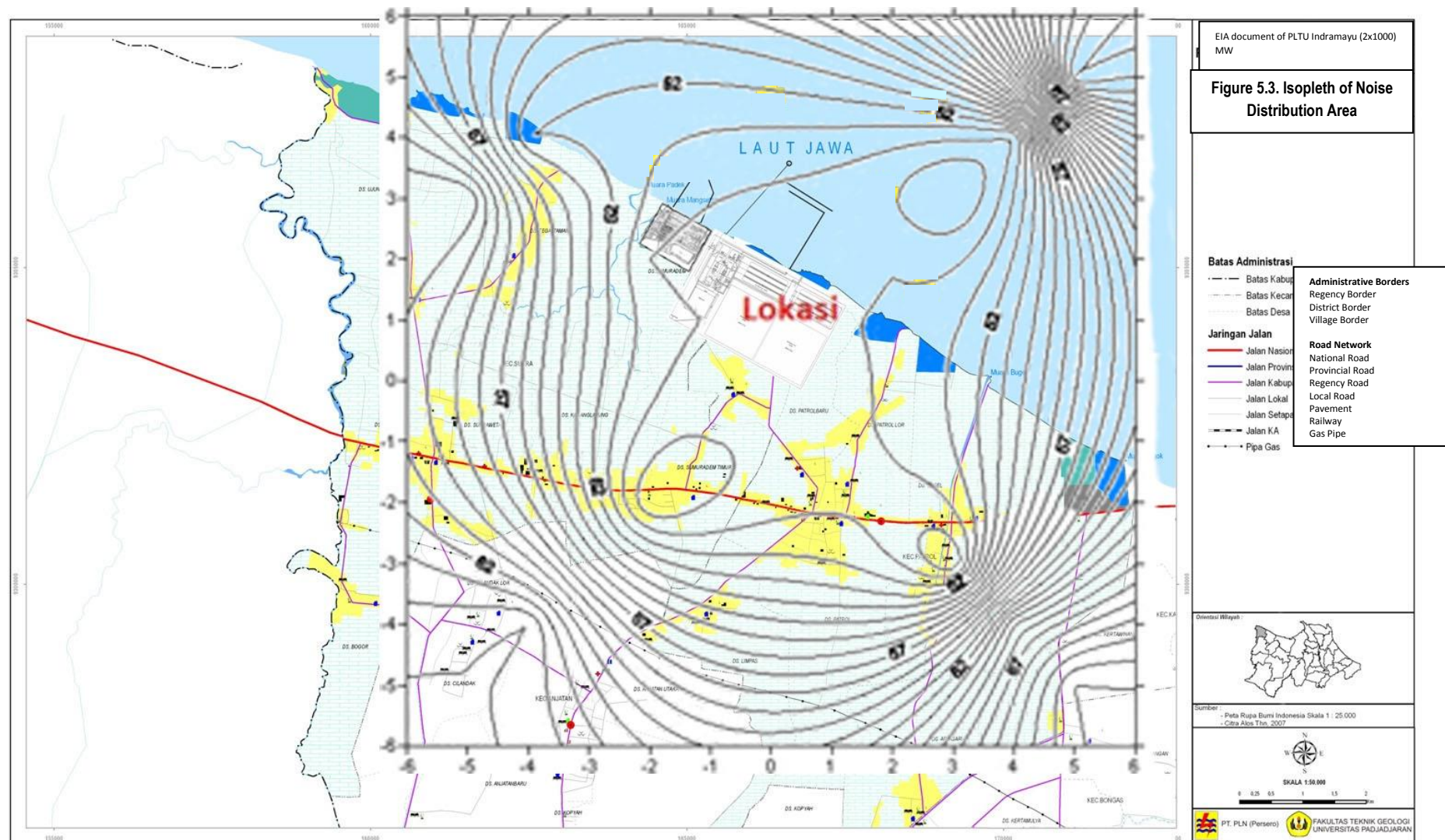
The level of noise that occurs during land clearing and preparation can be estimated using the following equation:

$$LP_2 = LP_1 - 20 \log (r_1/r_2)$$

Assuming the average noise level from the operation of heavy equipment at a distance of 500 m ( $r_1$ ) is 100 dBA, the noise level received by the settlements nearby (4000 meters,  $r_2$ ) is 82 dBA. This value has exceeded the quality standard of noise level for residential areas namely 55 dBA. Based on the level of noise intensity due to land clearing and preparation activities, the impact of the mobilization of tools and materials is an **significant negative impact (NP)** with regard to the noise level.



**FIGURE 5.2.**  
**NOISE DISTRIBUTION SCHEME AT THE PROJECT SITE**



### 3). Traffic Flow Disturance (Land)

Land maturing activities are carried out by piling up the potential location of the building site with soil as high as 2 m. The land area that will be prepared for the construction of the power plant is 318 ha requiring 6,500,000 m<sup>3</sup> piled up soil. The piled up soil is brought in from outside the area, which must be transported by truck. The type of transportation used is truck with the capacity of 8 m<sup>3</sup>. With the need 6,500,000 m<sup>3</sup> piled up soil transported by truck, the transportation requires  $(6,500,000 \text{ m}^3 / 8 \text{ m}^3 =) 812,500$  trucks. The piling up activity is assumed to last for six months, because piling up activity is a land maturing activity that should be completed so that development activities can be implemented. With these assumptions, the transportation of piled up soil activities is expected to cause an increase the traffic flow in the forms of  $(812,500 \text{ trucks} / 360 \text{ days} =) 226$  trucks per day. Assuming the daily piling up activities will last for 10 hours a day, the total vehicles for land transportation activities will lead to the addition of vehicle volume of as many as 23 trucks per hour equivalent to 46 SMP / h.

The increasing total traffic when compared with the recent volume of traffic in the area (prior to development activities) is quite high as the highest traffic volume in the area of the study is 2296 SMP / hour and the lowest is 151 SMP / h. Under these conditions, the impact of piled up soil transportation activities will increase 2.0% on the busiest path and the lowest will increase by about 30.46%. The 12 month piling up will increase the volume of vehicles passing PLTU Indramayu 2 x 1,000 MW construction site at the highest point will be  $2296 + 46 = 2342$  SMP / h and at the lowest point  $151 + 46 = 197$  SMP / h. Assuming the implementation will last 12 months, the road capacity still allows such condition because from the observation, the road capacity in the area is 5831.75 SMP / h at the highest point. In addition to the increased traffic volume, the piled up soil transportation activities will also potentially result in damage to the road and dirtiness which could further increase traffic accident probability. Under these conditions the transport of material for piling up is considered as a **significant impact that needs to be managed (NP)**.

### 4). Sea water quality

Piling up activities for the maturing of land for the infrastructure and facilities of PLTU Indramayu 2 x 1,000 MW (generator house) in an area of 318.5 ha (2450 m x 1300 m) at a height of about 2 m requires piled up soil of around 6,500,000 m<sup>3</sup>. At the times of rain and high waves, the piled up soil will enter the sea and is expected to increase the turbidity of seawater by  $> 400 \text{ mg} / \text{l}$ . The subsequent **negative** impact due to the increased turbidity of water is disruption to the marine life, including fish thus disrupting the income levels of fishermen.

Although the object affected by this activity is the water body along the coast, because it lasts for around 1 year, high impact intensity and spread along the coast, the impact is categorized as a significant negative impact (NP).

### 5). Land use change

The land to be used for the construction site at present is in the form of agricultural land. The use of land for the construction of a Steam Power Plant will result in changes in the land use from agricultural into construction land. Such changes in land use will lead to loss of production earned from the land. Field study shows that the area is used for growing rice with the production rate of 5.6 tons / ha per year. Therefore, the change of land use in an area of 300 ha from agricultural land into the structure of PLTU Indramayu 2 x 1,000 MW will cause reduced production of 1680 tons of rice annually.

The construction of PLTU Indramayu 2 x 1000 MW When viewed from the total area of agricultural land in Sukra District will result in changes in the reduced function of agricultural land in the form of conversion into construction land by 8.19% and when seen from the total area of agricultural land in Indramayu Regency that change accounts for 0.22% of the total agricultural land in Indramayu regency. Furthermore, when viewed from the land use allocation plan in the future, Indramayu regency allocates land for agriculture in an area of 118,513 ha. This means that 14,861 Ha of the existing agricultural land is reserved for use change, resulting in small changes in 300 ha of agricultural land of in Sukra District. In addition, the change of land use is still in line with the allocation of land under the Spatial Layout Plan of Indramayu Regency. Based on the impact, the land use change is considered as an insignificant negative impact (NTP) but as the change is in line with the Spatial Layout Plan of the regency, the impact is considered a significant positive impact (PP).

### 6). Flood

Land maturing activities in the forms of piling up and excavation will lead to changes in the landscape that can cause flooding / puddles during the rainy season and during tides resulting in a negative impact because the project site will cut the existing drainage channels which are not maintained.

The estimated increase in the surface flow rate due to the opening of land cover can be calculated using the Chow formula, as follows:

$$Q = (C_p - C_o) \cdot I \cdot A \text{ m}^3/\text{hari hujan}$$

$C_p$  is the coefficient of average water runoff in the area affected by the business plan and / or activities.  $C_p$  for rice fields is 0.01 - 0.10, 0.4 for shrimp ponds, 0.25 for rocky sand road and 0.30 for drainage channel while at the time of construction phase, vacant land has the  $C_p$  value of 0.30 and for open areas with soil compaction the  $C_p$  is 0.05 (Soemarwoto, 1991).  $C_o$  is the runoff coefficient in the area of virgin forest.

**TABLE 5.6.**  
**PREDICTED CHANGE OF SURFACE RUNOFF OF LAND OPENING AND MATURING**

No	Land Cover	Total Area (m <sup>2</sup> )	Land cover coefficient	Rain intensity (m/day)	Flood debit (m <sup>3</sup> /day)	Flood debit (liter/s)
<b>I</b>	<b>PRECONSTRUCTION PHASE (INITIAL CONDITION)</b>					
	a. Rice fields	3,099,980	0.100	0.0225	6,975	81
	b. Shrimp ponds	160,000	0.400	0.0225	1,440	17
	c. Soil road	9,100	0.250	0.0225	51	1
	d. Drainage channel	7,000	0.300	0.0225	47	1
	<b>Total Debit during Preconstruction (Initial Condition)</b>	<b>3,276,080</b>			<b>8,513</b>	<b>99</b>
<b>II</b>	<b>CONSTRUCTION PHASE</b>					
	a. Vacant Land	3,276,080	0.300	0.0225	22,114	256
	<b>Total Debit during Construction</b>	<b>3,276,080</b>			<b>22,114</b>	<b>256</b>
	<b>Increase of Debit during construction</b>				<b>13,600</b>	<b>157</b>

Source: Consultant Calculation, 2010.

Therefore the water runoff increase (AQ) after the construction of PLTU Indramayu 2 x 1,000 MW will increase by 22,114 m<sup>3</sup> / day - 8,513 m<sup>3</sup> / day = 13,600 m<sup>3</sup> / day or 157 liters / sec.

Based on the determination of significant impacts, land cover change can increase water run-off that can cause flooding. It is therefore a significant negative impact (NP).

#### 5.2.4. Construction of Facilities and Infrastructures

Construction of facilities and infrastructure predicted to have an impact on the environment component is onshore construction which includes the construction of the main building (plants) and replanting facilities (RTH) and offshore construction in the form of construction of jetty.

##### 1). Decreased Sea Water Quality

Construction of facilities and infrastructure in the planned construction of PLTU Indramayu 2 x 1,000 MW has an impact on the quality of sea water. The construction of facilities and infrastructure that brings the impact is the construction of coal unloading jetty with a capacity of 12,500 DWT. This construction will include the installation of stakes and dredging which will increase the turbidity of seawater and further disrupt marine biota water. The installation of jetty stakes and dredging has a negative impact on the environment component in the form of increased turbidity of seawater and water biota.

Installation of stakes will be done along the access bridge (1,500 m) and the Jetty (± 900 m) while dredging will be done along 900 m to a depth of 9 m and the construction of wave breaker will increase the turbidity of seawater above the natural turbidity and cause disturbance to marine life, especially in the forms of death of benthos, fish habitats and primary productivity.

Based on the considerations of the aforementioned characteristics, the impact of jetty construction activity is forecasted to be a significant negative impact (NP) on the quality of sea water and marine water biota.

## **2). Increased type and numbers of flora and fauna**

The construction activity predicted to have an impact on flora and fauna component is the **construction of facilities and infrastructure** such as the planting of green open space (RTH) on vacant land in the construction phase, which consists of the cover crops, fruit trees, ornamental plants and grasses. The impact is a positive impact namely the increase in the diversity of species and populations of plants and habitat of fauna, which at the project site only consisted of several similar cultivation plant which now will be diverse with more 20 types like those growing around the site. The impact of increased species and populations of plants in the activity site in the construction phase is a positive impact (+), because the number of species and populations of plants grows and provides a habitat for the fauna there and improves other ecological functions, namely generation of oxygen and carbon sequestration and binding of certain pollutant gases from PLTU Indramayu 2 x 1000 MW. Some research suggests that the plants will be able to absorb around 60-70% of the surrounding air pollutants.

The increased diversity of types and populations of plants in the construction phase has a relatively large value based on the difference in the number of plant species at the activity site during the baseline that consisted of only a few species compared with the number of plants species in other activities during the operation phase which is forecasted to reach more than 20 types.

Based on the criteria for assessing the interest impact, tree planting activities in the construction of infrastructure facilities in the green open space (RTH) is a significant positive impact (PP)..

## **3). Increased Income Level**

Activities of civil works, mechanical and electrical services require transportation, food, commerce, entertainment and supply of construction materials. They can improve people's economic activities and open new job opportunities for the people and businesses in the vicinity of the site. The derivative impact is the increased income levels. Therefore, the impact is categorized as a positive impact. Based on other earlier activities in PLTU Jawa Barat, at the stage of construction, some communities around the project site felt an increase in their income from providing boarding services, food, transportation and supplying construction materials. The revenues are used for other activities for example for purchasing livestock.

Judging from the impact interest based on six (6) criteria of a significant impact, the impact of civil, mechanical and electrical works increases income. Therefore, the impact of increased income level is considered a **significant positive impact (PP)**.

#### 4). Fishermen Transportation Disruption

The jetty construction activities will close the sea transport path in the vicinity of the jetty activity site about 2 km to the sea which causes disruption of transportation along 2 km. It can interfere with mobility of fishing boats especially those departing / returning eastwards to the Eretan village and otherwise. The impact of impaired boat mobility will make the travel distance to the location of fishing and home longer and will increase cost. Therefore, the impact is considered a negative impact. Disruption of transportation of fishermen will take place during the construction of jetty (6 months). Based on the criteria for a significant impact, the impact of fishermen transportation disruption due to pier construction is a **significant negative impact (NP)**

#### 5). Disruption to Fishermen

The location of construction of jetty at about 2 km to the sea is one of the areas of fish aquaculture or fish catching. The construction activity through the installation of stakes may increase the turbidity of seawater not only at the site but also at the surrounding depending on the speed and direction of currents. The increased turbidity can damage water biota as natural food and cause fish to move to other locations. It can lower fish catches. The reduced fish catches will lead to decreased income of fishermen for about 6 months. Based on the criteria for a significant impact, the impact on fishermen due to the jetty construction is a **significant negative impact (NP)**.

### 5.3. OPERATION PHASE

#### 5.3.1. Vacancy

##### 1). Work Opportunity

The operational stage of PLTU Indramayu 2 x 1,000 MW needs workers with various specifications according to the needs, namely around 200-250 workers with certain skills. Although the total workers required is small and the expertise required is very specific thus limiting the opportunity of local workers to work in the operational activities of PLTU Indramayu 2 x 1,000 MW, if the project provides courses / training for the local community, it is expected to broaden the opportunities to get jobs there. Under these conditions, the impact of operational activities of PLTU Indramayu 2 x 1,000 MW on employment opportunity is a **significant positive impact (PP)**.

##### 2). Increased Income Level



Increased income of the people around the project is the impact derived from the number of employment opportunities during the operation of PLTU Indramayu 2 x 1000 MW. Although the number of local workers is relatively small, in line with the long operation period of PLTU Indramayu 2 x 1000 MW, the impact of the increase in revenue is a **significant positive impact (PP)**.

### 3). Social Unrest

Recruitment problems are issues that often arise not only during construction but also during project operation phases. Demands to be involved in the projects operation are often hampered by the inability to meet the expertise required by the project by the local workers. The small number of local workers accepted to be employees of PLN has led to rivalry between communities and caused conflicts between local job seekers which will be escalated if the majority of workers are immigrants with no regard to culture resulting in imminent conflicts with local communities. If this issue is not managed properly, it will cause prolonged unrest in the community. In addition due to labor conflicts, social unrest can also be triggered by the operation of PLTU Indramayu 2 x 1000 which will potentially cause health problems, for example due to the reduced air and water quality (surface water and sea water). In addition, the unrest can also arise because of the potential disruption of access to sea transportation, especially for the fishermen in the vicinity of the jetty belonging to PLTU Indramayu 2 x 1,000. Based on this explanation, the impact of the operations of the steam power plant on social unrest is a **significant negative impact (NP)**.

## 5.3.2. Coal loading and unloading activities (Jetty)

### 1). Sea water Quality

The impact of coal fuel procurement activity to the declined sea water quality comes from the process of loading and unloading of coal. During the process of loading and unloading of coal, it is expected that there will be spillage from the loading vessel / barge to hopper or along the transport using conveyor to the coal yard. The impact of coal loading and unloading activity is negative in the form of declining water quality in the forms of increased turbidity of seawater and increased chemical parameters in the forms of organic and inorganic compounds.

Based on the project description, it is noted that the operation of PLTU Indramayu 2 x 1,000 will require a massive number of coal at 1500 tons / hour with the capacity of the belt conveyor of 3.600 tons per hour. Based on the annual coal requirement of 3752 million tons / 1000 MW (7.504 million tons), the estimated spillage during transportation is 0.01% which means that every year there will be spillage of 750,400 kg / year (750.4 tons / year) of coal.

Based on the considerations of the characteristics of impact, the impact of loading and unloading of coal activity is projected to be a **significant negative impact (NP)** on the quality of sea water and sea water biota.

## 2). Disruption to Fishermen

Based on the data, the operational needs of coal for the generation of 1000 MW electricity requires 3.752 million tons of coal every year. Such demand for coal is met from outside of Java namely from Kalimantan by using vessels with the capacity of 12,500 DWT. According to the annual needs of coal and capacity of the freighter used, it is expected that two vessels will be needed every day to transport the coal.

At this time, PLTU Jawa Barat which is located nearby with the capacity of 1000 MW has been in operation. The capacity must be met by coal which will require a vessel every day for transporting the coal. With the operation of PLTU Indramayu 2 x 1000 MW, located in Patrol village, the boats in the waters of Indramayu will increase by three ships a day.

The increased number of ships sailing is expected to give a negative impact on the fishermen communities in the region. The voyage to transport coal can cause accidents in the forms of collisions between fishing ships and colliers. Moreover, the area is the location of fishing nets and the colliers may damage the fishing nets due to being swept by the vessels. When this happens it is estimated that tension will break between the community and PLTU Indramayu 2 x 1,000 MW. Therefore, it is a **significant negative impact (NP)** which must be managed.

## 3). Abrasion and accretion

Based on the EIA study of PLTU 3 x 330 MW Jawa Barat (west to PLTU Indramayu 2 x 1000 MW), increased abrasion and accretion is studied using Genesisi and climate forecasting models with simulation of waveform resulting in estimates of abrasion and accretion along 2.5 km from Ujung Gebang coast with the average annual abrasion 9,566 m (73.99%). Operation of breakwater and jetty of PLTU Indramayu 2 x 1000 MW can spur changes in abrasion and accretion in Indramayu coast due to the currents generated by waves in the Java Sea. The increased abrasion has reduced the number of ponds while accretion shallows the sea that may disrupt the mobility of fishermen.

The predicted increased abrasion and public attention to abrasion during dissemination and discussion of the Terms of Reference and draft EIA report, the effect of abrasion is categorized as a **significant negative impact (NP)**.

### 5.3.3. Operation of Coal Handling System

#### 1). Quality of Surface Water and Groundwater

The coal yard will produce leachate that will have an impact on the environment, particularly groundwater and seawater because of its position on the shore. The leachate water comes from the washing of coal during rains or watering. The coal yard is equipped with a drainage channel to drain the leachate to the WWTP for treatment. In addition, the bottom of the coal yard is lined with geo-textile to prevent contamination of groundwater by the leachate. The Leachate from the coal yard contains a lot of organic and inorganic materials such as NO<sub>2</sub>, sulfur, and heavy metals that can cause negative impacts on the environment.

Based on the evaluation criteria of a significant impact, the operation of coal handling system on the quality of soil and sea water as described above is categorized as an insignificant negative impact (NTP), but soil pollution must be monitored.

#### 5.3.4. Plant Operation

##### 1). Air Quality

Based on the specifications of coal and operating system of PLTU 2 x 1000 MW and operation of existing PLTU Jawa Barat 3 x 330 MW (to the West) presented in Table 5.7, the concentration of emissions and maximum ambient air concentrations can be identified. Based on the results of calculations using the Briggs and Gaussian equations using SCREEN 3 software, it is known that the flow rate of gas (20.3 m / sec) of the chimney does not cause downwash. The pollutant emissions released by PLTU Indramayu 2 x 1000 MW complies with Regulation of the Minister of Environment No. 21/2008, and the location of receiving the biggest impact of PLTU 2 x 1000 MW is about 2 km from the plant.

**TABLE 5.7.**  
**SPECIFICATION OF UNITS 1 AND 2 OF PLTU INDRAMAYU 2 X 1000 MW**

Parameter		Unit	Project	
			Unit 1	Unit 2
Flow rate (wet) (0°C, O <sub>2</sub> 3.76%)		×10 <sup>3</sup> m <sup>3</sup> <sub>N</sub> /h	3,286	Same as unit 1
Flow rate (dry) ( 0°C, O <sub>2</sub> 3.76%)		×10 <sup>3</sup> m <sup>3</sup> <sub>N</sub> /h	2,752	
Sulphur content		%	0,5	
Gas temperature		°C	130	
Chimney height		m	220	
Chimney diameter		m	9.2	
Gas release rate		m/s	20.3	
Emission rate	Sulphur dioxide	kg/h	2,460	
	Nitrogen oxide	kg/h	1,592	
	Particulates	kg/h	155	

**TABLE 5.8.**  
**SPECIFICATION OF PLTU JAWA BARAT (ADJACENT)**

Parameter		Unit	Nilai
Flowrate		$\times 10^3 \text{ m}^3 / \text{h}$	6,400
Temperature		$^{\circ}\text{C}$	130
Chimney height		m	215
Chimney diameter		m	6.3
Emission rate	Sulphur dioxide	kg/h	4,800
	Nitrogen oxide	kg/h	4,200
	Particulates	kg/h	532

Source : EIA of PLTU Jawa Barat

Gas temperature is assumed equal to PLTU Indaramayu 130 $^{\circ}\text{C}$

**TABLE 5.9.  
EMISSION STANDARD**

Parameters	Unit	Regulation of the State Minister for the Environment No. 21/ 2008*	IFC EHS guideline** (Dec,2008)
SO <sub>2</sub>	mg/m <sup>3</sup> <sub>N</sub>	750	200-850
NO <sub>2</sub>	mg/m <sup>3</sup> <sub>N</sub>	750	510
Particulates	mg/m <sup>3</sup> <sub>N</sub>	100	50
Opacity	%	20	-

\* at 25°C, O<sub>2</sub> 7% \*\* at 0°C, O<sub>2</sub> 6%

Based on the specifications of PLTU Indramayu 2 x 1,000 MW, the type of coal, dominant wind direction and speed and operation of PLTU Jawa Barat 3 x 330 MW, it is known that the maximum pollutant gas concentration in the affected area is at residential areas. The distribution calculation uses Gaussian equation using SCREEN 3 software, for URBAN and flat terrain conditions.

The dominant wind directions towards the residential area are from the north, northwest, northeast and east, and the average wind speed is dominantly 1.0 to 1.9 m / sec. For calculation, the wind speed used is 1.5 m / sec and atmosphere stability is C (1-10 m / sec). The calculation of emissions impact of PLTU Indramayu 2 x 1000 MW on air quality is done through three scenarios: Scenario 1 if only one unit of the plant is operated, scenario 2 if PLTU Indramayu 2 x 1000 MW Unit 1 + 2 are operated, and scenario 3 if PLTU Indramayu 2 x 1000 MW Unit 1 + 2 and PLTU Jawa Barat are operated. The calculation of the scenarios is presented in Table 5.10 to 5:12 with the results as follows:

1. Locations exposed to the addition of SO<sub>2</sub>, NO<sub>x</sub> and PM<sub>10</sub> air pollutants are maximally 4500 meters from PLTU Indramayu 2 x 1000 MW
2. The concentration of SO<sub>2</sub> in the air in the study area is not detected – 16.9 µg/Nm<sup>3</sup> (1 hour), the operation of PLTU Indramayu 2 x 1000 MW and existing PLTU Jawa Barat without FGD will maximally increase to be - 552 µg/Nm<sup>3</sup> (1 hour). Meanwhile, if using FGD (efficiency 90%), it will increasing to 54 to 70.9 µg/Nm<sup>3</sup> (1 hour). The concentration still meets the quality standards under PPRI No. 41 of 1991 on national air quality (900 µg/Nm<sup>3</sup>, 1 hour).
3. The concentration of NO<sub>2</sub> in the study area is not detected – 27.5 µg/Nm<sup>3</sup> (1 hour), and the operations have Indramayu 2 x 1000 MW and the operation of existing PLTU Jawa Barat without LNB will maximally increase to be 355.9 to 383.4 g / Nm<sup>3</sup> (1 hour). This concentration has exceeded the quality standard under PPRI No. 41 of 1991 on national air quality (400 µg/Nm<sup>3</sup>, 1 jam). Jika menggunakan LNB (efisiensi 80 %), konsentrasi di wilayah pemukiman menjadi 81,4 Nm<sup>3</sup> – 108,9 Nm<sup>3</sup> ( 1 ja If using LNB (efficiency 80%), the concentration in residential areas is 81.4 Nm<sup>3</sup> - 108.9 Nm<sup>3</sup> (1 hour m).

4. Concentration of  $PM_{10}$  in residential areas is 30,8 – 86  $\mu\text{g}/\text{Nm}^3$  (24 jam), the concentration is expected to increase after the operation of PLTU Indramayu 2 x 1,000 MW and PLTU Jawa Barat will be 55.5 to 111.7  $\mu\text{g}/\text{Nm}^3$  (24 hours). Both power plants use ESP (99.9%) for reducing dust emissions into the atmosphere. The forecast results are still below the quality standard pursuant to PPRI No. 41 of 1999 (900  $\mu\text{g}/\text{Nm}^3$  (1 hour). The isophlete map of increase in  $SO_2$ ,  $NO_2$  and  $PM_{10}$  pollutant gas during the operation of PLTU Indramayu 2 x 1000 MW is shown in Figure 5.3.

However, the increased concentration of  $SO_2$  and  $NO_2$  after the operation of PLTU Indramayu 2 x 1000 MW without  $SO_2$  pollution control with FGD of eight addition (> 10% of the quality standard). PLN will build the FGD unit using sea water as the absorber to anticipate the quality of coal. In addition, it is a LowNOx Burner combustion system making it expected not to cause air pollution.

**TABLE 5.10.**  
**INCREASED  $SO_2$  CONCENTRATION FROM THE OPERATION OF PLTU INDRAMAYU UNIT 1, 2 AND PLTU JAWA BARAT**

Operation	Distance from PLTU Indramayu 2 x 1000 MW	Increased $SO_2$ concentration $\mu\text{g}/\text{Nm}^3$ 1 hour	
		without FGD	FGD (efficiency 90 %)
Unit 1 of PLTU Indramayu 2 x 1.000 MW	4500	118.6	11.6
Units 1 and 2 of PLTU Indramayu 2 x 1.000 MW	4500	205.5	20.2
Units 1, 2 of PLTU Indramayu 2 x 1.000 MW and PLTU Jawa Barat	4500	468.5	255.1
Quality Standard	Quality Standard PPRI No. 41 of 1999	900 1 hour $\mu\text{g}/\text{Nm}^3$	

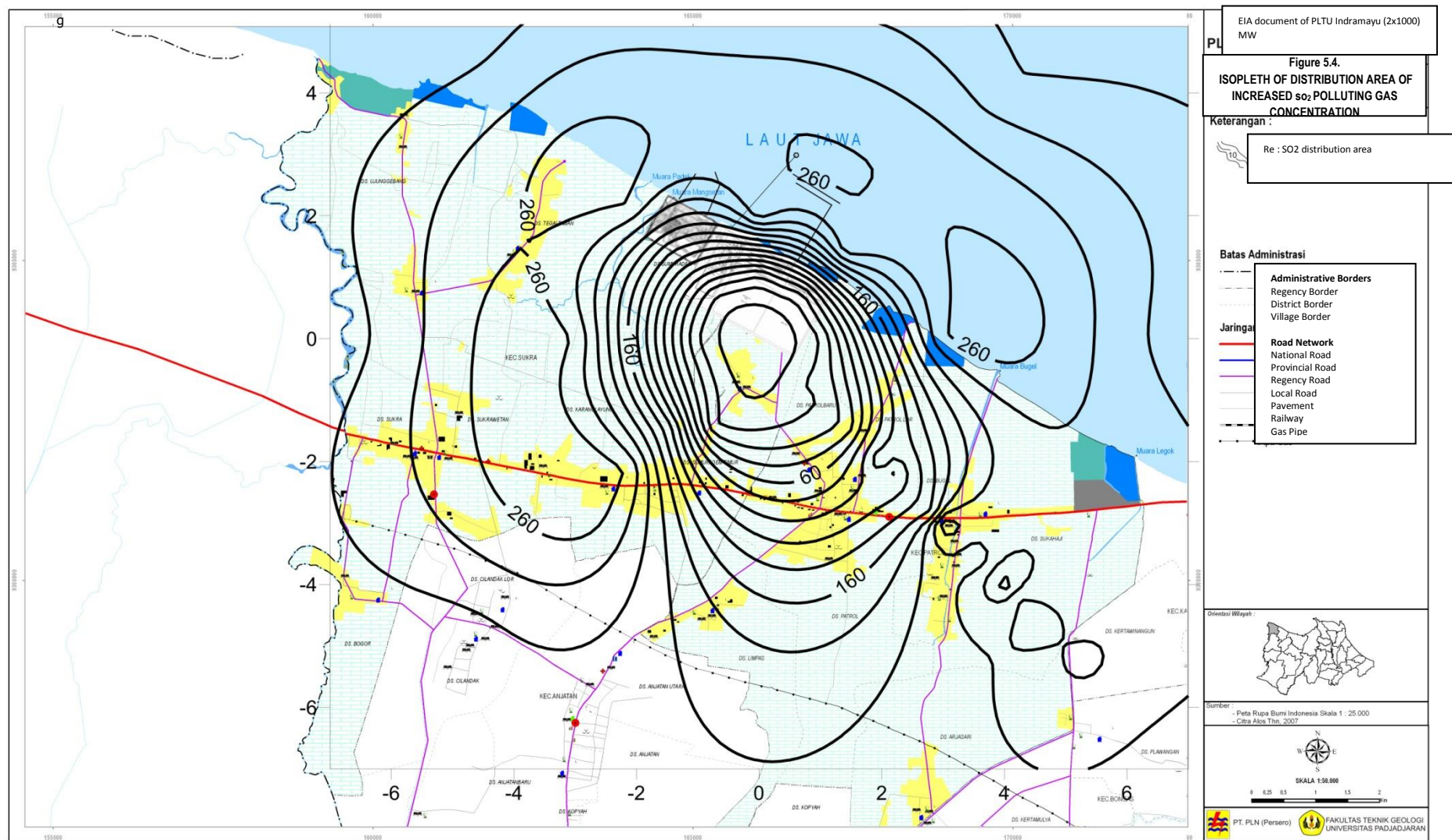
**TABLE 5.11.**  
**INCREASED  $NO_2$  CONCENTRATION FROM THE OPERATION OF PLTU INDRAMAYU UNIT 1, 2 AND PLTU JAWA BARAT**

Operation	Distance from PLTU Indramayu 2 x 1000 MW	Increased $NO_2$ concentration $\mu\text{g}/\text{Nm}^3$ (1 hour)	
		without LNB	LNB (efficiency 80 %)
Unit 1 of PLTU Indramayu 2 x 1.000 MW	4500	76.7	15.3
Units 1 and 2 of PLTU Indramayu 2 x 1.000 MW	3000	153.5	26.6
Units 1, 2 of PLTU Indramayu 2 x 1.000 MW and PLTU Jawa Barat	3000	355.9	71.5
Quality Standard	Quality Standard PPRI No. 41	400 1 hour $\mu\text{g}/\text{Nm}^3$	

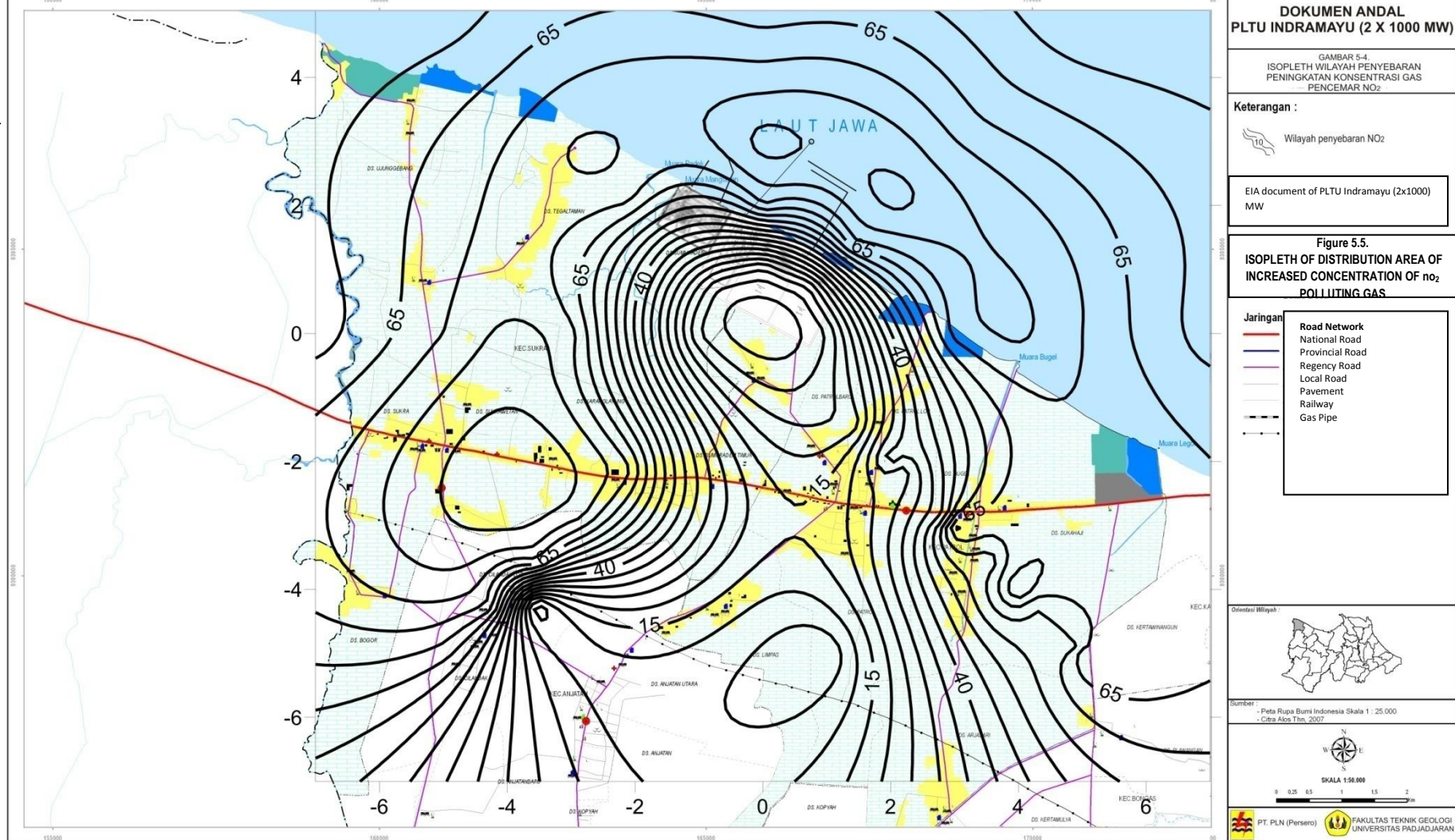
**TABLE 5.12.**  
**INCREASED PM<sub>10</sub> CONCENTRATION FROM THE OPERATION OF PLTU INDRAMAYU UNITS**  
**1, 2 AND PLTU JAWA BARAT USING ELECTRIC DUST CATCHER (ESP)**

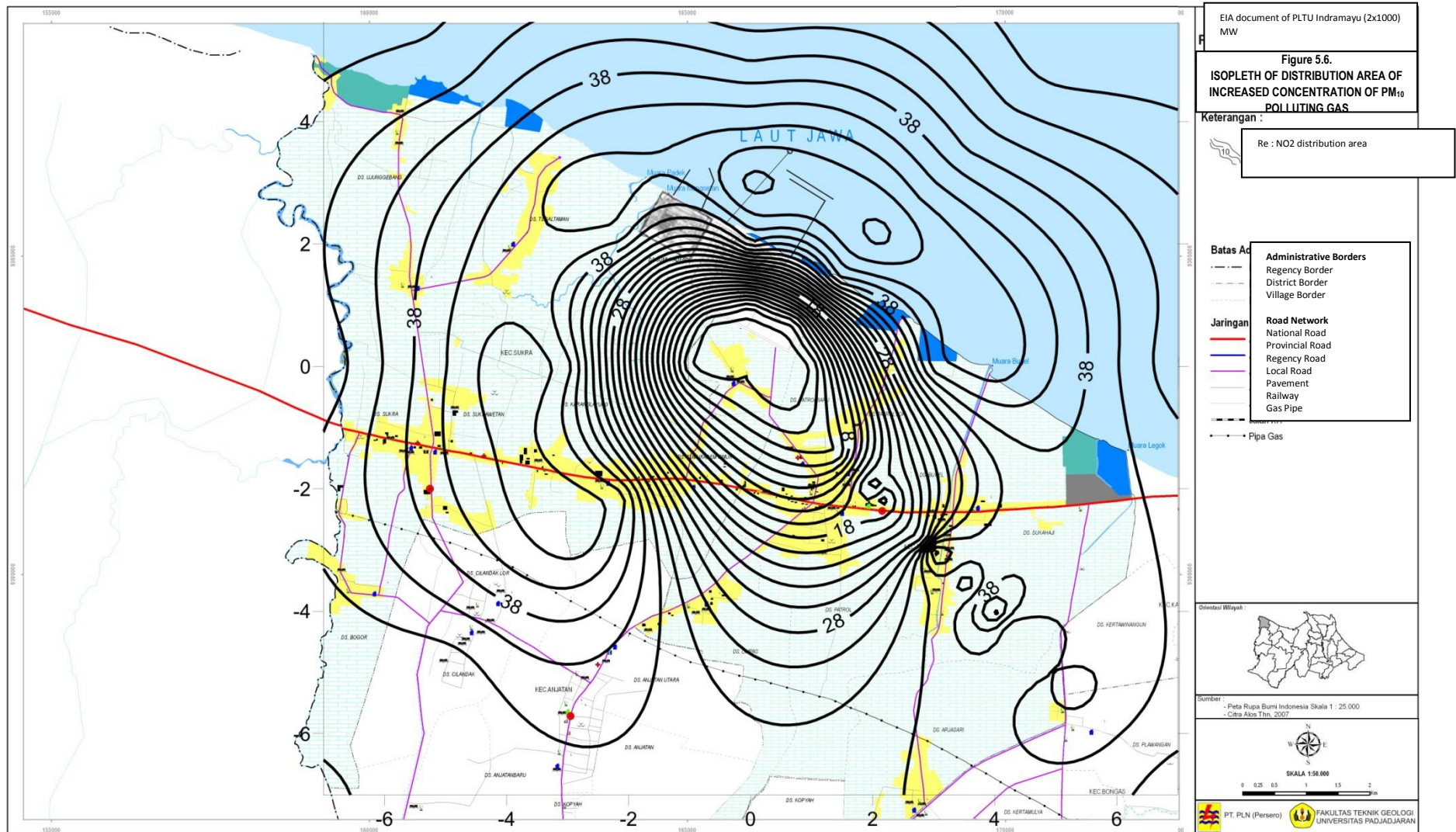
Operation	Distance from PLTU Indramayu 2 x 1000 MW	Increased PM <sub>10</sub> Concentration Nm <sup>3</sup> ( 24 hours)
Unit 1 of PLTU Indramayu 2 x 1.000 MW	2500	4,7 µg/Nm <sup>3</sup> )
Units 1 and 2 of PLTU Indramayu 2 x 1.000 MW	2500	8,2, µg/Nm <sup>3</sup>
Units 1, 2 of PLTU Indramayu 2 x 1.000 MW and PLTU Jawa Barat	2500	25,7 µg/Nm <sup>3</sup>
Quality Standard	Quality Standard PPRI No. 41	150 µg/Nm <sup>3</sup> ( 1 hour)

The forecast result indicates the operation of PLTU Indramayu 2 x 1,000 MW and PLTU Jawa Barat 3 x 300 MW will affect the ambient air pollution in the study area below the quality standard. However due to continuous exposure, it will cumulatively have an impact on public health in the form of ARS and therefore its impact is categorized as a **significant negative impact (NP)**, so it needs to be monitored and managed.

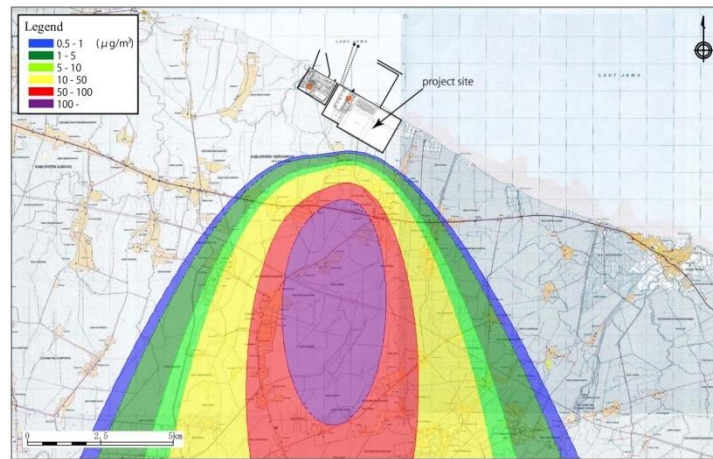




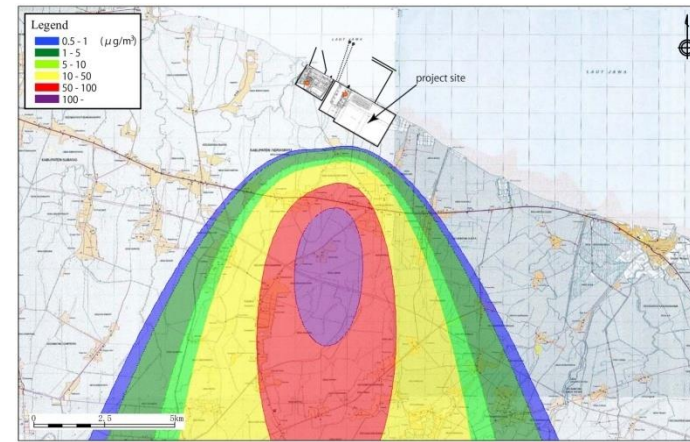








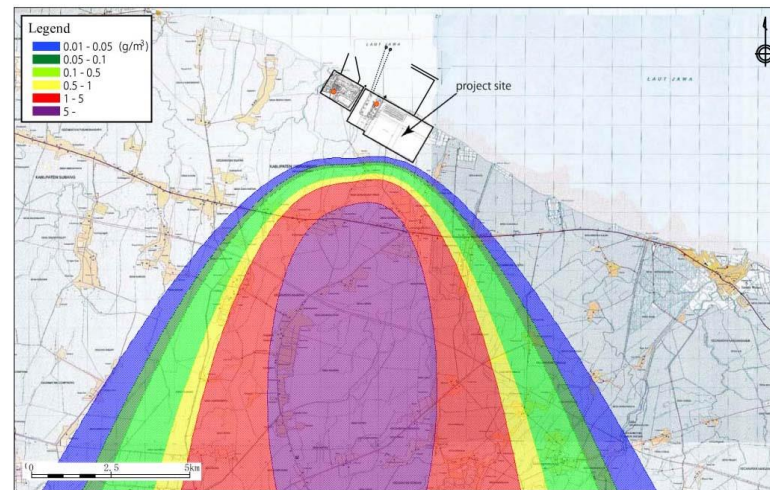
A



B

**FIGURE 5.7.**

**ISOPHLETE MAP OF PLUME OF SO<sub>2</sub> (A), NO<sub>2</sub> (B) FROM THE OPERATION OF PLTU 1 + 2 AND PLTU JAWA BARAT DOMINANT WIND DIRECTION TOWARDS THE NORTH, WIND SPEED 1.5 M/S**



**FIGURE 5.8. ISOPHLETE MAP OF PLUME OF PM<sub>10</sub> FROM THE OPERATION OF PLTU 1 + 2 AND PLTU JAWA BARAT DOMINANT WIND DIRECTION TOWARDS THE NORTH, WIND SPEED 1.5 M/S**

## 2). Disruption of Flora and Fauna (Declined Plant Productivity)

One of the effects of operational activities of PLTU Indramayu 2 x 1000 MW is the exposure to polluting gas from the plant operations that cause changes in air quality around PLTU Indramayu 2 x 1000 MW and its surroundings. Based on the model of air quality, the waste gas and dust flies about 4-5 km to the east-southeast. The impact of the exposure of ash is disruption to the plant along the radius. The disorders caused by dust exposure consist of two types namely dry and wet depositions. Dry deposition usually occurs at a distance that is relatively far from the sources of pollution in the form of fine dust covering the surface of leaves. The impact of the covering of leaves of plants / crops by dust is inhibited photosynthesis in the leaves that will affect the growth and the metabolic processes of plants / crops. In many cases the covering of leaves by dust will make the plants stunted and even may die as a result of inhibition of metabolism and covering of the pollen. Local plants in Sukra District are mango and rice.

Another impact of emission is acidic nitrogen and sulfur oxidizing which can cause rapid damage to plants known as the yellow / brown leaves disease. Nitrogen and sulfur oxides during the rainy season (wet deposition) lie at a relatively close distance around PLTU Indramayu 2 x 1000 MW at the radius of 4-5 km. The oxide will form sulfuric acid and nitric acid which can increase the acidity of soil and affect the productivity of crops / plants. Sikrosis and necrosis are predicted to not happen, because at the time of raining for water exposure after the first rain will clean the leaves from NO<sub>x</sub> and SO<sub>x</sub>. Under these conditions, in general the effect of dust and gas released by PLTU Indramayu 2 x 1,000 MW to the plants may expose a negative impact.

Dust and air polluting gases will not only affect the flora, but also the fauna at the project site and its surrounding area. The impacts are in the forms of dirty air which can also damage the plants thus reducing grass as a food source. Therefore, the impact on terrestrial flora and fauna exposes a significant negative impact (NP).

## 3). Public Health

Emission of pollutant gases, SO<sub>x</sub>, NO<sub>x</sub> and particulates originate from the continuous activities of PLTU Indramayu 2 x 1000 MW. Exposure of gas and particulates inhaled for a long time can cause respiratory problems and the impact is considered **negative**. The results of recording of level of public's health in various health centers in the area of PLTU Indramayu 2 x 1000 MW indicate that the rate of ARI patients are more than other patients. Particles derived from fly ash (fly ash) in the air have fine size and silicone content (SiO<sub>2</sub>) of 40% with sized  $\pm 10 \mu\text{m}$  can lead to respiratory disease called silicosis. The results of dust spread air quality simulation will reach 4-5 km but still meet the air quality standards required. As the dust or gas produced by PLTU Indramayu 2 x 1000 MW will change the composition of the air quality around the project continuously, although still within the allowable quality standards, the particles can accumulate in

the body. Keep in mind that changes in the composition of air quality can lead to disease for sensitive people. Therefore, the impact of dust and gas produced by the power plant operations is categorized a **significant negative impact (NP)**.

### 5.3.5. Cooling Unit Operation

#### 1). Declined Seawater Quality (Water Temperature)

The temperature of cooling water coming out of the cooling unit of PLTU Indramayu 2 x 1000 MW is around 38.4 ° C at the rate of 162,000 m<sup>3</sup> / hour which can cause an increase to sea water temperatures from the initial temperature (30 ° C). Increase in the temperature takes place not only at the location of the outlets but also spreads to the surrounding due to ocean currents. Prediction of locations of spread of heat waste is done by modeling based on the planning of PLTU Indramayu 2 x 1000 MW as follows :

**TABLE 5.13.**  
**SPECIFICATION OF COOLING UNIT OF PLTU INDRAMAYU 2 X 1000 MW**

Item	Unit	Coolant water	
		Unit1	Unit2
<i>Amount of discharge water</i>	m <sup>3</sup> /h	162,000	<i>same as on the left</i>
<i>Maximum increase of outlet temperature</i>	°C	Δ8.4	
<i>Temperature of discharge water</i>	°C	38.4	
<i>Temperature of ambient seawater</i>	°C	30.0	
<i>Salinity</i>	‰	35.1	
<i>Velocity of discharge water</i>	m/s	2.5	

The modeling of heat distribution due to the discharge outlet of PLTU Indramayu 2 x 1000 MW uses the approach of momentum equation, continuity equation and heat diffusion equation. To estimate the consequences of heat exhaust from the cooling water used by the system of PLTU Indramayu 2 x 1000 MW, the following condition data has been used:

**TABLE 5.14.**  
**SPECIFICATION & CONDITION USED IN THE MODELING OF PLTU INDRAMAYU 1 AND 2**

Item	Unit	Coolant water	
		Unit1	Unit2
<i>Amount of discharge water</i>	m <sup>3</sup> /h	162,000	Same as unit 1
<i>Maximum increase of outlet temperature</i>	°C	Δ 8.4	
<i>Temperature of discharge water</i>	°C	38.4	
<i>Temperature of ambient seawater</i>	°C	30.0	
<i>Salinity</i>	‰	35.1	

Item	Unit	Coolant water	
		Unit1	Unit2
Velocity of discharge water	m/s	2.5	

**TABLE 5.15.**  
**SEA WATER CONDITION**

Item	Unit	Coolant water
Amount of discharge water	m <sup>3</sup> /h	240,000
Maximum increase of outlet temperature	°C	Δ 8.6
Temperature of discharge water	m/s	0.25
Temperature of the surrounding	°C	27

The temperature of discharge water is designed to have difference with the intake water temperature at 8.4 ° C ( $\Delta T$  8.4 ° C) and the final temperature will be less than 40 ° C (average monthly temperature of the condenser outlet) that complies with the standard, in this case Regulation of the Minister of Environment No. 08/2009.

The modeling is done by three case studies, namely:

1. Case 1

The flow speed is set at 0 m / s and the model is run for 1 unit of PLTU Indramayu 2 x 1,000 MW, 2 units of PLTU Indramayu 2 x 1,000 MW and a combination of 2 units of PLTU Indramayu 2 x 1,000 MW and PLTU Jawa Barat.

2. Case 2

The flow speed is set at 0.25 m/s from the southeast and the model is run for 1 unit of PLTU Indramayu 2 x 1000 MW, 2 units of PLTU Indramayu 2 x 1,000 MW and a combination of 2 PLTU Indramayu 2 x 1000 MW and PLTU Jawa Barat.

3. Case 3

The flow velocity is set at a speed of 0.25 m / sec from the northwest and the model is run for 1 unit of PLTU Indramayu 2 x 1000 MW, 2 units of PTU Indramayu 2 x 1000 MW and a combination of 2 units of PLTU Indramayu 2 x 1000 MW and PLTU Jawa Barat.

Note: From the results of previous model it is predicted that the dominant currents come from the Southeast and Northwest.

**TABLE 5.16.**  
**CASE OF MODELING OF HEAT DISTRIBUTION PREDICTION**

No	Current		Case		
			PLTU INDRAMAYU		PLTU JAWA BARAT
	Speed (m/s)	DIRECTION	Unit1	Unit2	
1	0	-	X		

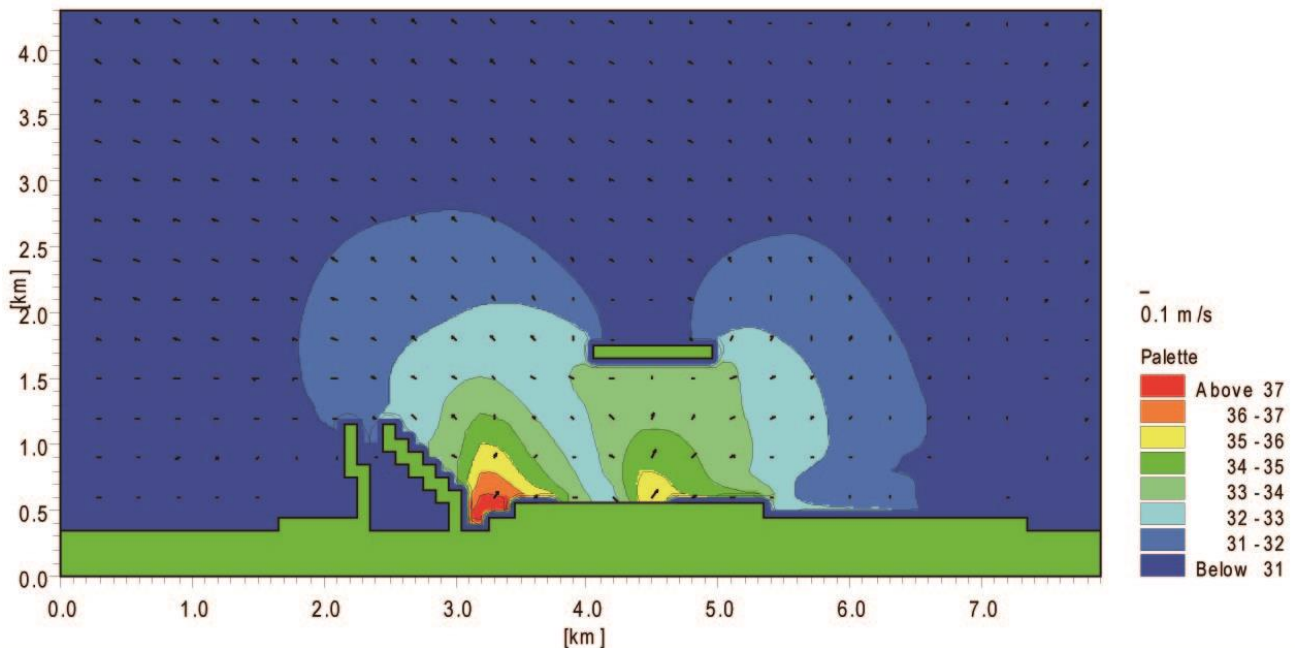
No	Current		Case		
			PLTU INDRAMAYU		PLTU JAWA BARAT
	Speed (m/s)	DIRECTION	Unit1	Unit2	
2	0	-	X	X	
3	0	-	X	X	X
4	0.25	Southeast	X		
5	0.25	Southeast	X	X	
6	0.25	Southeast	X	X	X
7	0.25	Northwest	X		
8	0.25	Northwest	X		
9	0.25	Northwest	X	X	X

The result of modeling gives the total area affected by the discharge water of PLTU Indramayu 2 x 1.000 MW. The distribution area experiencing the increase impact of 2 °C compared to the initial sea water temperature can be seen in the following table.

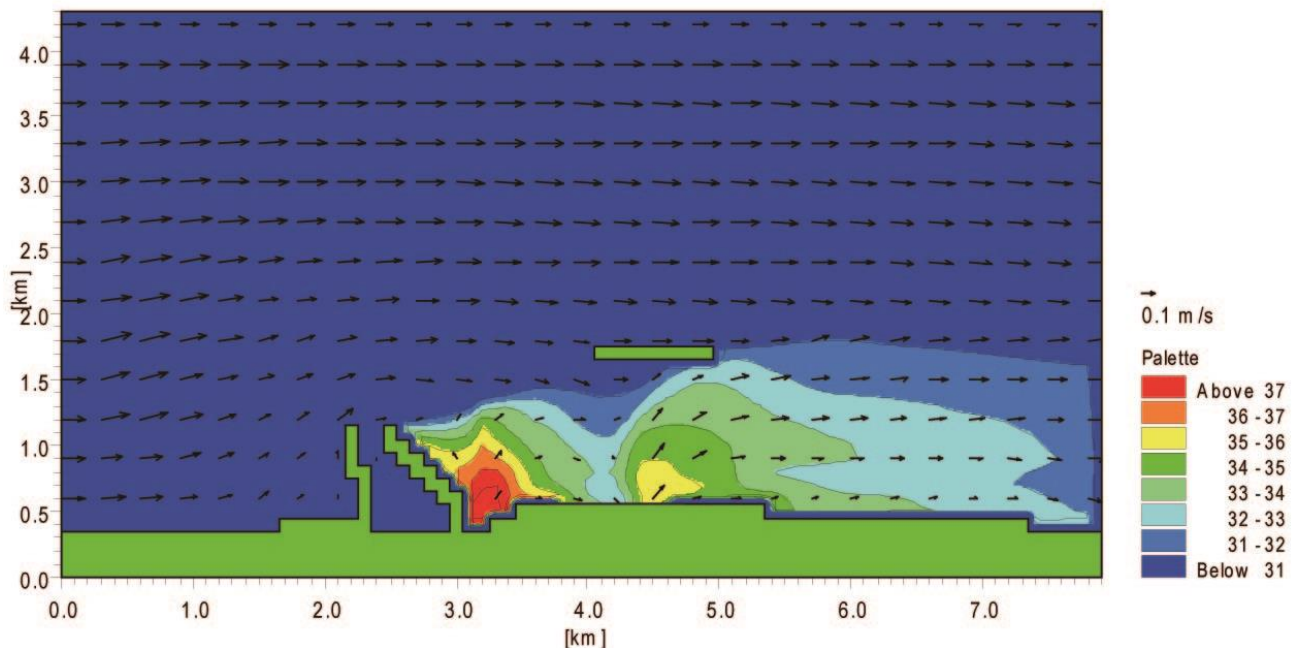
**TABLE 5.17.**  
**MODELING OF HEAT DISTRIBUTION LEVEL**

Item (condition of operating PLTU )	Discharge water speed 2.5m/s, current speed 0m/s	Discharge water speed 2.5m/s, current speed 0.25m/s to the southeast	Discharge water speed 2.5m/s, current speed 0.25m/s to the northwest
PLTU Indramayu 1	0.44 km <sup>2</sup>	0.45 km <sup>2</sup>	1.05 km <sup>2</sup>
PLTU Indramayu 1&2	1.54 km <sup>2</sup>	1.11 km <sup>2</sup>	2.50 km <sup>2</sup>
PLTU Indramayu 1&2 PLTU Jawa Barat	4.76 km <sup>2</sup>	2.68 km <sup>2</sup>	4.21 km <sup>2</sup>

The greatest distribution impact takes place where the current speed is 0 m / s and PLTU Indramayu 2 x 1000 MW 1 and 2 as well PLTU Jawa Barat operate simultaneously in which the affected area experiences the temperature rise of 2 °C compared to the initial temperature at an area of 4.76 km<sup>2</sup>. The visualization of heat distribution model results can be seen in the figure below.



**FIGURE 5.9.**  
**RESULT OF MODELING OF OPERATION OF PLTU INDRAMAYU 2 X 1000 MW AND PLTU**  
**JAWA BARAT WITH THE CURRENT SPEED 0.25M/S TO THE SOUTHEAST**



**FIGURE 5.10.**  
**RESULT OF MODELING OF OPERATION OF PLTU INDRAMAYU 2 X 1000 MW AND PLTU**  
**JAWA BARAT WITH THE CURRENT SPEED 0.25M/S TO THE SOUTHEAST**

By observing the area of spread of heat waste water to heat changes in the waters around the outlets and the duration of impact that will last so long as PLTU Indramayu 2 x 1000 MW is in operation, then the impact on the quality of sea water (temperature increase) and aquatic life is categorized as a **significant negative impact (NP)**.



## 2). Gangguan Biota Air Laut

Heat waste will also cause further impacts due to changes in sea water temperature on water biota such as benthos and nekton. The negative impact is in the form of decreased number and types of aquatic biota while the impact on plankton is expected to be insignificant because the shore location where the heat waste is discharge is very murky. The increased temperature on benthos organisms according to Coles (1977) will lead to sub lethal disruption in the form of temperature increase ranging between 2-5 °C and will die at a temperature rise abruptly by 5-7 °C. The disruption of benthic organisms will further result in the loss of food source of nekton for its growth, reproduction, and activities. The reduced food on the site has forced the fish to move to a location that has more food source. The impact is reduced number and species of fish that live in these waters. Based on the simulation results, the increase in sea water temperature after the operation of PLTU Indramayu 2 x 1000 MW is less than 2 ° C. Change in temperature by 2 ° C will cause sub-lethal effects on benthos, which means it will inhibit the growth or diversity of nekton which will affect the catch of fishermen in the area. Ecologically, there will be significant changes in the environment. Based on this explanation, the impact of heat waste is categorized a **significant negative impact (NP)**.

## 3). Decreased Income Level

The existence of heat waste and chlorine in the water will result in decreased water quality. The increased ambient sea water temperature to be 37-39 ° C from the cooling system and chlorine from the sodium hypochlorite of the exterminator of biota attached to the water pipe can cause changes in the composition of plankton and benthos. This will reduce the availability of natural variations in fish feed so that fish and other types with significant value will seek other suitable locations. The result is decreased catch of fishermen, thereby reducing their income. Based on the abovementioned explanation, the impact of operation of the generating system on fish catch and other species is a **significant negative impact (NP)**.

### 5.3.6. Seawater Processing and Liquid Water Treatment Operations

#### 1). Seawater Quality

The liquid waste generated from the operation coming from the desulfurization system, domestic sewage, water treatment (desalinization) and laboratories is around 0.066 m<sup>3</sup> / sec. The liquid waste will be treated first using the Waste Water Treatment Plant (WWTP) equipped with neutralization, coagulation, filtration units and so on. The quality of waste water discharged from the WWTP is guaranteed to meet the quality standards and regulations in force before being discharged into the sea.

**TABLE 5.18.**  
**WASTEWATER QUALITY STANDARD**

Parameter	Regulation of the State Minister of the Environment No.08/ 2009	IFC EHS guideline (Dec,2008)
pH	6 – 9	6 - 9
TSS	100 mg/l	50 mg/l
Oil and Fat	10 mg/l	10 mg/l
Residual chlorine *	0.5 mg/l	0.2 mg/l
Total Cr	0.5 mg/l	0.5 mg/l
Cu	1 mg/l	0.5 mg/l
Fe	3 mg/l	1 mg/l
Zn	1 mg/l	1 mg/l
Pb		0.5 mg/l
Cd		0.1 mg/l
Hg		0.005 mg/l
As		0.5 mg/l
PO <sub>4</sub> <sup>3-</sup>	10 mg/l	

\*Note : Chlorine injected into the intake water

**TABLE 5.19.**  
**STANDARD OF LIQUID WASTE LIMBAH CAIR (DESALINIZATION)**

Parameter	Regulation of the State Minister for the Environment No.08/ 2009
pH	6 – 9
Salinity	Concentration of wastewater salinity at the radius of 30 m from the <i>drain outlet</i> must be equal to the actual previous sea water salt concentration.

**TABLE 5.20.**  
**LIMBAH CAIR (FGD SYSTEM) (WET SCRUBBER AIR LAUT)**

Parameter	Regulation of the State Minister for the Environment No.08/ 2009
pH	6 – 9
SO <sub>4</sub> <sup>2-</sup>	The increased concentration of ion sulphate between the liquid waste and intake water is less than 4%.

**TABLE 5.21.**  
**WASTE WATER STANDARDS (COAL STOCKPILE)**

Parameter	Regulation of the State Minister for the Environment No.08/ 2009
pH	6 – 9
TSS	200 mg/l
Fe	5 mg/l
Mn	2 mg/l

The construction of wastewater treatment system to be built will meet the wastewater quality standards expected to be able to prevent significant decrease of water quality. Therefore, the impact is considered an **insignificant negative impact (NTP)**. Nonetheless, for monitoring the performance, it is necessary to supervise the WWTO so that the adverse effects that will occur can be identified.

### 5.3.7. Coal Storage Operation

### 1). Air Quality

Handling and stockpiling of coal, fly ash and bottom ash may result in increased concentration of dust. Assuming the average diameter of dust is 12  $\mu\text{m}$ , through Stoke legal approach, the particle terminal velocity value is 0.004 m / sec. If the height of dust on the location of activities reaches 2.5 m, the time required for the dust to reach the soil surface is 625 seconds or 0.17 hours.

The maximum speed of wind in the project site is > 10 m / sec, the distance distribution of dust reaching residential areas 1250-6250 m, this means that the distribution of dust has reached residential areas in Sumuradem Village within  $\pm$  4 km. The exposure to coal dust has a negative impact. Therefore continuous exposure to dust during the operation of PLTU Indramayu 2 x 1000 MW which can cause respiratory problems, affect crop productivity and damage other buildings.

PT. PLN (PLTU Indramayu 2 x 1000 MW) will do the management of coal ash to prevent the spread of dust by watering way to increase humidity and building green open land, coal stockpiling activity is considered an insignificant negative impact (NTP). However, because the management is done manually, there will be the possibilities of negligence and failure so that it is necessary to monitor the implementation and management of ambient air quality in the project area and the affected area.

### 2). Seawater Quality

Coal combustion will produce about 201,624 tons of fly ash per year to be dumped in the ash disposal area. The composition of coal ash in the form of fine particles (<200 mesh) consists of  $\text{SiO}_2$ , Fe and various toxic heavy metals such as zinc, copper (Cu), cadmium (Cd), chromium (Cr), cobalt (Co), Hg (mercury) and lead (Pb). In the rainy season, it is predicted that the chemical compounds will be washed away and produce leachate. The leachate will be carried by the flow of water into the sea and degrade the quality of sea water and sea water biota. The impact is considered negative. PT. PLN (PLTU Indramayu 2 x 1000 MW) will treat the leachate by containing it in a settling reservoir which is then processed in the WWTP. The treated water is partially used for watering the ashes to keep it moist. The soil at the project site is clay with high level of permeability and will be maintained so as to prevent reduced water quality as a result of the accumulation of coal ash. Based on the determination of a significant impact, the impact of coal stockpiling activity on the quality of the seawater is not an **insignificant negative impact (NTP)**.

### 3). Potential of B3 waste

The operation of PLTU Indramayu 2 x 1000 MW will generate around 201,624 ton of fly ash and bottom ash / year. The coal ash will be collected in an ash disposal area of  $\pm 1.364$  million m<sup>2</sup>. The composition of coal ash include fine particles (<200 mesh) which contain heavy metals toxic such as zinc, copper (Cu), cadmium (Cd), chromium (Cr), cobalt (Co), Hg (mercury) and lead (Pb ) in addition to SiO<sub>2</sub> and Fe. Therefore, coal ash should be managed as B3 waste. The coal management is done by PLTU Indramayu 2 x 1000 MW by containing the ash a waterproof disposal area with the capacity sufficient for operating for 30 years and the leachate will be managed in the WWTP. However, the decreased performance of the operating system will have an impact on the contamination of ground water, sea water and marine biota so that the impact is a significant negative impact (NP). To ensure the content of heavy metals in the coal dust and chemical content in the water body, it is necessary to carry out laboratory tests on a regular basis.

#### 4). Disruption to Public Health and Environmental Health

The operation of PLTU Indramayu 2 x 1000 MW is expected to produce particulates in the form of solid waste classified as hazardous, namely bottom ash and fly ash that can pollute the air and the surrounding areas of the project site. The solid waste (ash) from coal combustion will be contained in the coal ash landfill. During the dry season when the ash is dry and the wind is blowing hard, the ash is expected to degrade the air quality by exposing fly ash particles. Consequently, it can cause health problems particularly respiratory diseases to the workers and the surrounding community as a derivative impact of air quality deterioration. Besides, the health impact also can be caused by water contamination around the coal ash landfill. Several heavy metals such as SiO<sub>2</sub>, Zn, Cu and Pb leached may be carried over into groundwater. Certain concentration of heavy metals may affect the digestive tract. The location of ash disposal pond, in accordance with the design of the ash disposal pond will be lined with geotextile or HDPE with  $K = 10^{-7}$  m / sec permeability level to prevent the leachate from seeping into the groundwater during the rainy season. Therefore, the possibility of contamination of ground water is small so that the impact is considered a **negative insignificant impact (NTP)** while the particles from fly ash in the air with fine size and 40% grade of silicon (SiO<sub>2</sub>) sized  $\pm 10 \mu\text{m}$  can result in a respiratory disease called silicosis.

TABLE 5.22.

**MATRIX EVALUATION OF SIGNIFICANT IMPACT IN THE PRECONSTRUCTION,  
CONSTRUCTION AND OPERATION OF CONSTRUCTION OF PLTU INDRAMAYU 2 X 1.000  
MW**

Environment \ Activity	A		B				C						
	1	2	3	4	5	6	7	8	9	10	11	12	13
<b>Air quality</b>													
- Ambient air quality				NP	NTP					NP			NTP
- Increased noise				NTP	NP								
<b>Water Quality</b>													
- Decreased Surface Water Quality									NTP				
- Seawater Quality					NP	NP		NP			NP	NTP	NTP
- Groundwater Quality									NP				
<b>Space and Land</b>													
- Changed land function and allocation					NTP/PP								
- Flood					NP								
- Abrasion and Accretion								NP					
<b>Transportation System</b>													
- Disruption to Land Transportation Flow					NP								
- Disruption to Fishermen Transportation						NP							
<b>Flora &amp; Fauna</b>													
- Increased type and numbers of Jml Flora & Fauna						PP							
- Disruption to Flora & Fauna										NP			
- Disruption to Seawater biota											NP		
<b>Socio-Economical and Cultural</b>													
- Increased employment opportunity			PP				PP						
- Increased income level			PP			PP	PP						
- Decreased income level		NP									NP		
- Public unrest		NP	NP				NP						
- Disruption to fishermen						NP		NP					
<b>Public &amp; Environmental Health</b>													
- Decreased Public Health				NP						NP			NTP
<b>B3 Waste</b>													
- Potential B3 Waste													NP

**Remarks :**

**A = Preconstruction :**

1 = Survey

2 = Land acquisition

**B = Construction :**

3 = Recruitment of workers and personnel mobilization

4 = Mobilization of equipment and materials

5 = Land preparation

6 = Construction of facilities and infrastructure

**C = Operation :**

7 = Recruitment of Workers

8 = Coal Loading and Unloading (Jetty)

9 = Operation of Coal Handling System

10 = Operation of Generator

11 = Operation of Cooling Unit

12 = Operation of Processing of Water and Liquid Waste

### **13 = Operation of Storage of Coal Ash**

## **CHAPTER VI SIGNIFICANT IMPACT EVALUATION**

### **6.1. SIGNIFICANT IMPACT ANALYSIS**

In accordance with the methodology of significant impacts evaluation of each activities component compared to environmental components was conducted by observing the relationship between the significant impacts making it a holistic analysis. For the 2 x 1,000 MW Indramayu Steam Power Plant (PLTU Indramayu), the significant impacts, both positive and negative, as results of the activities are as follows.

#### **6.1.1. Preconstruction Phase**

The negative significant impact arising from the pre-construction stage is social unrest resulted from the procurement and land acquisition activities. Such preconstruction activity causes social impacts in the forms of loss of livelihood (farmers), reduced levels of income and improper land compensation. Accumulation of these three social impacts has then caused social unrest.

#### **6.1.2. Construction phase**

The significant impacts caused during the construction phase with regard to environmental components are more physical when compared with the pre-construction phase. The activities that have a significant impact as described in the impact estimates are activities of labor recruitment, mobilization of tools and material, preparation of land and construction of facilities and infrastructure while the components of activities that cause impacts on environmental components include:

##### **6.1.2.1. Recruitment of Manpower and Personnel Mobilization**

Based on the significant impact forecasts, it is indicated that recruitment activities expose an positive significant impact in the form of increased employment opportunities for the local men of about 1,106 people out of a total labors of about 1,400 people needed. The impact of labor absorption constitutes a multiplier effect, namely on the level of income. If the length of land preparation activities (by the majority of local workers) lasts for about a year and the wage for that is Rp. 39,000 / day / person, the total amount that can be earned is Rp. 1.17 million, - / month. This increase in revenue is significant compared to earnings as a laborer in the amount of less than Rp. 800,000, - / month which lasts for one year continuously. In addition to the positive impact arising from recruitment, there is also a negative impact in the form of social unrest. As the total of workforce in Indramayu is large, namely 42,612 people (BPS Indramayu, 2009), the level of employment of 1,106 local people by PLTU Indramayu 2 x 1,000 MW is low, at around 2.6%.

The education and expertise level of most of the population is laborer. This is a barrier for local residents to participate in development activities of PLTY Indramayu 2 x 1,000 MW. In this

condition, the contractor will recruit non-local workers with expertise as this will facilitate the construction of PLTU Indramayu 2 x 1,000 MW. However, hiring outside labors excessively can cause social jealousy that will ultimately lead to public unrest.

Therefore, to reduce the negative impact in terms of recruitment, the employment opportunities for PLTU Indramayu 2 x 1,000 MW are prioritized for local residents of Sumuradem and Patrol lor villages in accordance with the type of employment, education and skills possessed

#### **6.1.2.2. Mobilization of Equipment and Materials**

Mobilization of piled up sand can lead to decreased air quality in the surrounding residential area passed by the path of piled up sand mobilization. When the wind is blowing hard, the distribution of dust may extend to as far as 108 m reaching the residential areas along the path of mobilization. This activity will last for 4 to 6 months so that if not properly managed dust respired can cause health problems and issues of environmental aesthetics in residential areas along its path, which constitutes a significant negative impact.

#### **6.1.2.3. Land Preparation**

Activities of land piling up in the framework of the preparation of 318.5 ha (2,450 m x 1,300 m) at an altitude of about 2 meters requires piled up land of around 6,500,000 m<sup>3</sup>. Change of the face of land from rice fields into ready-to-build land has transformed the coefficient of water run-off, so that at the time of rain, the water run-off will increase to 157 liters / sec but will not cause flooding because the capacities of the channel are still sufficient. However the closure of Pelawad channel at the project site may impede the flow of water and the run-off will disrupt the agricultural land around PLTU Indramayu 2 x 1,000 MW.

Clearing and maturation will cause sand particles during rain or at the time of high wave to enter the sea and the turbidity of seawater is estimated to reach > 400 mg / l. The next negative impact due to increased turbidity of water is disruption to the sea life, including fish which will disrupt the income levels of fishermen.

The noise level of heavy equipment used in the activities of the maturation of land can reach 110 dBA (1 meter), the predicted impact is known to not disturb the nearby settlements (2,000 meters).

The use of part of the Cirebon – Indramayu and Indramayu - Jakarta roads for the mobilization of materials is expected to disrupt traffic activity mainly from the transportation of as much as 6,500,000 m<sup>3</sup> piled up materials. If the piling up is conducted over 6 months, additional volume of truck (8 m<sup>3</sup>) passing through the construction site of PLTU Indramayu 2 x 1,000 MW in the lane with the highest volume will increase to 1,354 SMP / h to 2,296 + 1,354 = 3,650 SMP / h and on the path with the lowest volume to be 151 SMP / h to 151 + 1354 = 1505 SMP / h. This



increase is significant and can cause disruption of traffic flow, thus categorized as a **significant negative impact**.

#### **6.1.2.4. Construction of Facilities and Infrastructures**

At this stage of construction, another activity that can increase people's income level is the construction of facilities and infrastructure which will require the services of food, lodgings, transportation and building materials, and such services are expected to be met by the public or local entrepreneurs. The participation of local entrepreneurs in the supply of transport services, food, building materials can increase people's income levels significantly. Another impact is the increasing the positive perception of PLTU Indramayu 2 x 1,000 MW of PT. PLN.

The activities of planning at RTH / greenbelt in the construction phase as noted above is expected to increase the diversity of plant species in the project site from some kinds to be more diverse and increase the availability of habitat for fauna. Although the area of land to be planted is relatively narrow, it will have positive impact on other components namely to the animals such as the availability of habitat for fauna, to the micro-climate in the form of shade and temperature which can contribute to the maintenance of air quality in terms of absorption of gaseous pollutants generated by the production unit. In addition, the impacts are cumulative along with the RTH around the site along with the long term / period until the end of the operation phase. Therefore, the impact of implantation in the RTH with regard to the components of flora, fauna and air quality is a significant positive impact.

Construction of jetty activities includes the installation of stakes and dredging. These activities will increase the turbidity of seawater and further disrupt marine biota water. Installation of the stake along the access bridge (1,500 m) and Jetty ( $\pm$  900 m) followed by dredging activities along 900 m with a depth of 9 m and the construction of wave retainer will increase the turbidity of seawater above the natural turbidity and cause the disruption to the marine life, especially the death of benthos, fish habitats and primary productivity.

These activities will also inhibit the mobility of fishing activities, change fish catchment lanes and areas (fishermen transportation disruptions), thereby disrupting the lives of fishermen in the forms of increased operating costs and decreased revenue of fishermen.

#### **6.1.3. Operation phase**

The significant impacts arising during operation phase on the environmental components as described in the forecast of significant impacts, including increased revenue, public unrest, decline in the quality of sea water, transportation, fishing, air quality, disturbance to flora and fauna (decreased crop productivity), public health and sea water biota.

As in the construction phase, recruitment of workers will open opportunities for the community around the project, and if the project activities increase the skill, the employment opportunities for the local workers will increase. The opening up of employment opportunities will result in increased revenue.

The transport of coal for the operational needs of PLTU Indramayu 2 x 1,000 MW by freighter with at least 2 ships a day will cause a disruption of the flow of traffic and disrupt the lives of fishermen in the form of decreased revenue due to the increased operating costs of fishermen and catchment area.

Unloading of coal in the dock will cause spills of coal which will go into the water and cause pollution of sea water. The polluted sea water will lower the water biota and fish productivity.

Operation of the plant will burn coal and the coal burning will emit air pollutants such as SO<sub>2</sub>, CO, NO<sub>2</sub> and fly ash which can degrade air quality. To reduce the level of emissions that will be released through the chimney, emissions will be controlled. PT. PLN will anticipate air pollution using supercritical technology and Low NO<sub>x</sub> burners to reduce emissions of oxides of hydrocarbons, CO<sub>2</sub> and nitrogen oxides. To suppress the SO<sub>2</sub> emissions, the coal used is low sulfur coal - a maximum of 0.5% equipped with Flue Gas Desulfurization (FGD) wet scrubber -sea with the efficiency of about 90%. And to reduce emissions of particulate matter (PM<sub>10</sub>), Electrostatic Precipitator (ESP) will be installed with the efficiency of approximately 99.9%. Based on the dispersion calculations, the increases in the maximum concentration (ground level concentration) for SO<sub>2</sub>, NO<sub>x</sub> and particulate after the operation of PLTU Indramayu 2 x 1,000 MW in West Java and 3 x 300 MW (existing), are respectively 36, 77.9 and 41.8 µg / m<sup>3</sup> (1 hour). Based on the results of measurements of the initial environmental setting, the increases will not result in the concentration to exceed the quality standard according to PPRI No. 41 1999 on ambient air quality.

Nevertheless, the impact will be ongoing during the operation of PLTU Indramayu 2 x 1,000 MW. Another activity that will still contribute to air pollution (mainly dust) is the transport or ash residue using trucks from the silo to the ash disposal area. In the event of wind during the transport and unloading, the ash will fly.

The area of distribution of pollutant gas from the dispersion calculation can be found in a maximum area of 2-3 km from PLTU Indramayu 2 x 1000 namely Patrol Lor and Sumuradem Villages. The decreased air quality will further affect public health and leads to the closure of the ash on the leaves of plants around PLTU Indramayu 2 x 1,000 MW.

Based on the experiences of some activities of PLTU Indramayu 2 X 1000 MW, the noise levels originate from the power plant room that reaches 105-110 dBA. If PLTU Indramayu 2 x 1,000 MW is fully operational it is predicted that the noise levels will reach 110 dBA from a distance of 1 meter. PLN will design the generating units to suppress the noise level that will arise with the installation of a silencer unit on the blower and a transformer unit that has low noise and insulation

layer. The noise impact will spread to the employees of PLTU Indramayu 2 x 1,000 MW and the local people. The influence on the employees is very large and continues during the operation phase making it classified as a significant negative impact compared to the surrounding population located over 1 km (still meets the quality standard of noise level) despite the continuous operation.

Waste water outcome from the WWTP to the sea can cause sea water contamination by organic matters, heavy metals, but based on the results of forecast it is not a significant impact. However, to prevent the pollution, it is necessary to include the performance monitoring of WWTP to ensure it meets the waste water quality standard.

Based on the forecasts of significant impacts, the operation phase activities cause decreased sea water quality, namely from the water treatment activity and wastewater and operation of cooling facilities. PT. PLN will complete the wastewater control facilities so it will not pollute the sea water quality as follows :

- Installing desalinization unit
- Ensuring the temperature and cooling process <38 ° C from the cooling channel mouth
- Installation of liquid waste unit, either from liquid waste from the generating unit or from the accumulation of coal ash (leachate)

The waste generated by each activity based on the operational estimates of PLTU Indramayu 2 x 1,000 MW will not exceed the threshold issued by the government. These wastes have been biologically compared with each of the standard of living organisms to be affected, and scientifically the disruption is still in early normal stages of animal's tolerance. However the problem is the accumulation of the effects of these wastes on the biota, especially in the area of sea waters around the project site. Although it is still below the threshold, the marine life will be exposed to wastes include rising temperatures, addition of chlorine, sulfuric acid, sedimentation / siltation, domestic waste (oil, etc.) and distribution of ashes. All of this waste may reduce the natural quality of the sea water around the project site and it will occur continuously, making the degree of interference large. Therefore, fish life will be disrupted. Besides, wastewater that will be discharged through the natural canals around the ash piling location will disrupt the life of mangrove forests growing around the canal. Based on the aforementioned considerations, the impact of each activity in the accumulation phase of operations will expose further significant negative impacts on the aspects of marine fauna.

## **6.2. ANALYSIS AS A BASIS FOR MANAGEMENT**

### **6.2.1. Construction of PLTU Indramayu 2 x 1.000 MW**

#### **6.2.1.1. Air Quality**

The distribution of the dust from the piled up sand during the mobilization activities can lead to decreased air quality in the surrounding residential area passed by the piled up sand mobilization. When the wind is blowing hard, the distribution can extend as far as 1250 to 6250 m reaching

residential areas in Sumuradem village. Dust inhalation can cause health problems and disturb environmental aesthetic in residential areas along its path.

The operation of PLTU Indramayu 2 x 1,000 MW will emit air pollutants such as particulates of fly ash, CO, sulfur oxides and nitrogen oxides dispersed to a radius of 15 km with a maximum concentration at 3 km. The changing air quality will cause some further impacts, on the health of human and other living creatures. One health impact arising from inhaling gases containing a high concentration of air pollutants is the case is irritation of the eyes and Respiratory Infection (ARI), such as runny nose, inflammation of the windpipe and bronchitis. Small particles can enter the lungs and spread through the circulatory system to the entire body. CO gas, when mixed with hemoglobin will affect the transport of oxygen.

The impact on plants and animals due to poor air quality is in the form of the emergence of various kinds of diseases. Acid rain caused by acid formation from the reaction of nitrogen oxides and sulfur and water will cause leaves to have yellow spots. The acid rain lowers the pH of water which then increases the solubility of heavy metals, for example, mercury (Hg) and zinc (Zn). As a result, the level of bioaccumulation of heavy metals in aquatic animals grows. The decreased pH will also lead to the loss of aquatic plants and microalgae that are sensitive to acid.

The use of heavy equipment at the construction activities of PLTU Indramayu 2 x 1,000 MW will cause noise intensity of up to 77 dBA in residential areas. Such increased noise level will indirectly interfere with the community, especially the community of Sumuradem village.

To reduce the impact of air quality deterioration, activities of PLTU Indramayu 2 x 1,000 MW have been equipped with air quality control unit in order to minimize the environmental impact. Such efforts include:

- ✓ Requiring the contractor to cover the tailgate to prevent the scattering of sand and and to water the path of mobilization to prevent the scattering of sand on the road.
- ✓ Requiring the workers to wear masks and ear plugs that have been provided by the contractor and PT. PLN.
- ✓ Watering the area of stockpiling of coal and coal ash to reduce the spread
- ✓ Using coal with low sulfur content
- ✓ Using Electrostatic Precipitator (ESP) for reducing the content of fly ash in emissions up to 99%
- ✓ Using NOx burner combustion system to reduce emissions of NOx and CO concentration
- ✓ Using Flue Gas Desulfurization to reduce the concentration of SO2 emissions by 90%..
- ✓ Preparing SOP and Emergency Response system.
- ✓ Creating greenbelts around the location of activities with plants that have dense leaves such as pine (*Cupresus* sp) and bamboo (*Bambusa* sp.) Or the type of plants according to the planned activities at several locations, namely:

- Coal yard surrounded by bamboo plants to inhibit dust blowing and to give protection from the wind. Drainage is built beneath it to drain the dust off the leaves at the time of watering to leachate water reservoirs
  - The location around the fence of PLTU Indramayu 2 x 1,000 MW planted with Angsana, casuarina and the combination of fruiting and flowering plants such as walnuts which can serve to support the feed of nectar-eating birds and pollen.
  - Adding mangrove population around the estuary of Bogen river that will support the functions of such area as a bird protection area. In addition to the type of perdada birds, around the estuary can also be added mangrove species such as *Rhizophora sp* or *Avicenaia sp*.
- ✓ Controlling the frequency of traffic to avoid the convoy of fleet of transport, restricting the material transport vehicle speed to maximally 40 km / h on public roads and 25 km / h on rural roads.
  - ✓ Conducting dissemination to the surrounding community about the route that will be passed and duration of the activity.

#### 6.2.1.2. Sea Water Quality

Addition of suspended materials due to runoff of land clearing activities will reduce the brightness of the waters, thus reducing the concentration of dissolved oxygen in the water. A decrease in the concentration of dissolved oxygen can cause the death of plankton and benthos. Based on the baseline data, the most commonly found phytoplankton in the estuary is *Chaetoceros sp.*, While the highest is benthos abundance is the groups of baivalvia and gastropods included into the type of filtering feeder. The benthos community structure can illustrate that today the organisms that survive are organisms that are more tolerant to water quality degradation, including to increased TSS, while conditions in waters that are far from shore show better water community.

Significant impacts on sea water quality degradation from the activities of land preparation, construction of infrastructure and facilities, loading and unloading of coal and operation of cooling units for coal accumulation will likely result in leaching by rain water. The leachate is acidic and containing of 10,000 ppm BOD +, which, if directly discharged into water bodies, will affect aquatic biota.

The operation of PLTU Indramayu 2 x 1,000 MW, will produce heat waste water containing chlorine about 0.5 ppm from the condenser cooling activity. With transport modeling it is predicted that the sea water temperature increase will exceed the quality standard based on Decree of the Minister of Environment no. 51 of 2004 at the east outlets ( $\pm$  400 m from the coast) and to the west of the mouth of the outlet ( $\pm$ 600 m).

During tide period in the afternoon (17:00-20:00 pm), the heat wastewater is retained in the mouth of the outlet, because of the push of ocean currents from the north. In the spring tide conditions, the head wastewater spreads as far as 800 meters to the northwest, while the when receding, the sea current speed (0.07 m / sec) will carry the heat wastewater northwest towards the open sea.

Increased temperatures lead to sea water biota disturbance. Around 2 ° C increase in sea water will increase the metabolism and productivity of aquatic biota. Plankton organisms are organisms that are sensitive to changes in pH so that in case of continuous decline, there will be a decrease in water plankton diversity that can alter aquatic ecosystems, such as the emergence of harmful anaerobic organisms as a result of the decaying process of the dead organism buried in the water bottom. Benthos is a basic aquatic animal that normally is not active so that exposure to diminishing pH conditions of water will interfere with its body's metabolism. Reduced populations of plankton and benthos may be one cause of the disappearance of fish populations due to the loss of its natural feed. Decreased levels of dissolved oxygen in the water can also trigger respiratory problems in fish so that it will look for another location that is more convenient. This disorder can cause a decrease in the population of fish, crabs and several species of crustaceans. The result is a decrease in fish catch of fishermen, thereby reducing their income.

Around PLTU Indramayu 2 x 1,000 MW, the main types of fish caught fish is basic fish like Sembilang (*Arius* sp.), Groupers (*Epinephelus* sp.), and small fish mixture. Some wild fish around the estuary include catfish, *kepala timah*, red *wader*, and *beunteur* while the types of crustaceans that are generally bago shrimp (*Panaeus monodon*), shrimp jerbung (*Panaeus merquensis*), and fire shrimp (*Metapanaeus monoceros*) are not found. No reef fish species that indicate the catch is from the area around the reef is found, so that it is concluded that no coral reef around the activity location is found.

To reduce the impact of PLTU Indramayu 2 x 1,000 MW to the quality of sea water, heat waste water before being discharged into the Java Sea is flowed through an open channel made of concrete. The use of open channels is intended to prevent the cooling of the heat wastewater due to evaporation and loss of heat to the air. Based on the data from several plants owned by PT. PLN (Persero) which are already in operation, the heat wastewater before being discharged into the sea has a temperature of 37-39 ° C, with chemical characteristics like the source of raw water used. Based on the simulation results, it shows an increase in sea water at 2-5 ° C, and a maximum increase in sea water temperature of about 0.75 km from the coast of PLTU Indramayu 2 x 1,000 MW which still meets the quality standards (the increase is 5 ° C) after 2.5 km. The increased sea temperatures cannot be avoided so that the management done is the construction and cooling system in accordance with the specification.

Other wastewater before being discharged into the Java Sea is treated in WWTP to reduce the TSS, ammonia, BOD, COD, nitrogen, phosphorus and oil / grease, so the quality of wastewater will be in compliance with the quality standards under Kep-051 / MENKLH / 10/1995 on Standards of Quality Liquid Waste For Industrial Activity. At the time of operation of PLTU Indramayu 2 x 1,000 MW, the WWTP will be operated in accordance with the specifications.

#### **6.2.1.3. Flood**

Clearing and preparation of land will increase water runoff of 157 liters / second. This increase does not cause water runoff, but the activity will cut the downstream of Pelawad channel. The channel cut may impede the flow of Pelawad river water. To prevent the barriers, new channels around the fence of PLTU Indramayu 2 x 1,000 MW are built taking into account the additional water discharge of 157 liters / sec.

#### **6.2.1.4. People's Increased Income**

Due to the acceptance and deployment of manpower, the opening of employment opportunities will have an impact on the change of livelihood for the local workforces who were unemployed or were formerly temporary workers. After getting jobs they get a relatively fixed income for the household and family.

The existence of a relatively fixed income will influence the increase of the consumption needs of the family so that it will have an impact on the demand for goods and services. These conditions will have an impact in the forms of opportunities for support economic sectors and other areas resulting in the number of people affected by the change of livelihood be doubled. If there are as many as 1,400 construction workers, it will result in economic impact on those who provide goods and services needed for the project workers and their families. It is estimated that, if every worker will interact with 3 other economic actors, the related effect will result in 5000 people will enjoy the impact of the changed livelihood.

The high activity of vehicles for the purposes of construction will lead to opportunities for selling goods and services in the transport sector. The existence of business opportunities for the demand for goods and services needed by the transport sector will change people's livelihood on economic activity in the informal sector. The estimated number of economic actors is not great, only about 50 businesses as the transport vehicles used are  $\pm$  300 units.

The informal sector is in fact a safety valve for the unemployed not absorbed in the formal sector as well as a 'helper' for workers with low incomes to meet the needs for goods and services. In practice the informal sector tend to be synonymous with chaos, indiscipline and other negative connotations, so that if not managed will lead to conditions that are harmful for the surrounding.

- Developing a model of community empowerment for development in the informal sector and mentoring program to implement models of community development in the informal sector.
- Providing opportunities for the local population to make business around the site of PLTU Indramayu 2 x 1,000 MW to supply the daily needs for construction workers and providing other service facilities such as rice shop, grocery shop, boarding services.
- Promoting the realization of increase in the positive impact so that they are actually realized and felt significantly by Sumuradem villagers.

#### **6.2.1.5. Land Transport Disruption**

Disruption of traffic flow is caused by the piled up sand transport vehicles in the clearing and preparation of land. Mixing between modes that have lower speeds such as bicycles and motorcycles will disrupt the flow of the movement of quarry transport. The movement of traffic flow at this time can still be served by the road capacity available because the level of service for both lines indicate the level of service A, meaning that currents can still move at high speed. But when associated with activities of construction of PLTU Indramayu 2 x 1,000 MW which requires 6.5 million m<sup>3</sup> quarry, the characteristics of the dominant modes namely motorcycles (45%) should be taken into consideration. The increasing density of traffic flow can cause traffic accidents. Meanwhile, the impact of heavy vehicles transporting materials can cause damage to roads that can disrupt the flow of traffic and increase accident.

To reduce land traffic flow interruption, it is necessary to perform management of signs and restrictions of tonnage of the transporting equipment according to the road class. The management is done in coordination with the Transportation Office of Indramayu Regency.

#### **6.2.1.6. Public unrest**

Public unrest takes place at the stages of pre-construction, construction and operation. In the pre-construction phase, the impact of public unrest arising from land acquisition activities, level of unrest caused by the difference between the compensation value of PT. PLN with the surrounding population, and the unrest level will increase with the decreasing levels of income due to loss of livelihood in the form of rice fields. The level of social unrest can be reduced through land acquisition method by deliberation in accordance with the applicable rules.

In the construction phase, the activities that cause unrest are activities of labor recruitment due to jealousy between local and migrant workers. The influence of social interaction arises due to the influx of large numbers of migrant workers. The presence of large numbers of immigrants is feared to bring the impact of the influx of migrants influences and habits that may be conflicting with the habits of the local community, which has the potential to cause public unrest.



Recruitment and mobilization of workforce will result in the opening of employment opportunities. The amount of labor needed in the construction phase is estimated as many as 1,400 people, of which approximately  $\pm 1,106$  of them are local workforce. Communities affected by the opening of job opportunities are unemployed and temporary workers in Sumuradem village, which based on data in 2010 were, 4,000 people in total.

#### **6.2.1.7. Increased Employment Opportunities**

Opening of employment opportunities have been anticipated by the community around the project site, as it means they will have a livelihood, even if the job is temporary, especially during the construction phase. For them, this is sufficient because it means the chances of getting a job with long duration because in general, their income is given on a daily basis. To increase the positive impact of the opening of employment opportunity, local workers are preferred to be recruited along with the provision of training.

Public unrest caused by the lack of job opportunities that cannot accommodate all local workforce can cause social jealousy, social interaction between migrant workers and local residents may potentially bring bad influence to the local culture, influx of workers in large numbers also means increasing prevalence of infectious diseases, decreased air quality, increasing intensity of noise and vibration that can cause an uncomfortable situation for the local population, increased traffic flow that can cause disruption of the economic activity of the surrounding communities, decreased agricultural production, which may affect the livelihoods of the surrounding communities who depend their livelihood from agriculture.

Security and order disturbances take place upon the acceptance and deployment of labor and manpower mobilization and demobilization; as the derivative impact of social unrest due to the jealousy of employment of local workers and workers from outside the project.

To reduce the impact, the efforts made by PT. PLN (Persero) are as follows:

- Dissemination involving community leaders, village officials and business people in Sumuradem village Sukra district in terms of recruitment, mobilization of equipment and materials and environmental impacts, which can disturb the public.
- Performing technical coordination with the Manpower and Transmigration Office of Indramayu Regency and Indramayu Regency Office to plan the mobilization of equipment and materials, in particular the use of vehicles with heavy tonnage.
- Recruiting workers by the contractor, which has an obligation to employ as many local people as possible in accordance with the skills and expertise based on transparency in the system of recruitment.

- Preparing Emergency Response as a result of social unrest resulting from the decreased air quality and noise, vibration, and traffic accidents.

In the operation phase, activities that lead to social unrest impacts are activities from the operations of loading and unloading dock and coal mainly on fishermen. The unrest is caused by damage to fishing equipment such as nets that are washed away by the collier, increased operating costs and lower catches resulted from the decreased quality of sea water due to spills of coal. Fishermen unrest is also caused by the declining fish stocks and increasing operating costs. To lower the impact of social unrest the following measures are done:

- To avoid damage to fishing equipment, information of collier lines and location of fishing grounds are spread to the people.
- To reduce the economic losses due to decreased fish catches, fishing community development is done through the CSR program.

## **6.2.2. Construction of Jetty**

### **6.2.2.1. Sea water quality**

Activities of relocation of coal from the transport ship to the conveyor belt result in coal spills to the sea which lowers the pH and affects aquatic life in the vicinity of the jetty and breakwater. With the estimated coal spill of as much as 0.01% of 33,936 tons / day the spills of coal each day is 3.4 tons. To decrease the amount of coal spilled into the ocean waters, closed conveyor belt will be used.

Dredging of 6.5 million m<sup>3</sup> sand from the coast will result in a loss of benthic organisms, as well as increased turbidity of 344,000 mg / L covering an area of 404,211 m<sup>2</sup> due to increased suspended material as much as 700,000 m<sup>3</sup>.

Blocking of sunlight that enters the water will disrupt the function of phytoplankton in producing oxygen and providing primary food source in waters which will influence the availability of food and water oxygen source.

Increased turbidity and TSS in water will result in a loss of potential natural fish food and disruption caused by the operation of heavy equipment. As the result, demersal fish and crustaceans around the coast will flee the location of the dredging activities and seek suitable sites. This condition will reduce the potential catches of fishermen around the coast.

Hydrocarbon layer due to coal spills in the waters will inhibit diffusion of oxygen waters resulting in declined dissolved oxygen, lowering the uniformity of plankton and aquatic benthos organisms.

Increased TSS as a result of spills will also interfere with the breathing of plankton so as to reduce populations of sensitive plankton species such as the families of baccilariophyceae.

Temperature changes that occur as a result of the deepening of water body is not expected to cause effects, due to temperature changes which occur at a depth of 10 meters will not change much ( $\pm 1^\circ \text{C}$ ).

To reduce the impact of jetty activities on sea water quality, dredging is done after the construction of the breakwater has been completed, so that ocean currents can be restrained which will prevent the spread of TSS towards the sea by installing sediment barrier made of bamboo along the path. Alternatively, the processing of pollutants into the waters is carried out following the primary impact sources.

#### **6.2.2.2. Improvement of Public Welfare**

Impact on livelihood appear on components of dredging activities, dock operations, and maintenance of dock as the impact derived from the declined fish catches around the coast due to the influence of decreased quality of sea water, Mangsetan river water and change of current patterns. The condition may affect the livelihood of fishermen. Public unrest arises on the components of dredging activities, dock operations as the impact derived from the declined fish catches.

Public unrest may lead to unfavorable public attitudes towards the plan. It therefore requires coordination with community leaders of Sumuradem village and Sukra district.

#### **6.2.3. Environmental Impact on the Project**

##### **6.2.3.1. Increased Abrasion and Accretion**

Operation of jetty results in increased abrasion and accretion caused by longshore currents caused by ocean waves in the Java Sea.

Increased abrasion and accretion is calculated using Genessis and climate forecasting models with simulation after the installation of jetty at the site of PLTU Indramayu 2 x 1,000 MW along 2.5 km of from Ujung Gebang Shore, has been obtained the estimate of abrasion and accretion along the 2.5 km from Ujung Gebang Shore or the site of PLTU Indramayu 2 x 1,000 MW after the construction of jetty with the average abrasion of 9566 m / year and average accretion of 9,735 m / year. Therefore, the average increase in abrasion compared to the baseline for the same distance is 48.7% and the increase of accretion is 73.99%.

The dominant direction of abrasion and accretion in terms of direction of the dominant waves throughout the year is northeast while waves come from the northwest and east and the breakwater is located northwest. It can then be concluded that abrasion dominantly moves eastwards and accretion dominantly takes place in the west of the breakwater.

To minimize the handling of abrasion and accretion, in areas experiencing abrasion are built shore line protection or protective coastal dikes, whereas areas affected by accretion are dredged

regularly. In addition, mangrove is also planted there under cooperation with the Fisheries and Marine Office of Indramayu Regency.

#### **6.2.3.2. Global warming**

Based on the analysis of global warming, the activities will cause sea level rise on average by 0.3 ° C per year and 1 cm / year increase of water level. Therefore, by increasing the project site of PLTU Indramayu 2 x 1,000 MW elevations by 2 meters, given the increase in sea level due to global warming, the sea level is expected to reach the project site in 200 years to come. At that time, it is expected the project is no longer in operation, so that the impact of global warming on the project is categorized insignificant.

## BIBLIOGRAPHY

- Anonymous, 1976. Quality Criteria for Water Environmental Protection Agency. U.S. Department of Commerce National Technical Information Service, Washington D.C.
- Bockris, J.O.M., 1977. Environmental Chemistry, Plemon Press, N.Y. and London.
- Canter, L.W., 1977. Environmental Impact Assessment. McGraw-Hill Book Company, New York.
- [CERC] Coastal Engineering Research Center, 1984. Shore Protection Manual Volume I, Fourth Edition. Washington: U.S. Army Coastal Engineering Research Center.
- Djajadiningrat, Surna T and Harry Harsono Amir, 1991. Penilaian Secara Cepat Sumber-sumber Pencemaran Air, Tanah dan Udara (*Quick Assessment on The Source of Water, Soil and Air Pollution*). Gadjah Mada University Press.
- Djajadiningrat, Surna T. Ed, 1990. Kualitas Lingkungan di Indonesia 1990 (*Indonesian Environmental Quality in 1990*). Kantor Menteri Negara Kependudukan dan Lingkungan Hidup (*Office of The Minister of Population and Environment*).
- Elliot, J.M., 1971. Some Method for The Statistical Analysis of Sample of Benthic Invertebrate, Scientific Publication: 148p.
- Fandeli, Chafid, 2000. Analisis Mengenai Dampak Lingkungan dan Pemaparannya dalam Pembangunan. Cetakan Revisi (*Analysis on Environmental Impact and Its Explanation in Development. Revised Edition*), Liberty. Jogjakarta.
- Hadi, Soedharto P., 2002. Aspek Sosial EMDAL: Sejarah, Teori dan Metode. Cetakan 2, (*Social Aspect of Environmental Impact Assessment: History, Theory and Method. 2<sup>nd</sup> Edition*) Gadjah Mada University Press. Jogjakarta.
- Horikawa, K., 1988. Nearshore Dynamics and Coastal Processes. University of Tokyo Press, Japan.
- Koentjaraningrat, 1989. Metode-metode Penelitian Masyarakat. (*Methods for Community Research*) Gramedia, Jakarta.
- Leopold, L.B., F.E. Clarke, B.B. Kanshaw and J.R. Bansley., 1971. A Procedure for Evaluating Environmental Impacts. US Geological Survey, Washington D.C.
- Mahida, U.N., 1992. Pencemaran Air dan Pemanfaatan Limbah Industri. (*Water Pollution and Industrial Waste Utilization*) Rajawali Press, Jakarta.
- Munn, r.E., 1979. Environmental Impact Assessment: Principal and Procedures. John Willey and Sons, New York.
- Newell, G.E. and R.C. Newell, 1963. Marine Plankton, A Practical Guide, 2<sup>nd</sup> Edition. Hutchinson Educational, Ltd. London.
- Nybakken, J.W., 1992. Biologi Laut: Suatu Pendekatan Ekologis. (*Marine Biology: An Ecological Approach*) PT Gramedia, Jakarta.
- Odum, E.P., 1971. Fundamental Ecology. 3<sup>rd</sup> Edition. Toppan Company Ltd. Tokyo.
- Row, J.B. and D.C. Wouten, 1980. Environmental Impact Analysis Handbook.
- Said, Nusa Idaman, 1999. Kesehatan Masyarakat dan Teknologi Peningkatan Kualitas Air. (*Community Health and Tachnology of Water Quality Improvement, Directorate of Environmental Technology of BBPT*), Jakarta.

- Sasongko, D.P., Agus H., Nasio A.H., and Agus S., 2000. Kebisingan Lingkungan. (*Environmental Noise*) Badan Penerbit Universitas Diponegoro, Semarang.
- Soeratno, Gunawan, 1990. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) Gadjah Mada University Press. Jogjakarta.
- Soemarwoto, Otto, 1991. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) Gadjah Mada University Press. Jogjakarta.
- Tjitrosoepomo, G., 1996. Morfologi Tumbuhan. (*Plant Morphology*) Gadjah Mada University Press. Jogjakarta.
- U.S. Army Corps of Engineers, 1984. Shore Protection Manual. Coastal Engineering Research Center, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Estimation of Nearshore Waves. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Water Wave Mechanics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Coastal Sediment Properties. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Longshore Sediment Transport. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Surf Zone Hydrodynamics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- Zen, M.T., 1982. Menuju Kelestarian Lingkungan. (*Towards Environment Sustainability*) Yayasan Obor Indonesia dan Institut Teknologi Bandung. PT Gramedia, Jakarta.

## REPORT OF MEETING

### Hearing of the Commission for Discussing the EIA, Environmental Management and Monitoring Plans (RKL and RPL) For the Planned Construction of PLTU Indramayu 2 x 1.000 MW by PT. PLN (Persero) Unit Induk Pembangunan Jaringan Jawa Bali (UIPJJB)

No	Page	Advice/Recommendation	Response	New Page
<b>Regional Secretary of Indramayu Regency</b>				
1.		The construction and operational activities of PLTU Indramayu 2 x 1000 MW in Indramayu Regency is expected to give major contributions for improving the economy of local communities, not just negative impacts	The existence of PLTU Indramayu 2 x 1000 MW, will be the trigger for regional economic development (positive impact), so it can be used by people in the area around the project (in the forms of stalls, local workers recruitment, etc.). It is already accommodated in this EIA study	EIA V – 3, VI – 10
2.		PT. PLN (Persero) Unit Induk Pembangunan Jaringan Jawa Bali (UIPJJB) as the initiator must meet its obligations during the implementation of activities both during the construction and operation periods, including to replace facilities affected by land acquisition such as irrigation channels and or the road by compensation or swapping;	The EIA document is binding and enforceable so that the obligations of the initiator should be implemented and be held accountable. The public can demand the implementation	EIA, RKL and RPL documents
3.		In principle, the Indramayu regency government will support the activities to be carried out but in the implementation of the activities PT. PLN (Persero) must refer to and be guided by the clauses in the Memorandum of Understanding (MoU) or mutual agreement between the Indramayu regency government and PT. PLN	MoU is different from the EIA. The MoU is an agreement between the Government and PT PLN (the Initiator), while EIA is a study of the impact of activities on the environment. Problems are solved separately in the MoU and the EIA. The MoU will be accommodated in PLN's CSR	

No	Page	Advice/Recommendation	Response	New Page
		(Persero)		
<b>Head of the Environmental Office of Indramayu Regency</b>				
1.		Recommendations of the technical team during the technical discussions on 24 March 2011 must be followed and will constitute inseparable parts of this EIA process	Advices and recommendations from the technical team have been accommodated in the latest revision of the EIA report	EIA, RKL and RPL documents
2.		Matters contained in the MoU between the Indramayu regency government and PT. PLN (Persero) must also be accommodated in the discussion of this EIA document	MoU is different from the EIA. The MoU is an agreement between the Government and PT PLN (the Initiator), while EIA is a study of the impact of activities on the environment. Problems are solved separately in the MoU and the EIA. The MoU will be accommodated in PLN's CSR	
3.		In the implementation of construction of PLTU Indramayu 2 x 1,000 MW, in addition to EIA, there should also be studies on Abrasion, given the study area is vulnerable to coastal erosion disaster especially during the operation of the coal jetty. This will exacerbate the occurrence of abrasion	Coastal erosion has been studied in the EIA documents and RKL,	RKL III – 36, RPL II – 34
4.		Special emphasis on the aspects of impacts resulting from the coal ash that can produce fly ash and bottom ash as well as a study of the impact on the level of human health	Analysis of the impact of coal ash (fly ash and bottom ash) has been discussed in this EIA report	EIA document page V – 26, V – 32, VI – 6, VI – 7, VI – 64.
5.		In the legal basis there are still a lot of legislations that have not been included as the standard and must be evaluated	Legislations have been completed in accordance with the EIA this discussion	EIA document chapter I.
6.		Most of the maps and images are scanned ones, making them unclear	Maps and images are quite clear according to the needs	EIA document
<b>Head of Sukra District</b>				



No	Page	Advice/Recommendation	Response	New Page
1.		The CSR (Corporate Social Responsibility) Program which has been planned shall be rolled out at the start of the construction work, but should be differentiated / separated with the implementation of swapping of facilities affected by land acquisition	CSR is an obligation of the initiator to empower communities around the project, while the issue of compensation is the obligation of the initiator to replace public assets affected by the project	
2.		From the explanations related to the discussion of the EIA, there is no SOP (Standard Operating Procedure) in case of emergency in the form of contact person and person in charge for handling the emergency	The SOP for emergency available is the SOP for fire fighting and handling of K3	EIA Document
3.		. In the management of activities, is it under one management with PLTU Pembangkitan Indramayu (PLTU 1), previous experiences show it is very difficult to coordinate with the management of the power plant	The management of PLTU Jawa Barat 3 x 330 MW and the Management of PLTU Indramayu 2 x 1000 MW are different. PLTU Jawa Barat 3 x 330 MW is managed by a Chinese Private enterprise while PLTU Indramayu 2 x 1000 MW is managed by a Japanese private enterprise	
4.		From the agreement set forth in the MoU, PT. PLN (Persero) shall immediately inform the access road that will be used or the location of the construction of the access road to the site of activity	Based on the information obtained by the EIA study team, the access road that will be used is the road of PLTU Jawa Barat 3 x 330 MW	EIA II – 15
5.		For B3 waste management, if there is a local company that meets the technical requirements of legality, it should be prioritized, to avoid the same issue as PLTU 1, which still encounters problems in connection with the management of B3 waste	This problem is an issue that should be discussed between the community and local government and PLN. PT. PLN will prioritize local enterprises to manage the waste B3 by meeting the technical qualification and legality issued by the Ministry of Environment	
<b>Kuwu of Tegal Village Patrol District</b>				
1.		To the initiator, we demand that the environmental	Learning from the problem of PLTU Jawa Barat 3 x	

No	Page	Advice/Recommendation	Response	New Page
		<p>management policy should not be like PLTU 1 (Pembangkitan Indramayu) which is full of issues, namely:</p> <ul style="list-style-type: none"> <li>Workers recruitment must be through government agencies (Social Office of Indramayu Regency). Unskilled labors should not be brought from outside the region as there are plenty workers here.</li> <li>Health impacts must be studied comprehensively so it can be used as a benchmark at the time the quality of health of buffer and support villages deteriorate like the present in which the dominant illness is ARI</li> </ul>	<p>330 MW, the management of PLTU 2 x 1000 MW will refer to the agreed RKL and RPL.</p> <ul style="list-style-type: none"> <li>In the RKL RPL documents, the workers priority will be given to local workers in accordance with the criteria</li> <li>The health study has included public health status that comes from the local health centers as a reference to changes in public health from the effects of the project. ARI is currently high but not because of the impact of PLTU Indramayu 2 x 1000 MW as the ARI that is now appearing has existed before the actualization of PLTU Indramayu 2 x 1000 MW.</li> </ul>	<ul style="list-style-type: none"> <li>RKL, III – 5 through III – 6 dan RPL II – 3 through II – 4</li> <li>ANDAL III – 97 through III – 98</li> </ul>
2.		From previous experiences, the dust from the activities of PLTU 1 reaches settlements and farming areas. Therefore, the initiator should do reforestation prior to the construction work so that during the operation, the trees have been able to capture dust	Before the operation of PLTU Indramayu 2 x 1000 MW there will be reforestation which is accommodated in the legally binding RKL & RPL	RKL III – 26 through III – 27.
3.		The construction of jetty will certainly have an impact on the severity of abrasion. The initiator must plan to plant mangrove and construct of breakwater	Coastal erosion has been discussed in the EIA and RKL/RPL documents	RKL III – 36, RPL II – 34
4.		As already presented at the meeting of KA-EIA, skill and non skill labor recruitment should prioritize local workers to avoid social inequality which could be turmoil in the community	Labor recruitment has been accommodated in RKL and RPL	RKL III – 5 through III – 6, RPL II – 3 through II – 4.
5.		The initiator shall inform the implementing schedule of activities to let the people know of the land to be released	PLN will inform the implementation schedule of activities after confirmation of the contractor for the	

No	Page	Advice/Recommendation	Response	New Page
		so that citizens do not fret as it is currently happening	construction of PLTU Indramayu 2 x 1000 MW	
<b>Representative of Sumuradem Village Sukra District</b>				
1.		The operation of the activities will Indramayu 2 x 1000 MW must give real contribution to the community, unlike PLTU Pembagkitan Indramayu which until now is loaded with the problems with the communities of the buffer village	We agree with this statement	
2.		If in the future there is a significant impact and emergency with regard to the activities PLTU Indramayu 2 x 1000 MW, to whom must the citizen report and who is the person in charge? In addition, land acquisition must be more careful so as to prevent citizens who do not have land from getting compensation	In the documents of RKL & RPL, the reporting procedures and the institution responsible have been discussed	RKL and RPL
3.		With regard to labor recruitment, let us know about the executive agency and whether it is in cooperation with the local government. There should be an independent institution to bridge the accommodation of local workforce. Small jobs or non skilled workers should not be brought from outside the area as they are available here	The contractor will be obliged to cooperate with the local government (Office of Labor, District, Village and RT / RW)	
4.		The construction phase should involve local companies. If they cannot meet the criteria to be a contractor, at least they can be a Sub Contractor. Do not involve companies from outside the area	We agree with this statement, provided they meet the technical requirements in accordance with the specification requirements	
<b>Representative of Patrol Baru Village Patrol District</b>				
1.		The planned construction of PLTU Indramayu 2 x 1000 MW is feared to result in electromagnetic waves, the EIA document has no explanation on this issue and the effect	The impact of electromagnetic waves has already been addressed in the EIA study of SUTET 500 kV GITET Indramayu - GITET Cilaku, whereas based on	

No	Page	Advice/Recommendation	Response	New Page
		on human must be discussed	the EIA discussion of PLTU Indramayu 2 x 1000 MW there will be no impact of electromagnetic waves	
<b>Representative of Mekarsari Village Patrol District</b>				
1.		It is feared that the operation activities of PLTU Indramayu 2 x 1000 MW will affect air quality and spread coal ash (fly ash), as is the case in PLTU Pembangkitan Indramayu (PLTU 1), considering the distance to the settlements is close, this needs to be taken into account in connection with the coal reactor design. If the impact is not handled PLN should able to relocate the residents	Results of analysis of the distribution of coal ash do not cause the concentration of dust around settlement to exceed the quality standards as the specification of PLTU Indramayu 2 x 1000 MW will be equipped with ESP (electrical dust catcher). PLN agrees to do the relocation if the impact is caused by the activities of PLTU Indramayu 2 x 1000 MW	EIA III – 11
<b>Investment and Licensing Agency of Indramayu Regency</b>				
1.		The Memorandum of Understanding (MoU) or mutual agreement between the Indramayu regency government and PT. PLN (Persero) is still in the stage of mediation, if there are suggestions and consultation, please come to BPMD	We agree with this statement. If we have recommendation PT. PLN will come directly to the BPMD of Indramayu Regency	
2.		There must be special considerations in determining the ideal location which provides a distance between residences and the location of activities	The location of PLTU Indramayu 2 x 1000 MW has considered from various aspects including the impact on the society	
3.		With regard to the waste generated, the management should work with local community groups, to actualize increase in the local economy	PT. PLN will prioritize local enterprises to manage the waste so long as they meet the technical and legal requirement set forth by the Ministry of Environment	III – 2
4.		The entrance to the location of activities according to the MoU shall be made separate or not integrated with the access road of PLTU 1	The access road will constructed in accordance with the MoU between PT. PLN and the Indramayu local government	
5.		Given the location is adjacent to PLTU 1, it is	In this study the cooling water discharge channel is	

No	Page	Advice/Recommendation	Response	New Page
		recommended to build together a canal / lagoon to discharge the water from the cooling process	separate, but in the future cooperation can be entered into between PLTU Jawa Barat 3 x 330 MW and PLTU Indramayu 2 x 1000 MW	
6.		After reaching a mutual agreement through the MoU and the Environmental Feasibility Recommendation, the initiator shall immediately apply for licensing related to the construction of PLTU Indramayu 2 x 1000 MW	We agree with this statement. PT. PLN will apply for licensing after the EIA is approved	
7.		The initiator is obliged to submit the profile of the contractors and sub-contractors to Indramayu regency government, with regard to the permitting process as an example in the activities of land piling up in which the sub contractors are required to have Excavation C permit	PT. PLN after obtaining a contractor through an open auction, will require the contractor to apply for the licensing to the Government of Indramayu	
<b>EIA Assessor technical Team of Indramayu Regency - Ir. Aep Surahman</b>				
1.		In the preparation of EIA documents, we understand it emphasizes on the discussion of Description of Activities, but the document has not contained a thorough design, making it difficult to even determine the reforestation zone. Therefore, technical design divided in technical subs are very important to minimize the impact during operation	The technical design is generally outlined in the project description. The detailed location of reforestation will be planned in accordance with the directives of RKL & RPL	EIA Chapter II, RKL III – 26 through III – 27, III – 42, RPL II – 35 through II – 36
2.		In the management of B3 waste the design of temporary collector (TPS) must be adapted to the dominant wind direction at the location of activities, so that the collected waste is not carried by the wind to settlements and paddy fields	The determination of the location of collectors has considered the dominant wind direction and the form of management guarantees that it will not be scattered, among others, by regular watering	EIA III – 3 through III – 5
3.		Implementation of reforestation must be adjusted with the zone / location of potential impacts and green belt with the	We agree with this statement and it has been accommodated in the RKL and RPL	RKL III – 26 through III – 27, III

No	Page	Advice/Recommendation	Response	New Page
		locations around the activities		– 42, RPL II – 35 through II – 36
4.		Site Plant has not been existed and should be included	Site Plan already exists in the project description	EIA Chapter II
5.		CSR, regardless of the impact, is the duty of the initiator, unless the company is insolvent or makes no profit / suffers loss	We agree with this statement, the implementation of CSR is the obligation of the initiator from 2.5% of the profit	
6.		In general, the study still has not been specific and it cannot explain the problems closely associated with the potential for significant impact	The detail of impact has been corrected in the final report	EIA Chapter V and Chapter VI
7.		In the management of B3 waste, in Government Regulation No. 18 of 1999 jo Government Regulation. No. 85 of 1999, it is mentioned the initiator has the obligation to provide guidance on waste management, B3 waste management should be managed under cooperation with community so that people can feel the benefit and will not suffer from the impact	PLN will follow the applicable regulations on B3 waste management (Government Regulation No. 18 of 1999 jo Government Regulation No. 85 of 1999).	
8.		The document has not included agricultural irrigation channel data. Please complete it	It is already corrected in the final report	EIA III – 26
9.		For the use of coal as an energy source, the quality of coal must meet the classification permitted by Regional Regulation of West Java of 2010	We agreed to refer to egional Regulation of West Java of 2010, with the sulfur content of < 0.3 %	
<b>EIA Assessor technical Team of Indramayu Regency - Ir. Firman Muntako</b>				
1.		Of all types of waste generated, there has been no discussion on the certification of the treatment equipment, please include it	This technology is a technology of Japan and the certification of the treatment equipment will be provided by the contractor to PLN during the	

No	Page	Advice/Recommendation	Response	New Page
			construction phase	
2.		The construction of jetty which will have an impact on the level of abrasion is not managed well described in the EIA, RKL and RPL	Coastal erosion has been studied in the EIA and RKL, RPL documents	RKL III – 36, RPL II – 34
3.		For the implementation of reforestation, the initiator should have designed the zone and the location within the site plan which is not contained in this EIA document	Site Plan has been included in the activity project description	RKL III – 26 through III – 27, III – 42, RPL II – 35 through II – 36, EIA Chapter II,
<b>EIA Assessor technical Team of Indramayu Regency - Dedi Rahmat, BE</b>				
1		The coal deposit location must be made / designed closed from the beginning, unlike PLTU 1 which was originally designed open but now built made closed	The coal deposit location is indeed open and the results of the study show it do not cause significant impacts on water quality and air quality. In addition, to reduce the impact, watering will be done regularly along with reforestation around the area	EIA III – 11, RKL III – 26 through III – 27, III – 42, RPL II – 35 through II – 36
2		The handling of Ash Pond from the beginning must be consulted with the Ministry of Environment	Handling of Ash Pond has been referring to the existing regulations, one of them by putting geotextile layer which has low permeability. The implementation will be consulted with the Ministry of Environment	
3		In the discussion the distribution of dust / fly ash has not calculated the extent of its distribution coverage, please include it	It has been explained in the isophlete map of ash spread.	EIA V – 17 through V – 24
<b>Expert Team (Mr. Benson)</b>				
1.		At the time of labor recruitment, the initiator should announce the competence required, so that the people can fulfill it	PT. PLN will conduct dissemination of labor recruitment required in accordance with the required competence and it has already been accommodated in	

No	Page	Advice/Recommendation	Response	New Page
			the RKL & RPL documents	
2.		Implementation of reforestation with green belt as the boundaries of activities with other locations	Green belt has been constructed around the border of PLTU Indramayu 2 x 1000 MW and ash and coal container	EIA, II – 35
3.		Study of the distribution of noise level has not been discussed, please complete it	It has been given in the final report	EIA V – 9
4.		For the level of public health, it is better to do a special study so that there is clarity of cause of dominant disease around the activity site allowing the public to know whether or not the health impact is caused by the project	Public health studies in the EIA has discussed the diseases suffered by the people in the project area which can be used as a baseline to determine the impact of the activities	
<b>BPD of Sukra Wetan</b>				
1		Consider the surrounding by organizing preventive action to avoid something detrimental to the surrounding community	We agree with this statement	
2		The power plant shall optimize the employment of the local people	We agree with this statement and it has been suggested in the RKL & RPL documents	
3		Allocate social funds continuously to help the local community for physical development or alleviation of the poor and support of development of education	We agree with this statement, it will be conducted using the CSR funds of PT. PLN	
4		Hold a gathering forum for the community and the local government	We agree with this statement. Gathering has been made since the EIA dissemination process and formulation of the CSR to be conducted	
5		Create a conducive PLTU condition and act firmly against corruption both internally and externally	Kami sepakat dengan pernyataan ini	
<b>Anonymous</b>				



No	Page	Advice/Recommendation	Response	New Page
1		<p>The existence of power plant projects in Mekar Sari Patrol Baru and Patrol Lor, in addition to reduces land, also affects human health and causes environmental problems:</p> <p>1. On human; The higher the capacity of PLTU 2 x 1000 MW, the higher its radiation on human body will be (Reference: A Drug Free 24 Hours, by Prof. Dr. Freddy Hutapea, P.hd)</p> <p>2. On the environment ; The surrounding/soil around the PLTU will not be productive and it will damage the plants</p>	<p>1. The radiation does not come from PLTU Indramayu power plant 2 x 1000 MW but from coal ash. It is already accommodated in the RKL &amp; RPL documents</p> <p>2. Damage to soil around PLTU Indramayu 2 x 1000 MW is caused by coal ash. It is already accommodated in the RKL &amp; RPL documents</p>	<p>1. RKL &amp; RPL</p> <p>2. RKL &amp; RPL</p>
<b>Representative of the People</b>				
1	Chapter V, Forecast of Significant Impact	The Survey Data from the EIA documents regarding increase of labor decreases the number of job seekers to 2.6% for the regency affected by the construction of PLTU 2 which covers 328 hectares. It has not been balanced with the losses in the agricultural sector, especially with regard to local workers recruitment, namely as many as 1106 workers at the stage of the construction period with the wage Rp. 39,000, - per day x 30 days = Rp. 1.17 million, - x 1 year (12 months) = Rp. 14.04 million	The impact which will occur this is a local direct impact, but besides that, it will provide multiplier impact to the economy of the region concerned. Additionally, the project has a national multiplier effect so that the positive impact is greater	
2	Chapter V, Forecast of Significant Impact	The calculation of 1 Ha rice yields is 6 Ton / season on average, grain price is Rp. 300,000, - / quintal with the total revenues of Rp. 18,000,000, -. Fee for cultivating is Rp. 2,500,000, -, the net income of the farmer is Rp. 15,500,000, - per season per Ha. Therefore, the income of farmers with two planting seasons per year and a land		

No	Page	Advice/Recommendation	Response	New Page
		area of 328 Ha is Rp. 10,168,000,000, - (Rp. 15,500,000, - x 2 Season x 328 Ha)		
<b>Tohidin (Wiralodra Indramayu University)</b>				
1		In principle, the EIA, RKL, RPL can already be accounted for in accordance with the guidelines for the preparation of EIA. However, as the projects in Indramayu Regency at construction and post-construction stages are always faced with social issues such as rallies, public dissatisfaction of the project. Although the EIA document in Chapter VI Sub-Chapter 6.1.2.1. Recruitment of Labor, has discussed the labor in the study area, there should be a Sub Chapter on "AMDAK" (Riot Impact Analysis) to anticipate the public discontent for example by hiring local workers to work for the plant and distributing CSR to the public around the site etc.	We agree with this statement. To give greater positive impacts, CSR programs will be done by PT. PLN	
2		General Guidelines for the preparation of EIA (the Decree has been revoked), namely in Regulation of the Minister of Environment No. 8 of 2006 concerning Guidelines for Preparation of EIA Section A, That ..... Regulation of the Minister of Environment No. 14 of 1997 is revoked. Do not include improper regulations	Appreciation is given for the comments and it has been corrected	EIA Chapter I
3		Please include : Law no. 18 of 2008 concerning Waste Management Presidential Decree No. 32 of 1990/2009 concerning environmental management	They are already included in the document	
4		In accordance with Regulation of the minister of Environment No. 7 of 2010 concerning Certification of	The EIA is prepared before Regulation of the Minister of Environment No. 7/2010 is enacted and has	

No	Page	Advice/Recommendation	Response	New Page
		Competence of Person Preparing EIA and requirements of EIA Document Competence Training institutions: <ul style="list-style-type: none"> <li>Any person preparing EIA shall provide certificate of competence for the Preparation of EIA</li> <li>Any institution providing services for preparing EIA Documents is required to have Competence registration</li> </ul>	received approval from the Environmental Office of Indramayu Regency	
5		Law No. 18 of 2008 concerning waste management, article 13: business industrial area shall provide a waste sorting facility: Where will the power plant waste be disposed? Make it clear, including for organic waste, inorganic and B3	Thank you for your comments and suggestions, domestic waste from the activities of PLTU Indramayu 2 x 1000 MW will be managed in coordination with the relevant office (the Hygiene Office) while B3 waste will managed in coordination with the B3 waste manager recommended by the Ministry of Environment.	
6		The construction implementation plan shall be made clear and measurable	The schedule has been made detail as received from the initiator	
<b>BPD of Patrol Lor</b>				
1.		The wage must conform with the prevailing wage in the community	We agree with this statement. PT. PLN will give wages according to the regulation of the Manpower Office of Indramayu Regency	
2.		The number of people must be in accordance with the fact	The number of people refers to the data from the Central Bureau of Statistics (BPS) taken from <i>Kabupaten Indramayu Dalam Angka</i> at the time of the study	
3.		There must be training for communities around the power plant so that they can be recruited and work for the project	We agree with this statement. The competence of the workers needed has been disseminated before the construction of PLTU Indramayu 2 x 1000 MW so that people can prepare for the competence required	



## TABLE OF CONTENT

<b>PREFACE .....</b>	<b>i</b>
<b>TABLE OF CONTENT .....</b>	<b>ii</b>
<b>LIST OF TABLE .....</b>	<b>iv</b>
<b>LIST OF PICTURE .....</b>	<b>v</b>

### CHAPTER I INTRODUCTION

1.1. Background .....	I – 1
1.1.1. Rules and Regulations .....	I – 2
1.1.2. Policy on Environmental Management .....	I – 13
1.2. Purpose and Benefit .....	I – 13
1.2.1. Purpose .....	I – 13
1.2.2. Benefit .....	I – 14

### CHAPTER II ENVIRONMENTAL MANAGEMENT APPROACH

2.1. Technological Approach .....	II – 1
2.2. Socio-Economical Approach .....	II – 1
2.3. Institutional Approach .....	II – 2

### CHAPTER III ENVIRONMENTAL MANAGEMENT PLANT

3.1. Pre Construction Stage .....	III – 1
3.1.1. Land Acquisition .....	III – 1
3.2.1.1. Community Restlessness .....	III – 1
3.2.1.2. Increasing Level of Income .....	III – 2
3.2. Construction Stage .....	III – 5
3.2.1. Labor Recruitment and Personnel Mobilisation .....	III – 5
3.2.1.3. Increasing Job Opportunity .....	III – 5
3.2.1.4. Increasing Level of Income .....	III – 6
3.2.1.5. Community Restlessness .....	III – 7
3.2.2. Equipment and Material Mobilisation .....	III – 9
3.2.2.1. Degrading Air Quality .....	III – 9
3.2.2.2. Transportation Problem .....	III – 10
3.2.2.3. Degrading Community's Health .....	III – 13
3.2.3. Land Preparation .....	III – 12
3.2.3.1. Increasing Noise Level .....	III – 14
3.2.3.2. Sea Water Quality .....	III – 15
3.2.3.3. Change in Spatial Use .....	III – 16
3.2.3.4. Flood .....	III – 17
3.2.3.5. Traffic Problem (Land) .....	III – 18
3.2.4. Facility and Infrastructure Development (Jetty) .....	III – 17
3.2.4.1. Degrading Sea Water Quality .....	III – 22
3.2.4.2. Fishermen Transportation Problem .....	III – 23
3.2.4.3. Increasing Number and Variety of Flora and Fauna.....	III – 26
3.2.4.4. Increasing Level of Income .....	III – 27
3.3. Operational Stage .....	III – 29
3.3.1. Labor Recruitment .....	III – 29
3.3.1.1. Job Opportunity .....	III – 29
3.3.1.2. Increasing Level of Income .....	III – 30

3.3.1.3.	Community Restlessness .....	III – 31
3.3.2.	Coal Discharging (Jetty) .....	III – 34
3.3.2.1.	Sea Water Quality .....	III – 34
3.3.2.2.	Fishermen Problem .....	III – 35
3.3.2.3.	Abrasion and Accretion Problems .....	III – 36
3.3.3.	Operation of Generator .....	III – 39
3.3.3.1.	Air Quality .....	III – 39
3.3.3.2.	Flora and Fauna Problems .....	III – 41
3.3.3.3.	Community's Health .....	III – 42
3.3.4.	Cooling Unit (Hot Waste) .....	III – 43
3.3.4.1.	Degrading Sea Water Quality.....	III – 43
3.3.4.2.	Sea Water Lifeforms Problem .....	III – 45
3.3.4.3.	Decreasing Level of Income.....	III – 46
<b>SUMMARY MATRIX OF PLTU INDRAMAYU 2 x 1.000 MW ENVIRONMENTAL MANAGEMENT PLAN .....</b>		<b>M-1</b>
<b>BIBLIOGRAPHY .....</b>		<b>D-1</b>

**LIST OF TABLE**

Table 3.1.	Sea Water Standard and Measuring Method during Construction Stage .....	III – 22
Table 3.2.	Air Quality Standard and Measuring Method during Construction Stage .....	III – 39
Table 3.3.	Air Emission Standard during Operational Stage .....	III – 40
Table 3.4.	Ambient Sea Water Quality Standard .....	III – 43

**LIST OF PICTURE**

Figure 3.1.	Location of Socio-Economic Aspect Management during Pre Construction Stage .....	III – 4
Figure 3.2.	Location of Equipment/Material Mobilisation Management during Construction Stage .....	III – 12
Figure 3.3.	Location of Landscape Change Management during Construction Stage .....	III – 20
Figure 3.4.	Location of Flora and Fauna Increasing Variety Management .....	III – 21
Figure 3.5.	Location of Sea Water Quality Management during Construction Stage .....	III – 24
Figure 3.6.	Location of Socio-Economic Aspect Management during Operational Stage ....	III – 33
Figure 3.7.	Location of Air Quality Management during Operational Stage .....	III – 37
Figure 3.8.	Location of Sea Water Quality Management during Operational Stage (Coal Discharge) .....	III – 38
Figure 3.9.	Location of Sea Water Quality Management during Operational Stage .....	III – 45



# **CHAPTER I INTRODUCTION**

## **1.1. BACKGROUND**

Development in Indonesia that is being actively implemented at this time aims at improving the welfare and quality of life of the people. Implementation of development on one hand is facing the issue of large population with high growth rates thus requiring better infrastructure. On the other hand, availability of natural resources is not increasing and is limited. Development activities and the increasing number of people can lead to increased pressure on natural resources.

Utilization of natural resources to improve the welfare and quality of life of the people must be accompanied by efforts to conserve the environment harmoniously in a balanced manner to support sustainable development. The development should be implemented in an integrated and comprehensive policy, taking into account the needs of the present and future generations. The important thing that should be observed in the integrated and total development is the environment. Therefore, the development intended must be environmentally sound and sustainable.

Construction of power plant installations is an inseparable part of development as the need for electricity will go in line with the increased activity and people's welfare. However, on the other hand, the construction of power plant may result in issues due to the cost needed and the labor requirements. The high costs will require reliable funding sources which must be found while labor-extensive project will lead to potential impacts on the environment.

At present PLTU Indramayu 2 x 1000 MW is about to be constructed to support the supply of electricity for Java and Bali. To anticipate the growing requirements for electricity, PT. PLN UIPJJB will increase the capacity by constructing PLTU Indramayu 2 x 1000 MW in West Java.

The 2 X 1000 megawatt (MW) steam power plant is planned to be constructed in the northern coast of Indramayu in Sumuradem Village, Sukra District and Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District, Indramayu Regency.

Environmentally-friendly construction and wise control of use of natural resources are the ultimate aims of environmental management. To that end, the planning of PLTU Indramayu 2 x 1.000 MW must predict the impact on environmental baseline, both beneficial and adverse.

Article 15 of Law No. 23 of 1997 states that every activity which is expected to produce significant impacts on the environment must be accompanied by an Environmental Impact Analysis Study. Implementation of the Environmental Impact Analysis is stipulated in Government Regulation No. 27 of 1999 and further in Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business and / or Activities that Must be Equipped by Environmental Impact Analysis

dictating that the activities of planned construction of power plant with a capacity of over 100 MW shall be equipped with an Environmental Impact Analysis study.

#### **1.1.1. Legislations**

The preparation of this Environmental Management Plan (RKL) refers to the legislations as follows :

##### **A. LAW**

- 1) Law of the Republic of Indonesia No. 1 of 1970 concerning Occupational Safety.  
Reason : As a reference in the construction of power plant with regard to the management of occupational safety impact.
- 2) Law No. 7 of 1981 concerning Compulsory Personnel Reporting.  
Reason : As a reference in the recruitment of workers for PLTU Indramayu 2 x 1000 MW.
- 3) Law of the Republic of Indonesia No. 5 of 1984 concerning Industry.  
Reason : As a reference in the construction of power plant with regard to industrial activities which will be built.
- 4) Law No. 1 of 1990 concerning Occupational Safety  
Reason : As a reference in the construction of power plant with regard to its Implementation which must meet safety requirements.
- 5) Law No. 5 of 1990 concerning Conservation of Natural Resources and Ecosystems.  
Reason : As a reference in the planning / conservation of natural resources related to impact management.
- 6) Law of the Republic of Indonesia No. 35 of 1991 concerning River.  
Reason : As a reference in the construction of the power plant with regard to the impact on the management of the river around the construction.
- 7) Law No. 3 of 1992, concerning Worker Social Security  
Reason : As a reference in the construction of power plant with regard to Social Security membership. Companies that employ workers should include them in the Social Security program
- 8) Law of the Republic of Indonesia No. 14 of 1992 concerning Traffic and Road Transportation.

Reason : As a reference in the construction of power plant with regard to the impact of traffic management and road transportation around PLTU Indramayu 2 x 1000 MW.

- 9) Law of the Republic of Indonesia No. 21 of 1992 concerning Shipping.

Reason : As a reference in the construction of power plant with regard to the management of traffic and impact of sea transport for the distribution of coal.

- 10) Law of the Republic of Indonesia No. 6 of 1993 concerning Climate Change.

Reason : As a reference in the construction of the power plant with regard to the management of the impact of climate change as a result of construction activities PLTU Indramayu 2 x 1000 MW.

- 11) Law of the Republic of Indonesia No. 5 of 1994 concerning Ratification of the International Convention Regarding Biodiversity.

Reason : As a reference in the construction of the power plant with regard to the management of the impact on flora and fauna.

- 12) Law of the Republic of Indonesia No. 5 of 1995 concerning Ratification of the Climate Convention.

Reason : As a reference in the construction of power plant with regard to climate change.

- 13) Law of the Republic of Indonesia No. 6 of 1996 concerning Indonesian Waters.

Reason : As a reference in the construction of power plant with regard to the activities of PLTU Indramayu 2 x 1000 MW in the area of Indonesian waters.

- 14) Law of the Republic of Indonesia No. 13 of 2003 concerning Manpower.

Reason : As a reference in the construction of power plant with regard to the management of the impact of labor mobilization.

- 15) Law No. 7 of 2004 concerning Water Resources

Reason : As a reference in the construction of power plant with regard to the use of water for the construction of PLTU Indramayu 2 x 1.000 MW.

- 16) Law No. 31 of 2004 concerning Fisheries.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of impacts.

- 17) Law No. 32 of 2004 concerning Regional Government (which has been amended by Government Regulation in Lieu of Law No. 3 of 2005).

Reason : As a reference in the construction of power plant as it relates to the development policy in Indramayu Regency

- 18) Law No. 27 of 2007 concerning Management of Coastal Areas and Small Islands.

Reason : As a reference in the management of PLTU Indramayu 2 x 1000 MW relating to the activities of PLTU Indramayu 2 x 1000 MW located in coastal areas.

- 19) Law No. 26 of 2007 concerning Spatial Planning.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to possible changes in land use due to the power plant.

- 20) Law No. 26 of 2008 concerning Regional Spatial Planning.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW related to spatial planning in the area of the power plant construction plan.

- 21) Law No. 30 of 2009 concerning Electricity.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of the impacts.

- 22) Law No. 32 of 2009 concerning Protection and Management of the Environment.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the obligation in the context of preparation of the EIA document for environmental management mainly due to the impacts caused by the project activity.

- 23) Law of the Republic of Indonesia No. 36 of 2009 concerning Health.

Reason : As a reference in the construction of power plant with regard to the management of public health impact.

## **B. GOVERNMENT REGULATION**

- 1) Government Regulation No. 13 of 1987 concerning Industrial Business License.

Reason : As a reference for the permits in the construction of PLTU Indramayu 2 x 1000 MW

- 2) Government Regulation No. 6 of 1988 concerning Vertical Institutional Coordination in Regions.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW as it relates to development policy in Indramayu Regency.

- 3) Government Regulation No. 10 of 1989 *juncto* Government Regulation No. 26 of 2006 concerning Provision and Use of Electric Power.

Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.

- 4) Government Regulation No. 41 of 1993 concerning Road Transportation.

Reason : As a reference for the management of transportation used in PLTU Indramayu 2 x 1000 MW.

- 5) Government Regulation No. 43 of 1993 concerning Road Infrastructure and Traffic.

Reason : As a reference for the mobilization of facilities and infrastructure management in the activities of construction of PLTU Indramayu 2 x 1000 MW.

- 6) Government Regulation No. 69 of 1996 concerning Exercise of Rights and Performance of Duties as well as Forms and Procedures for Public Participation in Spatial Planning.

Reason : As a reference to the participation of the local community towards PLTU Indramayu 2 x 1000 MW.

- 7) Government Regulation No. 70 of 1996 concerning Seaport.

Reason : As a reference in the construction of jetties that will be used for the distribution of coal.

- 8) Government Regulation No.7 of 1999 concerning Preservation of Plants and Animals.

Reason : As a reference in environmental management so that the construction activities of PLTU Indramayu 2 x 1000 MW do not disturb plants and animals around the site

- 9) Government Regulation No. 8 of 1999, concerning use of plants and wildlife.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW so as to not disturb the plants and animals around the construction site.

- 10) Government Regulation No. 18 of 1999 *juncto* Government Regulation No. 85 of 1999 concerning Management of Hazardous and Toxic Waste.

Reason : As a reference in waste management mainly due to the impact caused by the project activity.

- 11) Government Regulation No. 19 of 1999 concerning Sea Pollution and / or Destruction Control.

Reason : As a reference in the solution in the event if issues / impact of activities on the sea around PLTU Indramayu 2 x 1000 MW.

- 12) Government Regulation No. 27 of 1999 concerning Environmental Impact Analysis.

Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.

- 13) Government Regulation No. 41 of 1999 concerning Air Pollution Control.

Reason : As a reference in the solution in the event of issues / impact of activities against air quality.

- 14) Government Regulation No. 47 of 1999 concerning Spatial Planning.

Reason : As a reference in the spatial change with the construction of PLTU Indramayu 2 x 1000 MW

- 15) Government Regulation No. 82 of 1999 concerning Water Transport.

Reason : As a reference in traffic management and mobilization of the power plant's raw materials by sea.

- 16) Government Regulation No. 81 of 2000 concerning Navigation.

Reason : As a reference for coordination with the sea transportation office on the management and monitoring of sea lanes to be used as a coal raw material supplier.

- 17) Government Regulation No. 74 of 2001 concerning Management of Hazardous and Toxic Materials (B3).

Reason : As a reference in waste management mainly due to the impact caused by the project activity.

- 18) Government Regulation No. 82 of 2001 concerning the Management of Water Quality and Water Pollution Control.

Reason : As a reference in the solution in the event of issues / impact of activities on water quality.

### **C. PRESIDENTIAL REGULATION**

- 1) Regulation of the President of the Republic of Indonesia No. 71 of 2006 concerning Assignment to PT. PLN (Persero) for Performing Accelerated Construction of Coal Power Plant.

Reason : As a reference for PT. PLN (Persero) to construct PLTU Indramayu 2 x 1000 MW.

- 2) Regulation of the President of the Republic of Indonesia No. 72 of 2006 concerning Coordinating Team for the Acceleration of Construction of Power Plant..

Reason : As a reference for PT. PLN (Persero) to immediately form a coordinating team in the construction of PLTU Indramayu 2 x 1000 MW

### **D. MINISTERIAL REGULATIONS**

- a. Regulation of the Minister of Manpower and Transmigration No. 1 of 1980 concerning Occupational Safety and Health in Building Construction

Reason : As a reference in worker health and safety in the construction of PLTU Indramayu 2 x 1000 MW.

- b. Regulation of the Minister of Manpower No. 5 of 1985, concerning Lifting and Transporting Apparatuses.

Reason : : As a reference in the use of Apparatuses, Junis Cranes, Dozers, Excavators, Fork-lifts which meet the requirements of K3.

- c. Regulation of the Minister of Health No. 718/MENKES/PER/XII/1987 concerning Noise Related to Health.

Reason : As a reference for the solution in the event of issue or impact of the activities mainly related to noise that can affect health.

- d. Regulation of the State Minister of Agrarian / Head of BPN No. 1 of 1994 concerning Implementing Regulations of Presidential Decree No. 55 of 1993.

Reason : As a reference for the solution in the event of issues / impact of activities related to land release / land acquisition.

- e. Regulation of the Minister of Environment No. Kep. 08 of 2006 concerning Guidelines for the Preparation of Environmental Impact Analysis.

Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.

- f. Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business Plan and / or activities which must be equipped with EIA.

Reason : As a reference that PLTU Indramayu 2 x 1000 MW project is an activity that must have EIA documents.

- g. Regulation of the Minister of Environment No. 12 of 2006 concerning Licensing Requirements and Disposal of Wastewater to the Sea.

Reason : As a reference for the solution in the event of issues / impact of activities primarily those related to the possibility of the waste from PLTU Indramayu 2 x 1000 MW.

## **E. PRESIDENTIAL DECREE**

- 1) Presidential Decree No. 04 of 1980 on Obligatory Manpower Report.

Reason : As a reference in recruitment for PLTU Indramayu 2 x 1000 MW.

- 2) Presidential Decree No. 55 of 1993 on Land Procurement for Development for Public Interest.

Reason : As a reference in the determination of land for the construction of PLTU Indramayu 2 x 1000 MW Indramayu

- 3) Presidential Decree No. 10 of 2000 concerning Environmental Impact Management Agency.

Reason : As a reference in the determination of regulatory, executive and reporting agency for the environmental impact control of PLTU Indramayu 2 x 1000 MW

## **F. MINISTERIAL DECREE**

- a. Decree of the Minister of Manpower No. SE.OI/MEN/1978 concerning Ambient Air Quality Standards in Work Environment.

Reason : As a reference in the assessment of the environment, especially increase of ambient air pollution that can be caused by the construction activities of PLTU Indramayu 2 x 1000 MW.

- b. Decree of the State Minister of Population and the Environment No. KEP-49/MENKLH/6/1987 concerning Determination of Significant Impacts.

Reason : As a reference in the assessment of environmental factors as activities that have an important impact.

- c. Decree of the Minister of Environment No. KEP-14/MENLH/3/1994 concerning General Guidelines for the Preparation of Environmental Impact Analysis.

Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.

- d. Decree of the Minister of Mining and Energy No: 103.K/008/M.PE/1994 concerning Supervision of the Implementation of RKL and RPL in the field of Mining and Energy.

Reason : As a reference in the process of monitoring the implementation of the RKL and RPL of PLTU Indramayu 2 x 1000 MW

- e. Decree of the State Minister of Environment No. Kep. 13/MENLH/3/1995 concerning Emission Quality Standard from Immovable Sources.

Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.

- f. Decree of the State Minister of Environment No. Kep. 51/MENKLH/10/ 1995 concerning Liquid Waste Quality Standard for Industrial Activities.

Reason : As a reference in the assessment of the environment, especially wastewater that can be caused by PLTU Indramayu 2 x 1000 MW.

- g. Decree of the State Minister of Environment No. KEP-48/MENLH/XI/1996 concerning Quality Standard of Noise Level.



Reason : As a reference in the assessment of the environment, especially noise that can be caused by PLTU Indramayu 2 x 1000 MW.

- h. Decree of the Minister of Environment No. KEP-49/MENLH/XI/1996 concerning Quality Standards of Vibration Levels.

Reason : As a reference in the assessment of environmental conditions, especially the level of vibration that can be caused by PLTU Indramayu 2 x 1000 MW.

- i. Decree of the Minister of Environment No. KEP-50/MENLH/XI/1996 concerning Baku Quality Standards of Odor.

Reason : As a reference in the assessment of the environment, especially the odor that can be caused by PLTU Indramayu 2 x 1000 MW

- j. Decree of the State Minister of Environment No. KEP-13/MENLH/III/1996 concerning Quality Standards of Emission from Immovable Sources.

Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.

- k. Decree of the Minister of Environment No. KEP-299/MENLH/11/1996 concerning Social Aspects in EIA study.

Reason : As a reference in the assessment of the environment, especially the socioeconomic and cultural condition around the activities of PLTU Indramayu 2 x 1000 MW.

- l. Decree of the State Minister of Environment No. KEP-45/MENLH/10/1997 concerning Air Pollution Quality Standards Index.

Reason : As a reference in air pollution assessment based on the quality standards of air pollutants acceptable to the environment.

- m. Decree of the State Minister of Environment No. KEP-02/MENLH/8/1998 concerning Guidelines for the Determination of Environmental Quality Standards.

Reason : As a reference in the assessment of environmental conditions.

- n. Decree of the Minister of Transportation No. KM-26 of 1998 concerning Seaport.

Reason : As a reference for jetty construction activities of PLTU Indramayu 2 x 1000 MW

- o. Decree of the Minister of Mining and Energy No. 1457K/28/MEN/2000 concerning Guidelines for the Preparation of Environmental Management Plan of Mining and Energy Activities.

Reason : As a reference in the preparation of documents and implementation of the EIA study of PLTU Indramayu 2 x 1000 MW.

- p. Decree of the Minister of Health No. 907 of 2002 concerning Conditions of Water Quality Monitoring.  
Reason : As a reference in environmental assessment, especially with regard to the quality of water.
- q. Decree of the Minister of Health No.1405 of 2002 concerning Health Requirements of Office and Industry.  
Reason : As a reference in the assessment of the environment, particularly health in the surrounding environment, especially around the construction activities of PLTU Indramayu 2 x 1000 MW.
- r. Decree of the Minister of Energy and Mineral Resources No. 1752.K/34/MEM/2002 concerning Implementation of Electricity Inspection.  
Reason : As a reference in the assessment of the environment, especially the activities of electricity that may cause the impact of the activities of PLTU Indramayu 2 x 1000 MW.
- s. Decree of the Minister of Environment No. 51 of 2004 concerning Sea Water Quality Standard.  
Reason : As a reference in environmental assessment, especially the quality of sea water.

#### **G. DECREE OF THE HEAD OF ENVIRONMENTAL IMPACT CONTROLLING AGENCY**

- 1) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 056 of 1994 concerning Guidelines for the Determination of Significant Impacts.  
Reason : As a reference in determining significant impacts.
- 2) Decree of the Head of the Environmental Impact Controlling Agency No. 01 of 1995. concerning Procedures and Technical Requirements for Storage and Collection of Hazardous and Toxic Waste Materials.  
Reason : As a reference in the assessment of environmental conditions particularly hazardous and toxic waste that can be caused by PLTU Indramayu 2 x 1000 MW.
- 3) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 04/BAPEDAL/09/1995 concerning Procedures and Requirements for Stockpiling Processing, Requirements for Ex- Location of Processing and Requirements for Ex Location of Hazardous and Toxic Waste Materials.

Reason : As a reference for environmental assessment mainly the result of processing of hazardous and toxic waste materials that can be caused by PLTU Indramayu 2 x 1000 MW.

- 4) Decree of the Director General of Electricity and Energy Development No. 75 – 12/008/6002/1995 concerning Implementing Guidelines and Environmental Monitoring of Electricity.

Reason : As a reference in the study of the impact of electricity.

- 5) Decree of the Head of the Environmental Impact Controlling Agency No. Kep. 205/BAPEDAL/07/1996 concerning Technical Guidelines for Controlling Air Pollution from Immovable Sources.

Reason : : As a reference in the study of the impact of air pollution.

- 6) Decree of the Head of the Environmental Impact Controlling Agency No. 299 of 1996 concerning Technical Guidelines of Social Aspects Assessment in the preparation of EIA.

Reason : As a reference in social impact assessment.

- 7) Decree of the Head of the Environmental Impact Controlling Agency No. Kep-124/12/1997 concerning Public Health Aspects Study in the Preparation of EIA.

Reason : As a reference in the study of health effects.

- 8) Decree of the Head of the Environmental Impact Controlling Agency No. 8 of 2000 concerning Public Involvement and Information Disclosure in the Process of Environmental Impact Analysis.

Reason : As a reference to the participation of the public in the EIA of PLTU Indramayu 2 x 1000 MW

## **H. DECISION OF THE GOVERNOR OF WEST JAVA**

- 1) Regional Regulation of West Java Province No. 25 of 2002 concerning establishment of SOTK BAPEDAL of West Java Province.

Reason : As a reference in the study of the construction committee of PLTU Indramayu 2 x 1000 MW.

- 2) Regional Regulation of West Java Province No. 36 of 2002 concerning Spatial Planning.

Reason : As a reference in relation to the possibility of changes in land use due to PLTU Indramayu 2 x 1000 MW.

- 3) Regional Regulation of West Java Province Nomor : 02 of 2003 concerning General Spatial Plan of West Java Province.

Reason : Sebagai acuan dalam kaitannya dengan kemungkinan adanya perubahan penggunaan lahan akibat adanya pembangunan PLTU Indramayu 2 x 1.000 MW.

- 4) Regional Regulation of West Java Province No : 3 of 2004 concerning Management of Water Quality and Water Pollution Control.

Reason : As a reference in the impact assessment of water quality.

- 5) Regulation of the Governor of West Java No. 2 of 2006 concerning Coal Utilization.

Reason : As a reference in the study of the impact of coal fuel.

## **I. REGIONAL REGULATION**

- 1) Regional Regulation No. 01 of 1996 concerning General Spatial Plan for Indramayu Regency.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW in accordance with the Spatial Plan of Indramayu Regency

- 2) Circular Letter of the Regent of Indramayu No.660.1/882-LH/III/1997 concerning the Implementation of EIA studies, UKL and UPL.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 3) Decision of the Regent of Indramayu No. 660/Kep.265-Org/2000 concerning Establishment of the Audit Commission of the EIA and Environmental Management Plan / Environmental Monitoring Plan of Indramayu Regency.

Reason : As a reference in the process of establishing the EIA commission of PLTU Indramayu 2 x 1000 MW.

- 4) Regional Regulation of Indramayu Regency No. 26 of 2003 concerning Guidelines for the Implementation of Environmental Management and Utilization Efforts.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 5) Regional Regulation No. 5 of 2003, concerning Implementation of Manpower Administration in Indramayu Regency.

Reason : As a reference in the recruitment process of PLTU Indramayu 2 x 1000 MW

### **1.1.2. Environmental Management Policy**

Natural resources are the basic capital of national development. However, natural resources are something limited in terms of quantity and quality while human needs of natural resources will always increase in line with the increased total population.

The government has determined the policy for the management and collection of natural resources to increase people's livelihood. Collection and use of natural resources without considering environmental capacity will damage its balance and will ultimately degrade the environment.

Development activities contain risks of change to the environmental quality. If one or more of its component is damaged, the ecosystem function will be harmed as well. Therefore, development must be done based on the policy of sustainable development.

The environmental impact analysis of PLTU Indramayu 2 x 1000 MW is done to meet the provisions of the legislations and to implement government policy on sustainable development.

## **1.2. OBJECTIVES AND BENEFITS**

### **1.2.1. Objectives**

The preparation of this environmental management plan (RKL) is intended to provide guidance for the implementation of environmental management from the planned activity of construction of PLTU Indramayu 2 x 1000 MW. The sections managed are those affected or estimated to be affected by the positive or negative impact of the activity.

Environmental management is an integrated effort in the use, management, care, supervision, control and development of the environment so that natural resources potentials can be maintained and pollution or damage can be avoided or reduced.

This report is intended to prepare an environmental management plan for the construction of PLTU Indramayu 2 x 1000 MW with the objectives as follows:

- 1) To formulate the efforts to maintain environmental quality and supportability by using and preserving natural resources optimally.
- 2) To formulate the measures to handle the negative impacts arising from the project activities and to develop positive impacts according to the applicable legislations.
- 3) To determine the agencies related in the environmental management and mechanism of environmental management

### **1.2.2. Benefits**

The benefits of the Environmental Management Plan can be divided into three, namely:

#### ***For the Activity Initiator***

- a. To be the guidance, guidelines and reference for handling the significant impact arising from the project activity so that they can be prevented or controlled and the positive impact can be increased.

- b. To guarantee that the construction, commissioning and operation of PLTU Indramayu 2 x 1.000 MW comply with environmental legislations.
- c. To optimally anticipate the environmental monitoring plan in the construction, operation and maintenance,
- d. To be the guidelines and directives for the initiators on roles and responsibilities of environmental condition management by coordination with the relevant agency.

***For the Government***

- a. To be a guideline and recommendation for decision making with regard to licensing and coordination of construction to achieve an environmentally friendly development pattern.
- b. To ensure the roles and responsibilities and authorities of each agency in environmental management.

***For the Public***

- a. To obtain information on the characteristic of development in the region to avoid misunderstanding between the initiator and the surrounding communities.
- b. To obtain information on pre-predicted environmental change during and after the project so as to avoid the impacts.
- c. To entice public participation since the beginning of the project by disseminating information and direct participation in the project development and operation.
- d. To maintain a harmonious life in the social, economic and cultural life around PLTU Indramayu 2 x 1000 MW
- e. To be the guidelines and directives for the people on the roles and responsibilities in environmental management.

## CHAPTER II

# ENVIRONMENTAL MANAGEMENT APPROACH

To deal with the significant and important impacts that have been predicted in the EIA documents, will be used environmental management approach that includes technological approach, socio-economic approach and institutional approach, with the description as follows:

### 2.1. TECHNOLOGICAL APPROACH

This approach is a procedure or business that can technically be done to overcome, reduce or avoid negative impacts and to develop the positive impact of the activity, among others:

1. In principle, the planned construction of PLTU Indramayu 2 x 1,000 MW will use existing technology commonly used in Indonesia.
2. To reduce the decline in air quality and the aesthetics of the environment and the comfort of the people living in the vicinity of PLTU Indramayu 2 x 1000 MW, a guardrail will be erected around the Project area.
3. To reduce accidents and traffic disruption during construction, it is necessary to regulate the traffic and erect clear traffic signs apparent on land and at sea in accordance with the applicable regulations.
4. To prevent or reduce the decline in air quality due to the mobilization of heavy equipment or transportation of materials, will be done continuous watering on the road in the construction of PLTU 2 x 1000 MW Indramayu.
5. To prevent or reduce the deterioration of water quality due to waste water drainage channels, will be constructed settling ponds.
6. Constructing covered conveyor belt facilities to reduce coal dust.
7. Using coal with low sulfur content (<0.2%) to reduce the emissions of SO<sub>2</sub>
8. Installation of dust extraction unit (Electrostatic Precipitator).
9. Operation of generator according to the procedure so that the combustion can be ideal.
10. Handling bottom ash and fly ash with backfilling and compaction systems as well as conducting watering regularly.
11. Installing Silencer unit and insulation layer to suppress the noise level
12. Installing liquid waste treatment unit and leachate processing unit.

### 2.2. SOCIOECONOMIC APPROACH

approach is the step taken by the initiator in addressing the significant impacts through actions based on social interaction and support from the government. This approach includes:

- 1). To maximally use domestic products/materials, unless for the equipment that cannot be

obtained or made domestically, imported products will be used.

- 2). To prioritize local employment in accordance with the expertise and skills possessed.
- 3). To establish a harmonious social interaction with local communities in order to prevent the emergence of jealousy, especially through the Community Development program.
- 4). To gradually seek to hire local people / business in around PLTU Indramayu 2 x 1,000 MW.

### **2.3. INSTITUTIONAL APPROACH**

This approach is an effort of coordination and cooperation of various agencies involved in addressing the significant impacts that arise, so that the handling of these impacts can be done effectively and efficiently. Institutional approach is cross-cutting in nature and is divided into several areas:

- a. Person in charge of implementation of environmental management
- b. Person in charge of environmental management funding
- c. Environmental management report recipients

Coordination and cooperation of various agencies, for example:

- a. To prevent disruption to the network of other activities (public utilities), it will require coordination with relevant agencies as well as law enforcement approach.
- b. Oversight of the results of environmental management by the Office of Environment of Indramayu Regency and the Environmental Impact Management Agency (BPLHD) of West Java Province



## CHAPTER III

### ENVIRONMENTAL MANAGEMENT PLAN

Description of The Environmental Management Plan is limited only to activities that may cause significant impacts or to environmental components that may be affected by fundamental changes as forecasted in the ANDAL documents of PLTU Indramayu 2 x 1000 MW. Environmental Management Plan for activities of PLTU Indramayu 2 x 1000 MW is outlined based on the stage of the project, and each activity that may cause a significant impact. Whereas the same environmental impact issues which rise from similar activities are grouped as an integral description. Such descriptions are presented below, whereas its summary is presented in the Appendix Table.

#### 3.1. PRE-CONSTRUCTION STAGE

At Pre-Construction stage, the Development Activities for PLTU Indramayu 2 x 1000 MW includes activities such as procurement activity and land acquisition. Both of those activities are an integral part of the significant impact that shall be managed because it involves social economic aspects which may cause social unrest and disrupt the public safety and order. Whereas the management plan for each of those activities which form an integral part of the significant impact at pre-construction stage are as follows:

##### 3.1.1. Land Acquisition

##### 3.1.1.1. Social Unrest

###### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is the rise of social unrest due to the development plan of PLTU Indramayu 2 x 1000 MW.

###### B. Impact Source

At land acquisition activity, the source of significant impact is the incompatibility and disagreement in the matter of land compensation for the PLTU Indramayu 2 x 1000 MW development plan.

###### C. Impact Parameter

Parameter for the significant impact of social unrest is intensity of objection and protest/ complaint.

###### D. Environmental Management Objectives

The objectives of the implementation of environmental management are:

1. To prevent the rise of social unrest among exposed residents.
2. To concludes price agreement between the initiator and residents whose land being exposed.

###### E. Environmental Management Plan

1. Dissemination of the activity plan and land requirement to residents of Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol District.
2. Consultation concerning compensation price between Project and land owners.

###### F. Environmental Management Location

Environmental management is carried out mainly on PLTU Indramayu 2 x 1000 MW project's site which located in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

###### G. Environmental Management Period

Management is carried out during pre-construction stage.

**H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency and Office of Sukra and Patrol District.
- 3. Reporting** : Environmental management results are periodically submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

**3.1.1.2. Declining Income****A. Significant Impact That shall Be Managed**

Declining income.

**B. Impact Source**

Source of impact is the occurrence of declining of farmers' income due to loss of livelihood which caused by land acquisition for the development of PLTU Indramayu 2 x 1000 MW.

**C. Impact Parameter**

Parameters for significant impact of work/ business opportunity are:

1. Numbers of production from land coverage for the development of PLTU Indramayu 2 x 1000 MW
2. Numbers of tenant farmer who lost their chance to farm.

**D. Environmental Management Objectives**

The objective of environmental management plan is to reduce the impact which may arise due to land acquisition.

**E. Environmental Management Plan**

Feasible environmental management plans are by deliver an appropriate price for the land compensation so that land owners able to buy new land. Whereas for tenant farmers, management plan are done through training and community development.

**F. Environmental Management Location**

Management is performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

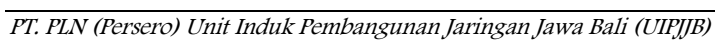
**G. Environmental Management Period**

Management period is started since land acquisition activity until construction.

**H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN. UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency and Office of Manpower and Transmigration of Indramayu Regency.
- 3. Reporting** : Result reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).





### **3.2. CONSTRUCTION PHASE**

At construction phase, the development activities for PLTU Indramayu 2 x 1000 MW are workforce recruitment, personnel, equipment and material mobilization, land preparation and construction of the facilities and infrastructure which descriptions are as follows:

#### **3.2.1. Workforce Recruitment and Personnel Mobilizations**

##### **3.2.1.1. Increase in Work Opportunity**

###### **A. Significant Impact That Shall Be Managed**

The impact of employment/ business opportunities due to development activities of PLTU Indramayu 2 x 1000 MW is an opportunity that can be utilized by people around projects area to participate in such activity. However, if the local residents are not being taken into consideration and thus larger construction workers are coming from outside locations, this would tend to create a competition among the employment seekers and may resulted in social resentment within residents who lives around the PLTU Indramayu 2 x 1000 MW development plan area. The presence of labor for construction activities requires services so that it can create a business opportunity for the local residents.

###### **B. Impact Source**

Source of impact is recruitment of 1,400 workforce related to workforce requirements for the development of physical building of the project, which create work opportunities for local residents.

###### **C. Impact Parameter**

Parameters for significant impact of work/ business opportunity are numbers and status of local workforce that employed in the project activity as well as the increase in the income for residents around the project.

###### **D. Environmental Management Objectives**

The objective of environmental management plan is to increase the positive impact so that residents' hope to be employed and have their own business can be actually realized.

###### **E. Environmental Management Plan**

Feasible environmental management plans are as follows:

1. Optimizes work opportunity & business opportunity by prioritizing the local residents from villages within Patrol & Sukra District in Indramayu Regency.
2. Transparency of the specification of workforce needed for the project.

**F. Environmental Management Location**

Management is performed in Sumuradem Village, Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

**G. Environmental Management Period**

Management period is started since workforce recruitment activity and during construction phase.

**H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency, Office of Manpower and Transmigration of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Result reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

**3.2.1.2. Increase in Income Level****A. Significant Impact That Shall Be Managed**

Such employment/ business opportunities impact mostly can be exploited by residents living around the project area. The presence of project workers who work in the area means that there are also the needs for services such as shops, lodgings and other services. It will provide business opportunities and sources of income for the local community which will further increase the income of the residents in the project area.

**B. Impact Source**

Source of impact is development of PLTU Indramayu 2 x 1000 MW and the presence of workers in project area which need various services so that economic activities may bloom.

**C. Impact Parameter**

Parameters for significant impact of work/ business opportunity are:

1. Increase in income level of residents around project area.
2. Development of economic activities around the project area.

**D. Environmental Management Objectives**

The objective of environmental management plan is to increase the positive impact from

the development of PLTU Indramayu 2 x 1000 MW.

#### **E. Environmental Management Plan**

Feasible environmental management plans are as follows: Guidance on the business activity by prioritizing the local residents in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District, which in this case is done through community development.

#### **F. Environmental Management Location**

Management is performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

#### **G. Environmental Management Period**

Management period is started since workforce recruitment activity and during construction phase.

#### **H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN. UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency and Office of Manpower and Transmigration of Indramayu Regency.
- 3. Reporting** : Results reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### **3.2.1.3. Community Restlessness**

#### **A. Significant Impact That Shall Be Managed**

Such employment/ business opportunities impact mostly can be exploited by residents living around the project area. However, if the local residents are not being taken into consideration and thus larger construction workers are coming from outside locations, this would tend to create a competition among the employment seekers and may resulted in social resentment within residents who lives around the PLTU Indramayu 2 x 1000 MW development plan area.

#### **B. Impact Source**

Source of impact is local resident who aren't employed in the development of PLTU Indramayu 2 x 1000 MW.



### C. Impact Parameter

Parameter for significant impact of work/ business opportunity is local residents' dissatisfaction and resentment against the numbers of migrant workers employed in the project activity.

### D. Environmental Management Objectives

The objective of environmental management plan is to prevent the dissatisfaction and resentment from the community who can't participate in the development of PLTU Indramayu 2 x 1000 MW.

### E. Environmental Management Plan

Feasible environmental management plans are as follows :

1. Optimizes work opportunity by prioritizing the local residents from Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.
2. Transparency of the specification of workforce needed for the project.
3. PLN shall inform the migrant workers to respect the local customs.

### F. Environmental Management Location

Management are performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

### G. Environmental Management Period

Management period is started since workforce recruitment activity and during construction phase.

### H. Environmental Management Institution

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency, Office of Manpower and Transmigration of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Result reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).



### **3.2.2. Material Equipment and Material Mobilization**

#### **3.2.2.1. Declining Air Quality**

##### **A. Significant Impact That Shall Be Managed**

Significant impact that shall be managed is the declining of air quality mainly caused by dust, SO<sub>2</sub> and NO<sub>x</sub> which will happen due to equipment and material mobilization activity for PLTU Indramayu 2 x 1000 MW development activities.

##### **B. Impact Source**

Source of the declining air quality is equipment and material mobilization activity for PLTU Indramayu 2 x 1000 MW development activities.

##### **C. Impact Parameter**

Parameter for impact on air quality is the increase in parameter of air quality and emission standard limit which set out in Decree of the Minister of Environment No. Kep-13/MENLH/3/1995 concerning Standard Limit for Immovable Resources Emission, Government Regulation No. 41 Year 1999.

##### **D. Environmental Management Objectives**

Objective of the management of air quality is to Prevent the increase in the quality of ambient air so that it doesn't exceed the standard limit

##### **E. Environmental Management Plan**

Environmental management plan to prevent/ mitigate the impact of declining air quality caused by the mobilization of equipment and material during construction phase are as follows:

1. Cover the transport truck with tarp.
2. Utilize transport vehicle with low gas emission.
3. Spraying the road with water.

##### **F. Environmental Management Location**

Location of environmental management plan concerning impact on air quality will be performed on road network which will be used for transporting the equipment and material.

##### **G. Environmental Management Period**

Air quality management will be performed during the mobilization of equipment and material.

## H. Environmental Management Institution

- 1. Executor** : Executor for environmental management during operations is initiator, which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Supervisor for implementation of the management is Office of Environmental Agency of Indramayu Regency.
- 3. Reporting** : Result reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.2.2.2. Transportation Disruption

#### A. Significant Impact That Shall Be Managed

Environmental components being affected is the transportation system in the form of damages to the road network, increase in traffic frequency and traffic accident.

#### B. Impact Source

Source of impact to transportation system is coming from the mobilization of equipment and material. On such activity there will be an increase in traffic frequency which potentially may cause traffic accident.

#### C. Impact Parameter

Parameters for this significant impact are increase in congestion intensity and frequency of traffic accident occurrences.

#### D. Environmental Management Objectives

The objective of environmental management plan is:

1. To avoid the occurrence of congestion which caused by the operation of heavy vehicle during the mobilization of equipment and material.
2. To avoid the occurrence of traffic accidents which caused by the increase in traffic frequency.

#### E. Environmental Management Plan

Environmental management plan can be carried out by:

1. Posting traffic signs on roads around project site which will be traversed by the equipment and material transport vehicle.
2. Arranging the entrance and exit of the project vehicle by trained personnel.
3. Utilizing transport vehicle which correspond to road supporting capacity.

#### F. Environmental Management Location

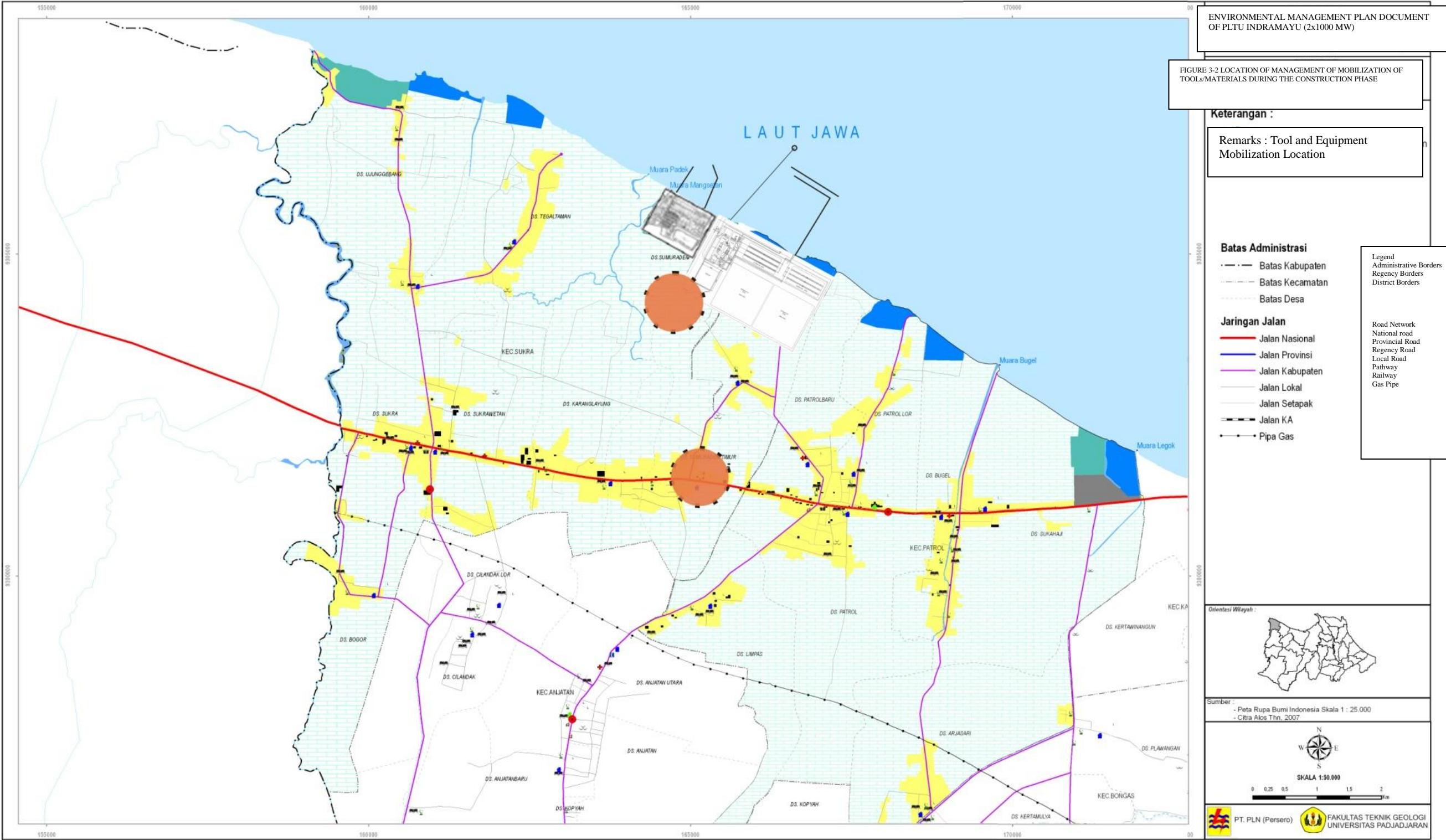
Locations of the implementation of management are in project site and entrance road around PLTU Indramayu 2 x 1000 MW project, which located in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District, mainly from project entrance.

#### **G. Environmental Management Period**

Management is performed since the mobilization of equipment and material and during the construction of facilities and infrastructure.

#### **H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : As supervisors for the environmental management are Office of Environmental Agency of Indramayu Regency and Transportation Service Office of Indramayu Regency.
- 3. Reporting** : Result reporting is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).



### 3.2.2.3. Declining of Public Health

#### A. Significant Impact That Shall Be Managed

Impact that shall be managed is the declining of public health due to increasing air pollution due to equipment and material mobilization activity of PLTU Indramayu 2 x 1000 MW.

#### B. Impact Source

Source of this impact is dust and emission and effluent gas which comes from the equipment and material mobilization for the development of PLTU Indramayu 2 x 1000 MW.

#### C. Impact Parameter

Parameter for this impact is the increase of disease prevalence specifically ARI (ISPA) which caused by dust and effluent gas from the equipment and material mobilization.

#### D. Environmental Management Objectives

Objective of the management of this impact is to prevent any minutest possibilities that may increase the occurrence of ARI, due to dust and effluent gas which comes from the equipment and material transport vehicle used in the development of PLTU Indramayu 2 x 1000 MW.

#### E. Environmental Management Plan

Environmental management actions that can be done are:

1. Utilize vehicle with low emission and roadworthy corresponds to the vehicle's specification.
2. Perform road spraying program periodically to remove dust from the road surface.

#### F. Environmental Management Location

Locations of the environmental management are on Road that will be used to transport the equipment and material especially the road in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village and Patrol Baru Village Patrol District.

#### G. Environmental Management Period

Public health management is performed during the mobilization of equipment and material used for the development of PLTU Indramayu 2 x 1000 MW.

#### H. Environmental Management Institution

1. **Executor** :Executors for the environmental management are the initiator; PT. PLN UIPJJB, and Health Service Office of Indramayu Regency.

- 2. Supervisor** : Supervisors for the environmental management are Office of Environmental Agency of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Reporting of the management results are submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.2.3. Land Preparation

#### 3.2.3.1. Increase in Noise Level

##### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is the increasing noise due to land preparation activity for the development of PLTU Indramayu 2 x 1000 MW. Source of increase in noise level is coming from operation of the equipment which used in ripening the soil of PLTU Indramayu 2 x 1000 MW development land.

##### B. Impact Source

Source of increase in noise level is coming from operation of the equipment which used in ripening the soil of PLTU Indramayu 2 x 1000 MW development land.

##### C. Impact Parameter

Parameter for impact of noise level is the range of noise level which will occur due to the activity and permitted noise level Standard limit.

##### D. Environmental Management Objectives

Objective of noise management is to prevent any noise which will disturb the local residents and not exceeding the permitted noise limit.

##### E. Environmental Management Plan

Environmental management plan to reduce/ mitigate the impact of increase in noise level due to land preparation are as follows:

1. Execute any activities in the daytime so that it shall not disturb residents' activity.
2. Build perimeter fence using material with the capacity to reduce the noise level.

##### F. Environmental Management Location

Location of the management of noise level is in project site area (PLTU Indramayu 2 x 1000 MW).

##### G. Environmental Management Period

Noise management is performed during the land preparation activity.

#### H. Environmental Management Institution

- 1. Executor** : Executor for environmental management during operations is initiator PT. PLN UIPJJB.
- 2. Supervisor** : Supervisor for implementation of the management is Office of Environmental Agency of Indramayu Regency.
- 3. Reporting** : Reporting of management result is submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

#### 3.2.3.2. Sea Water Quality

##### A. Significant Impact That Shall Be Managed

At land preparation activity, project area which in the size of 320 Ha which need piled-up soil in the amount of 66.5 million m<sup>3</sup>, which may affect quality of the sea water in the project perimeter. Subsequently disturb the lives of marine biota in such waters.

##### B. Impact Source

Source of the declining of sea water quality is the pollution from the piled-up soil which washed away by rain and carried over to the sea.

##### C. Impact Parameter

Parameters for this impact are the increase of TSS, TDS and turbidity of water quality around the beach and sea, compare it to period before the filling work executed, and to Decree of the Minister of Environmental No. 51/MENLH/2004 concerning Sea Water Standard Limit.

##### D. Environmental Management Objectives

The objective of environmental management plan is to prevent the occurrence of declining sea water quality so that such waters still have capacity to support the lives of marine biota.

##### E. Environmental Management Plan

To prevent the increase in turbidity level, there is method that can be utilized such as: filling activities is accompanied by the creation of mud precipitation ponds so that the water carrying piled-up soil particles suspension are deposited in precipitation ponds before it flows into the sea.

**F. Environmental Management Location**

Location of the environmental management is the location of land preparation activity.

**G. Environmental Management Period**

Period of environmental management will be carried out since the commencement of land preparation activity.

**H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors of the environmental management are Office of Environmental Agency of Indramayu Regency and Office of Maritime Affairs and Fisheries.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

**3.2.3.3. Changes in Land Use****A. Significant Impact That Shall Be Managed**

Significant impact of the soil ripening that shall be managed is the change in land function from agricultural land into Building/ Industrial land, which will give positive impact to the development of District's area specifically area of Patrol District and Sumuradem District.

**B. Impact Source**

Source of impact is the change in land use of the project site in the size of 327 Ha, which may functioned as growth trigger in the area of PLTU Indramayu 2 x 1000 MW and its surrounding area.

**C. Impact Parameter**

Parameter for significant impact of changes in land use is improvement of the function of land and buildings from agriculture to service and commerce activities.

**D. Environmental Management Objectives**

To prevent the occurrence of uncontrollable land changes and deviation from Spatial Layout of District and District.



**E. Environmental Management Plan**

Environmental management can be done by manage and guide such development so that it conform to Spatial Layout of District and Sub district.

**F. Environmental Management Location**

Location of the management is around the location of PLTU Indramayu 2 x 1000 MW, which covers Patrol and Sukra District.

**G. Environmental Management Period**

Management is performed since the commencement of changing the landscape until operation phase.

**H. Environmental Management Institution**

- 1. Executor** : Executor for the environmental management is Bappeda of Indramayu Regency in cooperation with PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors for the environmental management are Bappeda of Indramayu Regency, National Land Agency of Indramayu Regency, Office of Environmental Agency of Indramayu Regency and Office of Mining and Water Resources of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

**3.2.3.4. Flood****A. Significant Impact That Shall Be Managed**

Significant impact of the soil ripening that shall be managed is the increase in numbers of flood and inundation as a result of changes in the landscape due to soil ripening activities.

**B. Impact Source**

Source of the impact is the increase of the height ( $\pm 2$  m) of project sites in the size of 327 Ha, and changes in project site's reserved land in the context of developing PLTU Indramayu 2 x 1000 MW.

**C. Impact Parameter**

Parameter for significant impact of changes in landscape is the increase of flood frequency due to rain and sea tide.

**D. Environmental Management Objectives**

To prevent the occurrence of flood around the project location which caused by the development of PLTU Indramayu 2 x 1000 MW.

**E. Environmental Management Plan**

Management of the environment can be carried out by widen the Plawad River, which is a channel which passes through the prospective project site and serves as drainage for the irrigation water from the upstream part of the location of PLTU Indramayu 2 x 1000 MW, with length and dimension refers to recommendation from Main Center of River Cimanuk-Cisanggarung Area.

**F. Environmental Management Location**

Locations of this management are Plawad River and Bugel River.

**G. Environmental Management Period**

Management is performed since the commencement of changing the landscape specifically when increasing the height.

**H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : As supervisors for the environmental management are Office of Environmental Agency of Indramayu Regency and Office of Mining and Water Resources of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

**3.2.3.5. Transportation Disruption (Land)****A. Significant Impact That Shall Be Managed**

Environmental components being affected is the transportation system in the form of damages to the road network, increase in traffic frequency and traffic accident.

**B. Impact Source**

Source of impact to the transportation system is coming from mobilization of pile-up transport vehicles from quarry to project location. In such activity there will be an increase in traffic frequency which potentially may cause damages to road network and traffic accident.

**C. Impact Parameter**

Parameters for this significant impact are the occurrence of road damages, increase in the

intensity of congestion and the frequency of occurrence of traffic accidents.

#### **D. Environmental Management Objectives**

The objective of this environmental management plan are :

1. To avoid uncomfortable due to road damages which caused by the mobilization of pile-up transport vehicle.
2. To avoid the occurrence of congestion which caused by the operations of heavy vehicle during mobilization of the piled-up soil
3. To prevent the occurrence of traffic accidents which caused by the increasing traffic frequency.

#### **E. Environmental Management Plan**

Environmental management can be done by:

1. Posting traffic signs on roads around project site which will be traversed by the vehicle transporting equipment and material.
2. Arranging the entrance and exit and parking of the project vehicle by trained personnel.
3. Using transport vehicle which corresponds to the existed road class and repair the damages due to mobilization of pile-up transport vehicle.

#### **F. Environmental Management Location**

Location of this management is in project site and on the entrance road around the project of PLTU Indramayu 2 x 1000 MW which is located in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District, specifically from the project's entrance road.

#### **G. Environmental Management Period**

Management is performed since the mobilization of piled-up soil during the land preparation activity.

#### **H. Environmental Management Institution**

- 1. Executor** : Executor for this environmental management is the initiator (PT. PLN UIPJJB.)
- 2. Supervisor** : As supervisors for the environmental management are Office of Environmental Agency of Indramayu Regency and Transportation Service Office of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### **Translation of Legends of the Map:**

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-3

Location of management of changes in landscape at construction phase.

Information:

Location of management of changes in landscape

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

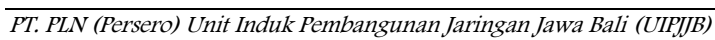
Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University





Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-4

Location of management of increases in numbers and types of flora and fauna.

Information:

Location of management of increases in numbers and types of flora and fauna.

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

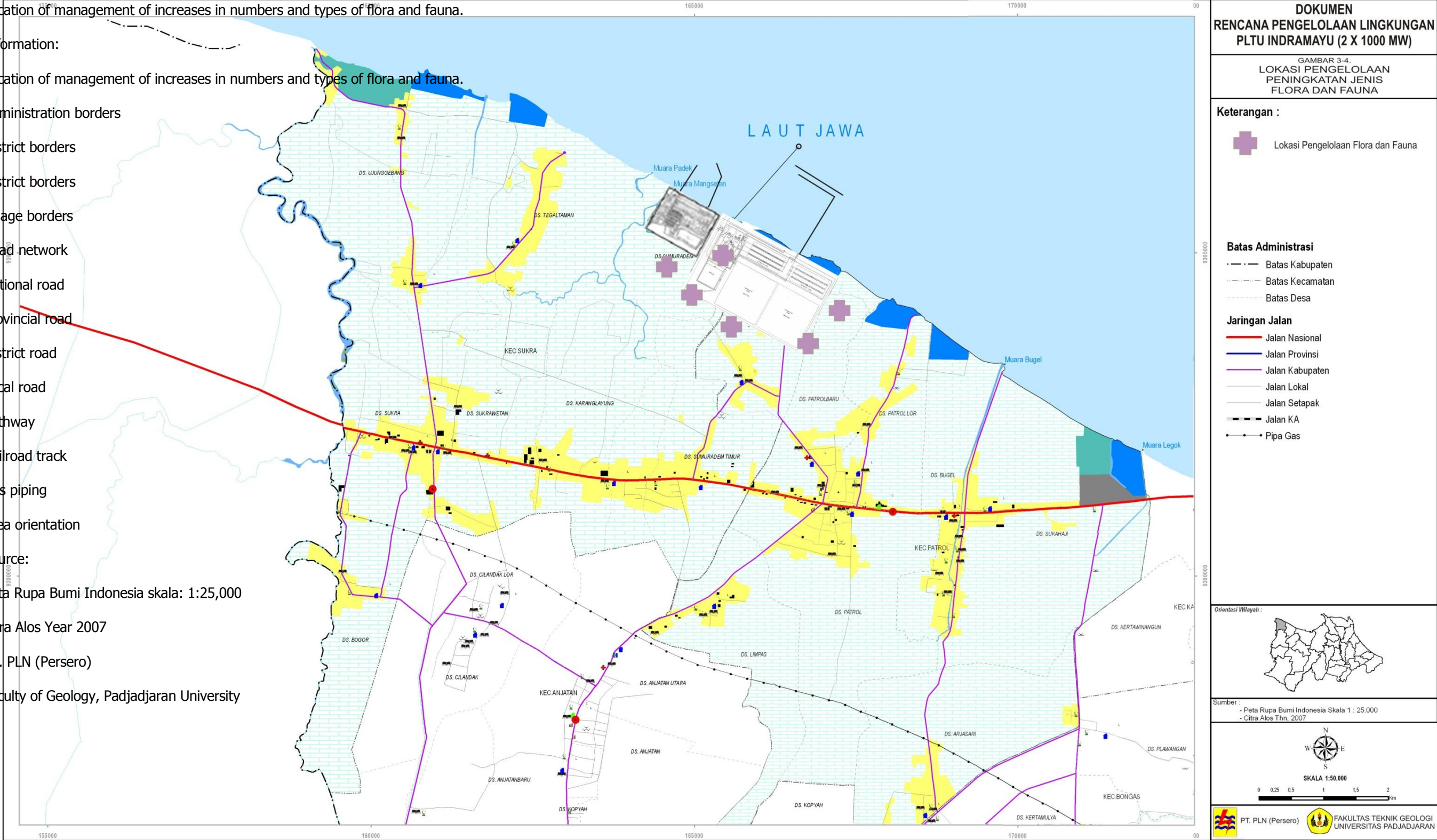
Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University



### 3.2.4. Development of Facilities and Infrastructures (Jetty)

#### 3.2.4.1. Declining of Sea Water Quality

##### A. Significant Impact That Shall Be Managed

With the construction of main building on the sea water such as jetty, inlet and outlet pipe, it is expected to have a significant impact on quality of sea water in the form of turbidity around the construction location, and the derivative impact is disturbance to the marine biota and fisherman activity.

##### B. Impact Source

Source of the declining of sea water quality is coming from construction of main building such as jetty on sea water.

##### C. Impact Parameter

Parameters for this impact are TSS, TDS and turbidity of water quality in waters around the beach and sea, compared to Decree of the Minister of Environment No. 51/MENLH/2004 concerning Sea Water Standard Limit (Table 3.1.). As a parameter for the marine biota is *bentos* which measured by the diversity index.

**Table 3.1. Sea Water Standard Limit and Measurement Method At Construction Phase**

No.	Parameter	Unit	Analysis	Standard Limit
1.	Temperature	°C	Expansion	2
2.	pH	-	pH meter	7 – 8,5
3.	TSS	mg/l	Gravimetrix	20
4.	Turbidity	NTU	Nefelometrix	5
5.	Salinity	%	Conductivity	34

Source : Kep MenLH No. 51 Year 2004

##### D. Environmental Management Objectives

The objective of this environmental management plan is to prevent the declining quality of sea water so that such waters condition is still able to support the lives of marine biota.

##### E. Environmental Management Plan

To prevent the turbidity from getting higher, there is a method that can be done: Construct the jetty by way of precast element and/or shuttering form, so that the scattered particulates (TS and TDS) can be minimized.

##### F. Environmental Management Location

Location of this environmental management is in the jetty construction location and its surrounding area. (Picture 3.5).

### G. Environmental Management Period

Period of this environmental management shall be performed since the construction of main building specifically when the main pile of the jetty installed in the sea.

### H. Environmental Management Institution

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors of this environmental management are Office of Environmental Agency of Indramayu Regency and Office of Maritime Affairs and Fisheries of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

#### 3.2.4.2. Disruption to Fishermen Transportation

##### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is disruption to transportation line and fisherman fishing area.

##### B. Impact Source

Source of disruption to fisherman is the construction activity of the Dock (Jetty).

##### C. Impact Parameter

Parameters for this significant impact are: disruption to the fishermen voyage and fishermen lost their usual place to fish.

##### D. Environmental Management Objectives

The objective of this environmental management plan is to reduce the impact of the declining numbers of fishermen catches.

##### E. Environmental Management Plan

1. Arrange consultation with fishermen community in order to conclude an agreement.
2. Coordinate with government (Office of Maritime Affairs and Fisheries as well as Office of Sea Transportation) in arranging the location for fishing in the waters around the project pursuant to regulation set out by the Office of Maritime Affairs and Fisheries and Office of Sea Transportation.



**F. Environmental Management Location**

Location of this environmental management is in waters around the location of Jetty construction.

**G. Environmental Management Period**

Period of this environmental management is started since the commencement of construction phase until operations period.

**H. Environmental Management Institution**

- 1. Executor** : Executor for this environmental management is the initiator in this case is PT. PLN. UIPJJB.
- 2. Supervisor** : Supervisors for this environmental management are Office of Environmental Agency of Indramayu Regency and Office of Maritime Affairs and Fisheries of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### **Translation of Map Legends**

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-5

Location of management of sea water quality at construction phase.

Information:

Location of management of sea water quality

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

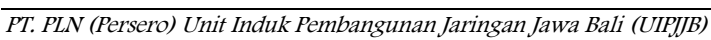
Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University



### 3.2.4.3. Increases in Number and Type of Flora and Fauna

#### A. Significant Impact That Shall Be Managed

The significant impact is increases in diversity and composition of flora in project site.

#### B. Impact Source

Source of this increase in the diversity of species of flora is planting activity in RTH (open green space/ ruang terbuka hijau) of the construction of other facilities and infrastructure during the construction phase of the PLTU Indramayu 2 x 1000 MW.

#### C. Impact Benchmark

Positive impact is important because other than trigger the increase in flora diversity it's also create a secondary positive impact in the long term which is the availability of natural habitat for fauna and it's also contribute to the improvement of air quality.

#### D. Environmental management objective

Cover the open green space with various vegetations in order to improve the quality of the environment to be a better one.

#### E. Environmental Management Plan

Environmental management is a routine maintenance of the RTH. Management are performed using technological approach, which is by planting the open space which is not intended for building as soon as possible. The vegetation is combination of grass, shade plant and decorative plant or plant which has economic, ecological and aesthetical function.

Following list are species of plant of various plant class that is recommended to be planted in open space, office courtyard, road side, park, parking lot and or RTH with area for planting in the size of 0.25 ha:

1. Shade Plant : *Angsana* (*Pterocarpus indicus*) which is fast growing and combined with *kisabun* (*Filicium decipiens*) which have lush characteristic. These plant can be planted along the environment road, around office building and parking lot. Other shade plant are *ketapang* (*Terminalia catapa*), *cemara laut* (*Casuarina yunghuniana*) and *mahoni* (*Swietenia macrophylla*)
2. Plant which has economic function such as *mangga* ('pelem', *Mangifera indica*), which is a symbolic fruit from Indramayu.
3. Plant which has ecological function:
  - *Dadap hias* (*Erythrina sp*) which can function as habitat for birds.
  - *Kihujan, baujan/trembesi* (*Samanea saman*), habitat for birds and can absorb carbon and other polluting gas, to help reduce global warming effect. It can be planted in a sufficiently large area.

- *Bambu jepang (Bambusa sp)* which can be used as fence and habitat for birds and has an aesthetical function.
- 4. Plant which has aesthetical function such as, *kembang kertas (Bougenvillea spectabilis)*, *semboja hias, Adenium spp; palem ekor tupai; palem raja, Oredoxa regia; Euphorbia sp., and soka, Ixora sp* etc.

#### F. Environmental Management Location

Location of this environmental management is in the open green space which is not intended for building, which is courtyard of the buildings of PLTU Indramayu 2 x 1000 MW.

#### G. Environmental Management Period

1. Grass and tree planting is performed at the end of construction phase.
2. Replanting are performed as long as there are withered plant during the construction phase and operations period.
3. Maintenance (fertilizing, watering and trimming are performed since the construction phase and until the end of operation period.

#### H. Environmental Management Institution

- 1. Executor** : Executor of this environmental management is the initiator; PT. PLN UIPJJB.
- 2. Supervisor** : Acting as Supervisors of the management are Office of Environmental Agency of Indramayu Regency and Office of Agriculture and Animal Husbandry of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.2.4.4. Increase in Income Level

#### A. Significant Impact That Shall Be Managed

Impact of the employment/ business opportunities mostly can be exploited by residents living around the project area. The presence of project workers who work in the area means that there are also the needs for services such as shops, lodgings and other services. It will provide business opportunities and sources of income for the local community which will further increase the income of the residents in the project area.

#### B. Impact Source

Sources of impact are the development activity of PLTU Indramayu 2 x 1000 MW and the

presence of workforce in project area which need various services so that economic activities may bloom.

### C. Impact Parameter

Parameters for significant impact of work/ business opportunity are:

1. Increase the income level of the residents who lives around the project.
2. Development of economic activity in an area around the project.

### D. Environmental Management Objectives

The objective of this environmental management plan is to increase the positive impact which comes from the development of PLTU Indramayu 2 x 1000 MW.

### E. Environmental Management Plan

Feasible environmental management plans are as follows: Guidance on the business activity by prioritizing the local residents of Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village and Patrol Baru Village Patrol District which in this case is done through community development.

### F. Environmental Management Location

Management are performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

### G. Environmental Management Period

Management period is started since the workforce recruitment activity and during construction phase.

### H. Environmental Management Institution

- |                      |  |
|----------------------|--|
| <b>1. Executor</b>   | : Executor for environmental management is the initiator which in this case is PT. PLN. UIPJJB.  |
| <b>2. Supervisor</b> | : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency and Office of Manpower and Transmigration of Indramayu Regency.   |
| <b>3. Reporting</b>  | : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources). |

## 3.3. OPERATAION PHASE

At operation phase, the development activities for PLTU Indramayu 2 x 1000 MW are

workforce recruitment, loading and unloading of coal fuel, coal storage, cooling unit operation (heat effluent), PLTU unit operation (coal firing), solid waste handling (coal ash) and liquid waste handling which descriptions are as follows:

### **3.3.1. Workforce Recruitment**

#### **3.3.1.1. Work Opportunity**

##### **A. Significant Impact That Shall Be Managed**

Impact of work/ business opportunity of development activity of PLTU Indramayu 2 x 1000 MW is a positive impact which will reduce the numbers of unemployment in such area. The presence of labor for construction activities requires services so that it can create a business opportunity for the local residents.

##### **B. Impact Source**

Source of impact is the recruitment of 1,400 workers related to following matter: The need of workers for the project activities will create a work opportunities for local residents.

##### **C. Impact Parameter**

Parameters for significant impact of work/business opportunity are numbers and status of local workforce employed in the project activity and the increase of income for the residents around the project.

##### **D. Environmental Management Objectives**

The objective of this environmental management plan is to increase the positive impact so that residents' hope to be employed and have their own business can be actually realized.

##### **E. Environmental Management Plan**

Feasible environmental management plans are as follows:

1. Optimize work opportunity & business opportunity by prioritizing the local residents from villages within Patrol & Sukra District in Indramayu Regency.
2. Transparency of the specification of workforce needed for the project.

##### **F. Environmental Management Location**

Management are performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

##### **G. Environmental Management Period**

Management period is started since the workforce recruitment activity and during the operations of the PLTU Indramayu 2 x 1000 MW.

##### **H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator which in this case is PT. PLN UIPJJB.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency, Office of Manpower and Transmigration of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.3.1.2. Increase in Income Level

#### A. Significant Impact That Shall Be Managed

The presence of project workers who work in the area means that there are also the needs for services such as shops, lodgings and other services. It will provide business opportunities and sources of income for the local community which will further increase the income of the residents in the project area.

#### B. Impact Source

Sources of impact are the presence of workers in project area which need various services so that economic activities may bloom.

#### C. Impact Parameter

Parameters for significant impact of work/ business opportunity are:

1. Development of economic activities around the project area.
2. Increase in income level of residents around project area.

#### D. Environmental Management Objectives

The objective of environmental management plan is to increase the positive impact from the development of PLTU Indramayu 2 x 1000 MW.

#### E. Environmental Management Plan

Feasible environmental management plans are as follows: Guidance on the business activity by prioritizing the local residents of Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village and Patrol Baru Village Patrol District which in this case is done through community development.

#### F. Environmental Management Location

Management is performed in Sumuradem Village Sukra District, Mekarsari Village, Patrol



Lor Village, and Patrol Baru Village Patrol District.

### **G. Environmental Management Period**

Management period is started since the workforce recruitment activity and during construction phase.

### **H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management is the initiator; PT. PLN. UIPJJB in cooperation with Local Government.
- 2. Supervisor** : Acting as management supervisors are Office of Environmental Agency of Indramayu Regency and Office of Manpower and Transmigration of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

#### **3.3.1.3. Community Restlessness**

##### **A. Significant Impact That Shall Be Managed**

Impact that shall be managed is community restlessness of residents around PLTU Indramayu 2 x 1000 MW.

##### **B. Impact Source**

Sources of impact are the residents who are not employed in the development activity of PLTU Indramayu 2 x 1000 MW.

##### **C. Impact Parameter**

Parameters for this impact are local residents' dissatisfaction and resentment against the numbers of migrant workers employed in the project activity.

##### **D. Environmental Management Objectives**

Objective of the workforce management is to prevent the dissatisfaction and resentment from the resident who can't participate in the development of PLTU Indramayu 2 x 1000 MW.

##### **E. Environmental Management Plan**

Environmental management plan carried out are:

1. Optimizes work opportunity by prioritizing the local residents.

2. Transparency of the specification of workforce needed for the project.
3. PLN must inform the migrant workers to respect the local customs.
4. Carried out CSR program that corresponds to local residents' potential.

#### **F. Environmental Management Location**

Locations of this environmental management are Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

#### **G. Environmental Management Period**

Workforce management is performed whenever there was workers recruitment during the operations period.

#### **H. Environmental Management Institution**

- 1. Executor** : Executor for the environmental management is the initiator PT. PLN UIPJJB, and Office of Manpower and Transmigration of Indramayu Regency.
- 2. Supervisor** : Supervisor of the environmental management are Office of Environmental Agency of Indramayu Regency, Office of Manpower and Transmigration of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### **Translation of Map Legends**

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-6

Location of management of social economic aspect at operations phase.

Information:

Location of management of social economic aspect

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

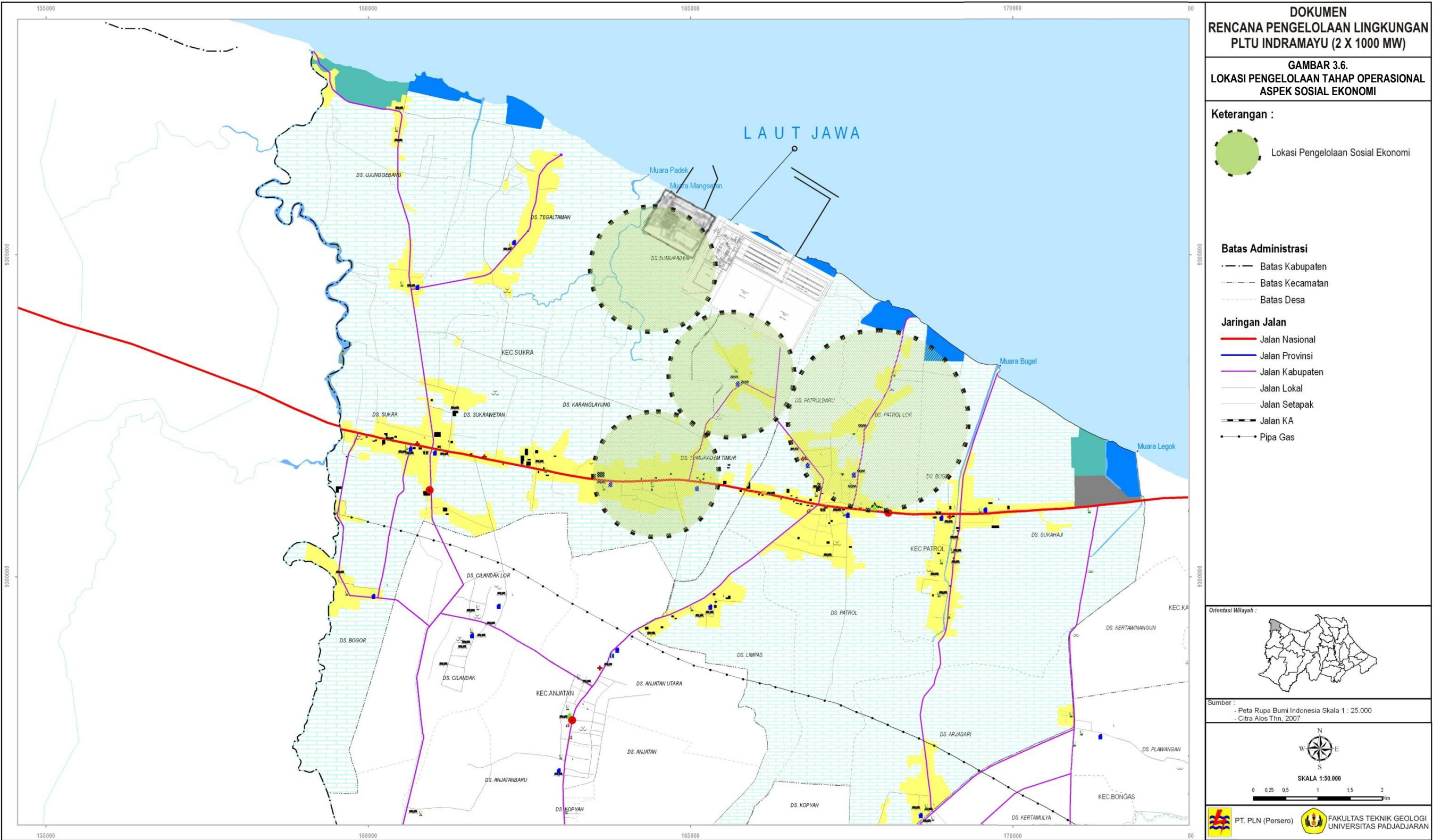
Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University



### 3.3.2. Loading and Unloading of Coal (Jetty)

#### 3.3.2.1. Sea Water Quality

##### A. Significant Impact That Shall Be Managed

It is forecasted that activity of loading and unloading coal during operation of PLTU Indramayu 2 x 1000 MW will give rise to impact in the form of declining sea water quality around the jetty. Such declining will subsequently affect the marine biota.

##### B. Impact Source

Source of the declining of sea water quality is the scattered coal during the activity of loading and unloading the coal.

##### C. Impact Parameter

Parameters for the impact are the increase in turbidity and chemical parameter based on sea water quality standard limit pursuant to Decree of the Minister of Environmental No. Kep-51/MENLH/2004 concerning Sea Water Standard Limit, Appendix III for marine biota.

##### D. Environmental Management Objectives

Objective of the implementation of environmental management is to prevent the entry of scattered coal which reduces the quality of sea water pursuant to standard limit which set out in Decree of the Minister of Environmental No. Kep-51/MENLH/2004.

##### E. Environmental Management Plan

Environmental management actions to mitigate the decreasing quality of the sea water are by utilize closed belt conveyor and using dust protection cover and mobile hopper.

##### F. Environmental Management Location

Environmental management is performed in the loading-unloading dock of the coal and along the jetty (Picture 3.8).

##### G. Environmental Management Period

Environmental management is performed during the loading-unloading activity and during the operations activity.

##### H. Environmental Management Institution

1. **Executor** : Executor for the environmental management during operations is the initiator; PT. PLN UIPJJB.
2. **Supervisor** : Supervisors for implementation of the management are Office of Environmental Agency of Indramayu Regency, Office of Maritime

Affairs and Fisheries of Indramayu Regency.

- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.3.2.2. Disruption to Fishermen

#### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is disruption to fisherman activity in the form of damages to fishing equipment and risk of accident due to the voyage of coal transport vessel.

#### B. Impact Source

Source of disruption to fisherman is the voyage of coal transport vessel.

#### C. Impact Parameter

Parameters for this significant impact are: damages to fishing equipment and occurrence of accident due to the voyage of coal transport vessel.

#### D. Environmental Management Objectives

The objective of environmental management plan is to reduce the impact of damages to fishing equipment and the occurrence of fishermen accident.

#### E. Environmental Management Plan

1. Arrange consultation with fishermen community in order to conclude an agreement.
2. Coordinate with government (Office of Maritime Affairs and Fisheries as well as Office of Sea Transportation) in arranging the location for fishing in the waters around the project pursuant to regulation set out by the Office of Maritime Affairs and Fisheries and Office of Sea Transportation.

#### F. Environmental Management Location

Location of this environmental management is in the waters of coal vessel route.

#### G. Environmental Management Period

Environmental management is performed during the operations period.

#### H. Environmental Management Institution

- 1. Executor** : Executor of this environmental management is the initiator which in this case is PT. PLN. UIPJJB.
- 2. Supervisor** : Supervisors of the environmental management are Office of

Environmental Agency of Indramayu Regency and Office of Maritime Affairs and Fisheries.

- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.3.2.3. Abrasion and Accretion Disturbance

#### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is the increase in abrasion and accretion occurrence due to the operation of jetty.

#### B. Impact Source

Source of abrasion and accretion disturbance is the change in sea current.

#### C. Impact Parameter

Parameter for this significant impact is the occurrence of abrasion.

#### D. Environmental Management Objectives

The objective of this environmental management plan is to reduce the occurrence of abrasion.

#### E. Environmental Management Plan

Strengthen the beach by way of engineering and by planting mangrove plant.

#### F. Environmental Management Location

Location of the environmental management is the beach which situated in project location and its surrounding waters.

#### G. Environmental Management Period

Environmental management is performed during the operations of PLTU Indramayu 2 x 1000 MW.

#### H. Environmental Management Institution

- 1. Executor** : Executor of the environmental management is the initiator which in this case is PT. PLN. UIPJJB.
- 2. Supervisor** : Supervisor of the environmental management is Office of Environmental Agency of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of

Electricity and Energy Development (Dep. of Energy and Mineral Resources).



**Translation of Map Legends**

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-7

Location of management of air quality at operations phase.

Information:

Location of management of air quality

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-8

Location of management of sea water quality at operations phase (loading and unloading of coal)

Information:

Location of management of sea water quality (loading and unloading of coal)

Administration borders

District borders

Subdistrict borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

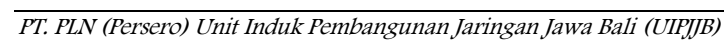
Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

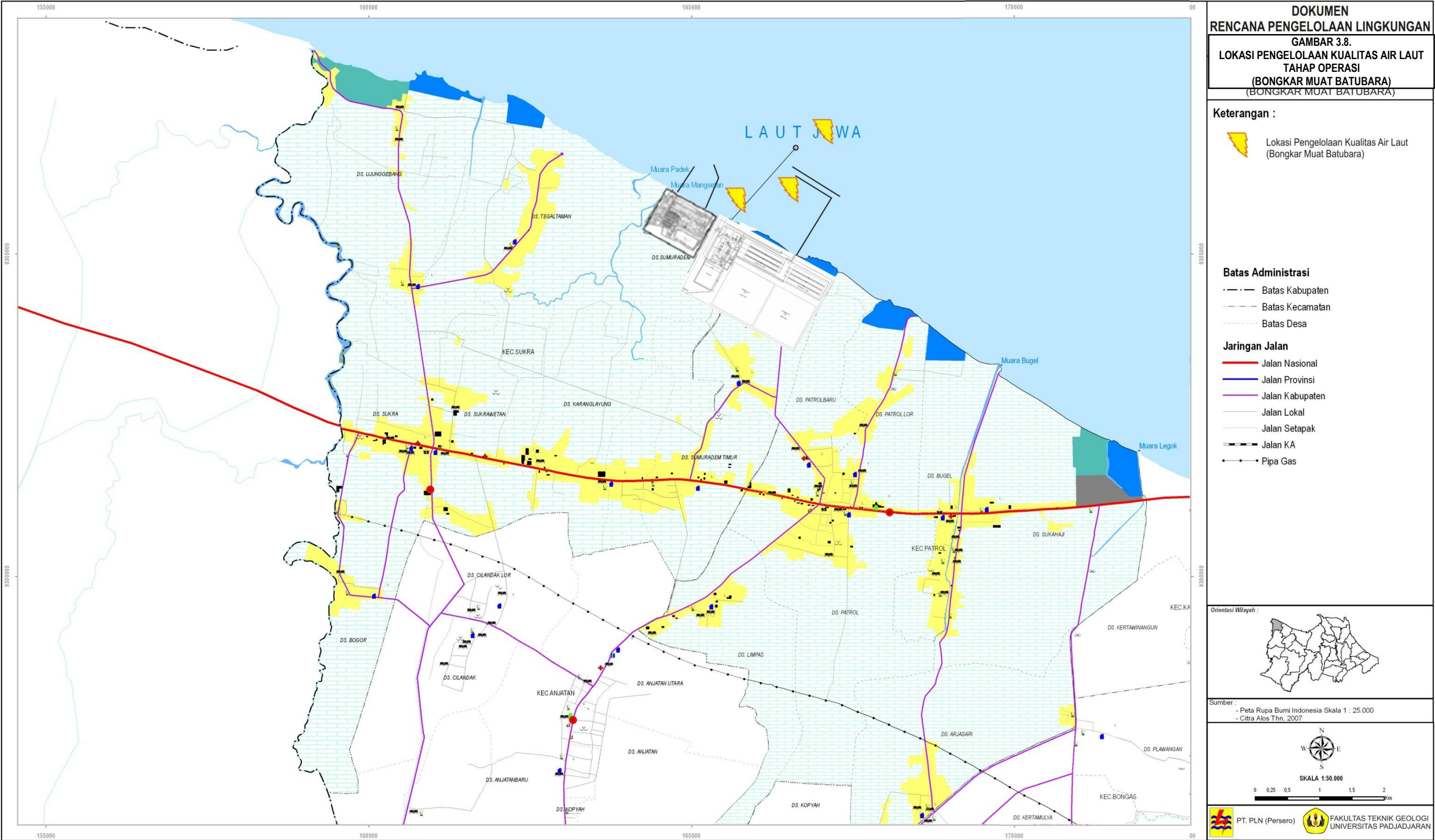
Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University







### 3.3.3. Operation of the Generator

#### 3.3.3.1. Air Quality

##### A. Significant Impact That Shall Be Managed

Significant impact that shall be managed is the declining of air quality mainly caused by dust, SO<sub>2</sub> and NO<sub>x</sub> which will occur continuously during the operation of PLTU Indramayu 2 x 1000 MW which will further affect the public health. Impacts on air quality are emission from coal loading and unloading activity, coal storage, firing process and coal ash handling which will affect the surrounding area.

##### B. Impact Source

Source of the declining air quality is the operations of PLTU Indramayu 2 x 1000 MW specifically during the coal firing process.

##### C. Impact Parameter

Parameters for impact on air quality are parameter within Emission Standard Limit pursuant to Decree of the Minister of Environment No. Kep-13/MENLH/3/1995 concerning Standard Limit for Immovable Resources Emission, Government Regulation No. 41 Year 1999 (Table 32.), and Decree of the Head of Agency for Environmental Impact Management No. 205/BAPEDAL/07/1996 concerning Technical Guide on Controlling Immovable Resources Air Pollution

**Table 3.2. Air Quality Standard Limit and Measurement Method at Operations Phase**

No.	Parameter	Unit	Analysis	Standard Limit
1.	Dust	µg/m <sup>3</sup>	Gravimetrix	230
2.	Nox	µg/m <sup>3</sup>	Saltzman	150
3.	SO <sub>2</sub>	µg/m <sup>3</sup>	Pararosanilin	365
4.	CO	µg/m <sup>3</sup>	NDIR	15.000

Source : Government Regulation of RI No.41 Year 1999

**Table 3.3. Emission Air Quality Standard Limit at Operations Phase**

No	Parameter	Unit	Standard Limit
1.	Total particle	mg/m <sup>3</sup>	150
2.	SO <sub>2</sub>	mg/m <sup>3</sup>	750
3.	NO <sub>2</sub>	mg/m <sup>3</sup>	850
4.	Opacity	%	20

Source: Kep-13/MENLH/3/1995; **Appendix IIIB**

#### **D. Environmental Management Objectives**

The objective of air quality management is to prevent the quality of gas emission and ambient air to not exceed the standard quality.

#### **E. Environmental Management Plan**

Environmental management plan to reduce/ mitigate potential impact of the declining air quality during operations phase are as follows:

1. Use coal with low *ekskontent*.
2. Optimizes air quality control system such as maintenance of the stack, ESP and FGD.

#### **F. Environmental Management Location**

Environmental management plan on the impact against air quality will be performed in several locations such as in air quality control system which covers: Stack, FGD and ESP.

#### **G. Environmental Management Period**

Air quality management is performed during the operations of PLTU Indramayu 2 x 1000 MW.

#### **H. Environmental Management Institution**

- 1. Executor** : Executor for environmental management during operations is initiator; PT. PLN UIPJJB.
- 2. Supervisor** : Supervisor for implementation of the management is Office of Environmental Agency of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

#### **3.3.3.2. Disturbance to Flora and Fauna**

**A. Significant Impact That Shall Be Managed**

Impact that is forecasted to arise during the operation of PLTU Indramayu 2 x 1000 MW is disturbance to flora and fauna specifically from dust/ ash which comes from the operation of PLTU Indramayu 2 x 1000 MW.

**B. Impact Source**

Source of the disturbance to flora and fauna is dust/ fly ash which comes out from the stack during the operations of PLTU Indramayu 2 x 1000 MW.

**C. Impact Parameter**

Parameter for this impact is reduction in vegetation culture production.

**D. Environmental Management Objectives**

Objective of the implementation of this environmental management is to minimize as small as possible the possibilities of disturbance to flora/ fauna which caused by coal ash pollution.

**E. Environmental Management Plan**

Manage the dust/ fly ash through maintenance of EPS to keep its efficiency remains high so that the concentrations of fly ash produced by it remain low.

**F. Environmental Management Location**

Environmental management is performed outside the location of PLTU Indramayu 2 x 1000 MW, Sumuradem Village, Mekarsari Village, Patrol Lor Village and Patrol Baru Village.

**G. Environmental Management Period**

Environmental management is performed during the operations period.

**H. Environmental Management Institution**

- |                      |  |
|----------------------|--|
| <b>1. Executor</b>   | : Executor of the environmental management during pilot test is the initiator; PT. PLN UIPJJB.   |
| <b>2. Supervisor</b> | : Supervisor of the environmental management is Office of Environmental Agency of Indramayu Regency.   |
| <b>3. Reporting</b>  | : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources). |

**3.3.3.3. Public Health**

**A. Significant Impact That Shall Be Managed**

Impact that shall be managed is the declining of public health due to air pollution which comes from the operation of PLTU Indramayu 2 x 1000 MW.

**B. Impact Source**

Sources of such impact are the emission and tail gas of the firing of coal for generating the power of PLTU Indramayu 2 x 1000 MW.

**C. Impact Parameter**

Parameter of this impact is the increase in frequency of disease occurrence specifically ARI which caused by silicosis.

**D. Environmental Management Objectives**

Objective of this environmental management is to prevent any minutest possibilities that may increase the occurrence of ARI, which caused by silicosis as a result of the operations of PLTU Indramayu 2 x 1000 MW.

**E. Environmental Management Plan**

Environmental management actions that can be taken:

1. Optimizes the operations of fly ash absorbance system which produced during the coal firing process.
2. Performs periodic health examination program in cooperation with local Community Health Center.

**F. Environmental Management Location**

Locations of this environmental management are in Sumuradem Village Sukra District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol District.

**G. Environmental Management Period**

Public health management is performed during the operations of PLTU Indramayu 2 x 1000 MW.

**H. Environmental Management Institution**

- 1. Executor** :Executors for the environmental management are the initiator; PT. PLN UIPJJB, and Health Service Office of Indramayu Regency.
- 2. Supervisor** : Supervisors of the environmental management are Office of Environmental Agency of Indramayu Regency, Office of Sukra and Patrol District.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of

Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.3.4. Cooling Unit (Heat Effluent)

#### 3.3.4.1. Declining in Sea Water Quality

##### A. Significant Impact That Shall Be Managed

Impact that is forecasted to arise during the operation of PLTU Indramayu 2 x 1000 MW is the declining quality of the sea water specifically due to the increase in sea water temperature in waters around the outfall.

##### B. Impact Source

Source of the declining quality of the sea water is the disposal of heat effluent from the cooling system which still emits heat to the sea.

##### C. Impact Parameter

Parameter for the impact on sea water temperature is based on Decree of the Minister of Environment No: Kep-51/MENLH/2004 concerning Sea Water Standard Limit Appendix III for marine biota (Table 3.4.)

**Table 3.4. Standard Limit for Quality of the Ambient Sea Water**

No	Parameter	Unit	Standard Limit*)
A	PHYSICS		
1.	Brightness (insitu)	Meter	C : > 5 M : - L : >3
2.	Odor (insitu)	-	Natural
3.	Turbidity	NTU	< 5
4.	Suspended Solid (TSS)	mg/l	C : 20 M : 80 L : 20
5.	Temperature (insitu)	°C	C : 28-30 M : 28-32 L : 28-30
6.	Oil layer (insitu)	-	None
7.	Salinity	‰	C : 33-34 M : 34 L : 33-34
B.	CHEMICAL		
1	pH (26 °C)	-	7 - 8,5
2	Dissolved Oxygen (DO) insitu	mg/l	> 5
3	BOD	mg/l	20
4	Total Amonia (NH <sub>3</sub> -N)	mg/l	0,3
5	Phospate (PO <sub>4</sub> -P)	mg/l	0,015
6	Nitrate (NO <sub>3</sub> -N)	mg/l	0.008
7	Cyanide (CN)	mg/l	0.5



No	Parameter	Unit	Standard Limit*)
8	Sulphide (H <sub>2</sub> S)	mg/l	0.01
9	Phenol	mg/l	0.002
10	Anionic Surfactant (MBAS)	mg/l	1.0
11	Oil & Grease	mg/l	1.0
12	Mercury (Hg)	mg/l	0.001
13	Chromium VI (Cr 6 <sup>+</sup> )	mg/l	0.005
14	Arsenic (As)	mg/l	0.012
15	Cadmium (Cd)	mg/l	0.001
16	Copper (Cu)	mg/l	0.008
17	Lead (Pb)	mg/l	0.008
18	Zinc (Zn)	mg/l	0.05
19	Nikel (Ni)	mg/l	0.05
C.	MICROBIOLOGY		
1.	Coliform (total)	MPN/100ml	None
2.	Pathogenic Bacteria	Cell/100ml	None

Information : \*) KEP 51/MENLH/2004 For Marine Biota

< = smaller than L = (Lamun) Sea grass

C = Natural coral

M = Mangrove

#### D. Environmental Management Objectives

Objective of the implementation of environmental management is to keep sea water temperature against the cooling system outlet so that it remains within the liquid waste standard limit and its specification.

#### E. Environmental Management Plan

Environmental management to mitigate the declining quality of the sea water is by optimizing the operations of cooling system in accordance with SOP.

#### F. Environmental Management Location

Environmental management implemented in the location of generator installation (cooling tower) precisely in cooling system heat effluent outlet.

#### G. Environmental Management Period

Environmental management is performed during the operations period.

#### H. Environmental Management Institution

- 1. Executor** : Executor of the environmental management during pilot test is the initiator; PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors of the environmental management are Office of Environmental Agency of Indramayu Regency, Office of Maritime Affairs and Fisheries of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of

Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### **Translation of Map Legends**

Document of Environmental Management Plan of PLTU Indramayu (2 x 1000 MW)

Picture 3-9

Location of management of sea water quality at operations phase.

Information:

Location of management of sea water quality at operations phase

Administration borders

District borders

District borders

Village borders

Road network

National road

Provincial road

District road

Local road

Pathway

Railroad track

Gas piping

Area orientation

Source:

Peta Rupa Bumi Indonesia skala: 1:25,000

Citra Alos Year 2007

PT. PLN (Persero)

Faculty of Geology, Padjadjaran University



### 3.3.4.2. Disturbance to Marine Biota

#### A. Significant Impact That Shall Be Managed

Operation of cooling system may result in the increase in sea water temperature which causes the changes in marine environment which subsequently disturb the local marine biota.

#### B. Impact Source

Source of disturbance to marine biota is the increase in sea water temperature due to disposal of cooling system effluent.

#### C. Impact Parameter

Parameter for this impact is the changes in the composition of marine biota in the location where heat effluent of the cooling system is disposed.

#### D. Environmental Management Objectives

Objective of this environmental management is to minimize the impact which caused by heat effluent disposal as small as possible.

#### E. Environmental Management Plan

Environmental management to reduce disturbance to marine biota is by operating the cooling system effectively in accordance with its operating manual.

#### F. Environmental Management Location

Environmental management is performed in the cooling system and its supporting facilities.

#### G. Environmental Management Period

Environmental management is performed during the operations of PLTU Indramayu 2 x 1000 MW.

#### H. Environmental Management Institution

- 1. Executor** : Executor of the environmental management during operation period is the initiator; PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors for implementation of the management are Office of Environmental Agency of Indramayu Regency, Office of Maritime Affairs and Fisheries of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General of Electricity and Energy Development (Dep. of Energy and Mineral Resources).

### 3.3.4.3. Decrease in Income Level

#### A. Significant Impact That Shall Be Managed

Operation of cooling system may result in the increase in sea water temperature and disturb the local marine biota as source of feeding for fishes and subsequently make fish become scarce and ultimately make fisherman get less catches.

#### B. Impact Source

Source of impact of reduced/ loss of fishermen catches is the increase in sea water temperature which caused by the disposal of cooling system's heat effluent.

#### C. Impact Parameter

Parameter of this impact is when numbers of fishermen catches is reduced in the location where heat effluent is disposed of.

#### D. Environmental Management Objectives

Objective of the environmental management is to minimize the impact which caused by heat effluent disposal as small as possible.

#### E. Environmental Management Plan

Environmental management to reduce the disturbance to marine biota is by operating the cooling system effectively in accordance with its operating manual.

#### F. Environmental Management Location

Environmental management is performed in the cooling system and its supporting facilities.

#### G. Environmental Management Period

Environmental management is performed during the operations of PLTU Indramayu 2 x 1000 MW.

#### H. Environmental Management Institution

- 1. Executor** : Executor of the environmental management during operations period is the initiator; PT. PLN UIPJJB.
- 2. Supervisor** : Supervisors for implementation of the management are Office of Environmental Agency of Indramayu Regency, Office of Maritime Affairs and Fisheries of Indramayu Regency.
- 3. Reporting** : Reporting shall be submitted to Office of Environmental Agency of Indramayu Regency, BPLHD of West Java and Director General Of

Electricity and Energy Development (Dep. of Energy and Mineral Resources).

## Matrix of Summary of Environmental Management Plan of Activities of PLTU INDRAMAYU 2 x 1000 MW

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
<b>3.1. PRECONSTRUCTION PHASE</b>										
<b>3.1.1. Land Acquisition</b>										
3.1.1.1	Public unrest	Discrepancy and disagreement over land compensation on the planned Indramayu power plant of 2 x 1,000 MW in land acquisition activities	Intensity of complaints and protests	<ul style="list-style-type: none"> <li>To prevent unrest in the affected communities.</li> <li>To achieve price agreement between the initiator and the communities whose land is affected.</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination of plan of activities and land needs to the citizens of Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.</li> <li>Meeting on compensation between the project owner and landowners.</li> </ul>	Sites of construction of PLTU Indramayu 2 x 1000 MW in Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	During the pre-construction phase	PT PLN UIPJJB.	Environmental Office of Indramayu Regency and Offices of Sukra and Patrol Districts.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.1.1.2.	Decreased Income Level	Loss of livelihood due to the decrease of agricultural land from the land acquisition activities	<ul style="list-style-type: none"> <li>Total production of hectare for PLTU Indramayu 2 x 1000 MW.</li> <li>Number of farm workers who lose the opportunity to work</li> </ul>	To reduce the impact arising from land acquisition	<ul style="list-style-type: none"> <li>Provision of suitable land compensation value so as to allow land owners to buy new land.</li> <li>Training and community development for tenants</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	Since the activities of land acquisition up to construction	PT PLN UIPJJB.	Environmental Office of Indramayu Regency and Manpower and Transmigration Offices of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
<b>3.2. CONSTRUCTION PHASE</b>										



No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
<b>3.2.1. Recruitment of Workers (Increase Employment Opportunities) and Personnel Mobilization</b>										
3.2.1.1	Increased Employment Opportunities	Workers recruitment activities	<ul style="list-style-type: none"> <li>Number and employment status of local Workers absorbed.</li> <li>Increased income of residents around the project</li> </ul>	To increase positive impacts so that the expectations of citizens to be employed and open businesses can actually be realized	<ul style="list-style-type: none"> <li>Optimization of employment opportunities and chances for business with priority for local residents of villages in Patrol &amp; Sukra districts in Indramayu Regency.</li> <li>Transparency of workers specifications required by the project.</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	Since the activities of recruitment during construction activities	PT. PLN UIPJJB.	Environmental Office of Indramayu Regency, And Manpower and Transmigration Offices of Indramayu Regency, Offices of Sukra and Patrol Districts.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.2.1.2	Increased income levels	Presence of workers in the project area that require a variety of services giving rise to economic activities	<ul style="list-style-type: none"> <li>Increased income of residents around the project.</li> <li>Growing fields of economic activity in the project area.</li> </ul>	To expand the positive impact of the presence of construction activities of PLTU Indramayu 2 x 1000 MW	Development of business activities with a priority for local residents through community development	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	Since the activities of recruitment during construction activities	PT. PLN UIPJJB.	Environmental Office of Indramayu Regency, And Manpower and Transmigration Offices of Indramayu Regency, Offices of Sukra and Patrol Districts.	Environmental Office of Indramayu Regency, BPLHD Jawa Barat dan Ditjen Listrik & Pemanfaatan Energi (Dep. ESDM).
3.2.1.3	Public unrest	Non-absorption of the local population in the construction activities of PLTU Indramayu 2 x 1,000 MW	Sense of discontent and jealousy of the local population to the number of labor migrants absorbed in the project activities	To prevent public discontent and envy for not being able to participate in the construction activities of PLTU Indramayu 2 x 1000 MW	<ul style="list-style-type: none"> <li>Optimization of employment opportunities with priority for local residents.</li> <li>Transparency of Workers required specifications of the project.</li> <li>Informing migrant</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	Since the activities of recruitment during construction activities	PT. PLN UIPJJB.	Environmental Office of Indramayu Regency, Manpower and Transmigration Offices of Indramayu	Kantor Lingkungan Hidup Kabupaten Indramayu, BPLHD Jawa Barat dan Ditjen Listrik & Pemanfaatan Energi (Dep. ESDM).

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
					workers to respect local customs.				Regency, Offices of Sukra and Patrol Districts.	
<b>3.2.2. Mobilization of Equipment and Materials</b>										
3.2.2.1.	Decreased air quality	Mobilization of equipment and materials	Parameters of air quality in accordance with the Emissions standard under Decree of the Ministry of Environment No. Kep-13 / MENLH / 3/1995, the Government Regulation No. 41 of 1999	To prevent increased ambient air quality in order not to exceed the quality standards	<ul style="list-style-type: none"> <li>▪ Covering trucks with tarpaulin.</li> <li>▪ Using freight cars with low gas emission.</li> <li>▪ Performing watering</li> </ul>	On the road network that will be used for the transport of equipment and materials	During the transportation of equipment and materials	PT. PLN UIPJJB.	Environmental Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.2.2.2	Disruption to Transportation	Mobilization of equipment / materials	Increased congestion intensity and frequency of traffic accidents	<ul style="list-style-type: none"> <li>▪ To avoid the congestion caused by the operation of heavy vehicles</li> <li>▪ To prevent traffic accidents due to the increased frequency of vehicle traffic flow.</li> </ul>	<ul style="list-style-type: none"> <li>▪ To erect traffic signs on roads around the project site that are suitable for vehicles transporting equipment and materials.</li> <li>▪ Control of entry and exit of vehicle and parking in the project by trained staff.</li> </ul>	Tapak proyek dan jalan masuk sekitar proyek PLTU Indramayu 2 x 1000 MW.	During the mobilization of equipment and materials as well as construction of facilities and infrastructure	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Transportation Office of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.2.2.3.	Decreased Public Health	Dust and exhaust gas emissions and mobilization	Increased frequency of disease prevalence, especially ARI	To prevent the smallest possible increase in respiratory diseases	<ul style="list-style-type: none"> <li>▪ Use of vehicles that produce low emissions and roadworthy in</li> </ul>	Paths used to transport equipment and materials	During the mobilization of equipment and	PT. PLN UIPJJB, and Health Office	Environmental Office of Indramayu	Environmental Office of Indramayu Regency, the

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
		of equipment and materials		caused by dust and exhaust gases	accordance with the specifications of the vehicles. ▪ Conducting periodic watering program to reduce dust from the path used to transport equipment and materials,	particularly Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District	materials	of Indramayu Regency	Regency, Offices of Sukra and Patrol Districts	Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
<b>3.2.3. Land Preparation</b>										
3.2.3.1.	Increased Noise	Operational activities of equipment for land preparation	Level of noise	To prevent increased noise that disturbs the public and not exceeds the permissible noise	▪ To conduct activities during the day so it does not interfere with the activities of society. ▪ To build a fence that could reduce noise levels	Project site	During the land preparation activities	PT. PLN UIPJJB	Environmental Office of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.2.3.2.	Seawater Quality	Pollution due to piled up soil erosion washed by rainwater and washed into the sea	Increased TSS, TDS and turbidity of water quality around the coast and the sea	To preventing the decline in the quality of sea water	Piling up activities accompanied by the manufacture of the slurry ponds so that water that brings the suspension of piled up soil particles is deposited in the settling ponds before flowing into the ocean	At the land preparation activities	Performed since the implementation of land preparation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
										Energy and Mineral Resources)
3.2.3.3	Changes in land use	Changes in 327 hectares of site	Increased function of building and land from agriculture towards services and trading activities	To preventing uncontrolled development of land-use change which is not in accordance with the Spatial Planning of the regency and District	Sub Done by maintaining and fostering the development to fit the Spatial Planning of the regency and District	In the vicinity of PLTU Indramayu 2 x 1000 MW	Since the landscape changes to the operational stage	PT. PLN UIPJJB	Development Planning Agency of Indramayu Regency, National Land Agency of Indramayu Regency, Environmental Office of Indramayu Regency and Mining and Natural Resources Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.2.3.4.	Flood	Increased height (+ 2m) of the project site area of 327 hectares, and land cover changes in the project site	Landscape change is the increased frequency of flooding due to rain and sea water	To prevent flooding in locations around the project	Widening Plawad River which is a channel passing through the prospective project site locations and the discharge of irrigation water from the upstream locations of PLTU Indramayu 2 x 1000 MW	Plawad and Bugel River	Since the change of landscape in particular increase in ground surface elevation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Mining and Water Resources Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.2.3.5.	Disruption to land	Mobilization land	Increased intensity,	To avoid congestion and	To put traffic signs on	in the project site and	Since the	PT. PLN	Environmental	Environmental

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
	traffic flow	transport of piled up soil	frequency of occurrence of traffic accidents and damage to the road lane	damage to the path caused by the operation of heavy vehicles on the ground during the mobilization activities. To prevent the occurrence of traffic accidents due to the increased frequency of vehicle traffic flow	roads around the project site that are suitable for vehicles transporting equipment and materials. Control of entry and exit of vehicle and parking in the project by trained staff. Using the transport vehicle in accordance with the road grade and repair damage to roads	the entry around the project	mobilization of the piled up soil during land preparation activities	UIPJJB	Office of Indramayu Regency and Transportation Office of Indramayu Regency	Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
<b>3.2.4. Construction of Facilities and Infrastructures (Jetty)</b>										
3.2.4.1.	Decreased Seawater Quality	Construction of the main building in the seawaters such as jetty	TSS, TDS and turbidity of water quality around the coast and sea	To prevent degradation of seawater quality	Construction of jetty is done by precast elements and / or shuttering form, so that spilled particulates (TS and TDS) can be minimized	At the location of the jetty and the surrounding	Since the commencement of construction activities of the main building piles in the sea for the jetty	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.2.4.2.	Disruption to Fishermen Transportation	Jetty construction activities	Loss of business locations of fishermen to catch fish	To reduce the impact of decreased fish catch of fishermen	<ul style="list-style-type: none"> <li>Consultations with fishing communities to seek a deal.</li> <li>Coordination with the government (Marine and Fisheries Office and Sea Transportation Office) in the regulation of fishing</li> </ul>	In the waters around the construction of Jetty	From the time of construction begins until the operation	PT. PLN. UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
					locations in the area around the project in accordance with the rules existing in the Marine and Fisheries Office and the Sea Transportation Office					and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.2.4.3.	Increased type and number of Flora and Fauna	Planting of plants in open green space	<ul style="list-style-type: none"> <li>Increased type and species of flora and fauna.</li> <li>Increased air quality</li> </ul>	To increase environmental quality.	Routine RTH maintenance.	At the RTH of the project site on open land, yard of the power plant and facilities and infrastructure	<ul style="list-style-type: none"> <li>Sejak tahap konstruksi sampai operasional</li> </ul>	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Agricultural and Breeding Office of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.2.4.4.	Increased income level	Presence of workers in the project area that require a variety of services giving rise to economic activities	<ul style="list-style-type: none"> <li>Increased income of residents around the project.</li> <li>Growing fields of economic activity in the project area.</li> </ul>	To expand the positive impact of the presence of construction activities of PLTU Indramayu 2 x 1000 MW	Development of business activities with a priority for local residents through community development	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District.	Since the activities of recruitment during construction activities	PT. PLN. UIPJJB	Environmental Office of Indramayu Regency and Manpower and Transmigration Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
<b>3.3. OPERATION PHASE</b>										

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
<b>3.3.1. Recruitment of Workers</b>										
3.3.1.1.	Working Opportunities	Recruitment of workers	number and status of employment of local workers absorbed in the project activities as well as increased income residents around the project	To increase positive impacts so that the expectations of citizens to be employed and open a business can actually be realized	<ul style="list-style-type: none"> <li>Employment opportunities and chances for business with priority for residents Local villages in Patrol and Sukra districts in Indramayu Regency.</li> <li>Transparency of specifications required by the project</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District	Since recruitment activities during the operation of PLTU Indramayu 2 x 1000 MW	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, And Manpower and Transmigration Offices of Indramayu Regency, Offices of Sukra and Patrol Districts	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.3.1.2.	Increased income level	Presence of workers in the project area that require a variety of services giving rise to economic activities	<ul style="list-style-type: none"> <li>Increased income of residents around the project.</li> <li>Growing fields of economic activity in the project area.</li> </ul>	To expand the positive impact of the presence of construction activities of PLTU Indramayu 2 x 1000 MW	Development of business activities with a priority for local people of Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District. In this regard, community development is advisable.	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District	Since the activities of recruitment during construction activities	PT. PLN. UIPJJB in cooperation with the local government	Environmental Office of Indramayu Regency And Manpower and Transmigration Offices of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.3.1.3	Public unrest	Non absorption of local people in the power plant construction activities	Discontent and jealousy of the local population to the number of migrant labors absorbed in the project activities.	To prevent public discontent and envy for not being able to participate in power plant construction activities	<ul style="list-style-type: none"> <li>Optimization of employment opportunities with priority for local residents.</li> <li>Transparency of workers specifications required</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District	Every recruitment activities during the operation	PT. PLN UIPJJB, and Manpower and Transmigra	Environmental Office of Indramayu Regency, Manpower Office of Indramayu	Environmental Office of Indramayu Regency, the Environmental Management Agency of West

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
					by the project. <ul style="list-style-type: none"> <li>Informing the migrant workers to respect local customs.</li> <li>Conducting CSR program in accordance with the potential of local communities.</li> </ul>			tion Offices of Indramayu Regency	Regency, Offices of Sukra and Patrol Districts	Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
<b>3.3.2. Coal Fuel Loading and Unloading</b>										
3.3.2.1.	Seawater quality	Coal spillage during loading and unloading of coal	Increased turbidity and chemical parameters	To prevent the entry of coal scattered which damages the quality of sea water	Using covered <i>belt conveyor</i> and <i>dust protection cover</i> and <i>mobile hopper</i> .	Coal unloading site and along the jetty	During the loading and unloading of coal during the operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office of Indramayu	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.3.2.2.	Disruption to fishermen	Freighter traffic	Damage to fishing gears and accident due to freighter traffic	To reduce the occurrence of damage to fishing gears and fishermen accident	<ul style="list-style-type: none"> <li>Consultations with fishing communities to seek a deal.</li> <li>Coordination with the government (Marine and Fisheries Office and Sea Transportation Office) in the regulation of fishing locations in the area around the project in accordance with the rules existing in the</li> </ul>	In the waters of path of freighters	During the operational period	PT. PLN. UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)



No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
					Marine and Fisheries Office and the Sea Transportation Office					Resources)
3.3.2.3	Disruption due to Abrasion	Jetty building and operations	Coastal abrasion	To reduce abrasion	Shore embankments by building and mangrove	Coasts around the PLTU site	During the PLTU Operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
<b>3.3.3. Operation of Unit of PLTU Indramayu 2 x 1000 MW</b>										
3.3.3.1	Decreased air quality	Operation of the power plant during the coal burning process	Parameters of air quality in accordance with the Emissions standard under Decree of the Ministry of Environment No. Kep-13 / MENLH / 3/1995, the Government Regulation No. 41 of 1999	To prevent emissions and ambient air quality so as not to exceed the quality standards	<ul style="list-style-type: none"> <li>Promoting the use of coal with low <b>excontent</b>.</li> <li>Optimizing air quality control system that includes the maintenance of chimney, ESP and FGD.</li> </ul>	In the air quality control system that includes: Chimney, FGD and ESP.	During the operation of the power plant	PT. PLN UIPJJB	Environmental Office of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
3.3.3.2	Disruption to Flora and Fauna	Due to ash / fly ash coming from the chimney (stack) of the operation of	Decline in the productivity of crops	To minimize disruption to flora / fauna due to coal ash contamination	EPS maintenance so that its efficiency does not lower resulting in low fly ash produced	At the site of PLTU Indramayu 2 x 1000 MW, Sumuradem Village, Mekarsari, Patrol Lor, Patrol Baru Villages.	During the operation period.	PT. PLN UIPJJB	Environmental Office of Indramayu Regency.	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.3.3.3.	Public Health	Emission and gas from coal combustion	Increased frequency of diseases, especially respiratory infection caused by silicosis	To minimize in respiratory disease caused by silicosis as a result of the operation of PLTU Indramayu 2 x 1000 MW	<ul style="list-style-type: none"> <li>Optimization of the operation of the absorption system of the fly ash generated in the coal combustion process.</li> <li>Periodic inspection program in cooperation with local health centers</li> </ul>	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District	During the operation of PLTU Indramayu 2 x 1000 MW	PT. PLN UIPJJB, and Health Office of Indramayu Regency	Environmental Office of Indramayu Regency, Offices of Sukra and Patrol Districts	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
<b>3.3.4. Cooling Unit (waste heat)</b>										
3.3.4.1	Decreased Seawater Quality	Heat waste from the cooling system	Seawater quality standard refers to Decree of the State Minister of	To maintain the water temperature from the outlet of the cooling system in accordance	Optimizing the system cooling operations in accordance with the SOP	Location of the generating plant project site (cooling	During the operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and	Environmental Office of Indramayu Regency, the Environmental

コメント [d1]: DAMPAKNYA KECIL / TIDAK SIGNIFIKAN TAPI PERLU ADA PEMANTAUAN

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
			Environment No. Kep-51 / MENLH / 2004	with the effluent quality standards and specifications		tower).			Marine and Fishery Office of Indramayu Regency	Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources).
3.3.4.2.	Disruption to marine biota	Increased seawater temperature due to the discharge of the cooling system waste	Changes in the composition of marine biota in the location of the cooling system of waste disposal (heat waste).	To reduce the impact of the cooling system waste discharge as minimally as possible	To reduce disruption to marine biota by operating the water cooling system effectively in accordance with its operating instructions	On the cooling system and its supporting facilities	During the operation of PLTU Indramayu 2 x 1000 MW	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Marine and Fishery Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of Energy and Mineral Resources)
3.3.4.3.	Decreased income level	Increased seawater temperature due to the discharge of the cooling system waste	Decreased fish catches in the location of discharge of the cooling system waste (heat waste)	To reduce the impact of the cooling system waste discharge as minimally as possible	by operating the water cooling system effectively in accordance with its operating instructions	On the cooling system and its supporting facilities	Selama operasional PLTU Indramayu 2 x 1000 MW	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, Marine and Fishery Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, Directorate General of Electricity and Energy Utilization (the Ministry of

No	Significant Impact Managed	Significant Impact Sources	Impact Benchmark	Management Purposes	Environmental Management	Management Location	Management Period	Management Agency		
								Executive	Supervising	Reporting
1	2	3	4	5	6	7	8	9	10	11
										Energy and Mineral Resources)

## BIBLIOGRAPHY

- Anonimous, 1976. Quality Criteria for Water Environmental Protection Agency. U.S. Department of Commerce National Technical Information Service, Washington D.C.
- Bockris, J.O.M., 1977. Environmental Chemistry, Plemon Press, N.Y. and London.
- Canter, L.W., 1977. Environmental Impact Assessment. McGraw-Hill Book Company, New York.
- [CERC] Coastal Engineering Research Center, 1984. Shore Protection Manual Volume I, Fourth Edition. Washington: U.S. Army Coastal Engineering Research Center.
- Djajadiningrat, Surna T and Harry Harsono Amir, 1991. Penilaian Secara Cepat Sumber-sumber Pencemaran Air, Tanah dan Udara (*Quick Assessment on The Source of Water, Soil and Air Pollution*). Gadjah Mada University Press.
- Djajadiningrat, Surna T. Ed, 1990. Kualitas Lingkungan di Indonesia 1990 (*Indonesian Environmental Quality in 1990*). Kantor Menteri Negara Kependudukan dan Lingkungan Hidup (*Office of The Minister of Population and Environment*).
- Elliot, J.M., 1971. Some Method for The Statistical Analysis of Sample of Benthic Invertebrate, Scientific Publication: 148p.
- Fandeli, Chafid, 2000. Analisis Mengenai Dampak Lingkungan dan Pemaparannya dalam Pembangunan. Cetakan Revisi (*Analysis on Environmental Impact and Its Explanation in Development. Revised Edition*), Liberty. Jogjakarta.
- Hadi, Soedharto P., 2002. Aspek Sosial EMDAL: Sejarah, Teori dan Metode. Cetakan 2, (*Social Aspect of Environmental Impact Assessment: History, Theory and Method. 2<sup>nd</sup> Edition*) Gadjah Mada University Press. Jogjakarta.
- Horikawa, K., 1988. Nearshore Dynamics and Coastal Processes. University of Tokyo Press, Japan.
- Koentjaraningrat, 1989. Metode-metode Penelitian Masyarakat. (*Methods for Community Research*) Gramedia, Jakarta.
- Leopold, L.B., F.E. Clarke, B.B. Kanshaw and J.R. Bansley., 1971. A Procedure for Evaluating Environmental Impacts. US Geological Survey, Washington D.C.
- Mahida, U.N., 1992. Pencemaran Air dan Pemanfaatan Limbah Industri. (*Water Pollution and Industrial Waste Utilization*) Rajawali Press, Jakarta.
- Munn, r.E., 1979. Environmental Impact Assessment: Principal and Procedures. John Willey and Sons, New York.
- Newell, G.E. and R.C. Newell, 1963. Marine Plankton, A Practical Guide, 2<sup>nd</sup> Edition. Hutchinson Educational, Ltd. London.
- Nybakken, J.W., 1992. Biologi Laut: Suatu Pendekatan Ekologis. (*Marine Biology: An Ecological Approach*) PT Gramedia, Jakarta.
- Odum, E.P., 1971. Fundamental Ecology. 3<sup>rd</sup> Edition. Toppan Company Ltd. Tokyo.
- Row, J.B. and D.C. Wouten, 1980. Environmental Impact Analysis Handbook.
- Said, Nusa Idaman, 1999. Kesehatan Masyarakat dan Teknologi Peningkatan Kualitas Air. (*Community Health and Tachnology of Water Quality Improvement, Directorate of Environmental Technology of BBPT*), Jakarta.
- Sasongko, D.P., Agus H., Nasio A.H., and Agus S., 2000. Kebisingan Lingkungan. (*Environmental*

- Noise) Badan Penerbit Universitas Diponegoro, Semarang.
- Soeratno, Gunawan, 1990. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) Gajah Mada University Press. Jogjakarta.
- Soemarwoto, Otto, 1991. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) Gajah Mada University Press. Jogjakarta.
- Tjitrosoepomo, G., 1996. Morfologi Tumbuhan. (*Plant Morphology*) Gajah Mada University Press. Jogjakarta.
- U.S. Army Corps of Engineers, 1984. Shore Protection Manual. Coastal Engineering Research Center, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Estimation of Nearshore Waves. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Water Wave Mechanics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Coastal Sediment Properties. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Longshore Sediment Transport. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Surf Zone Hydrodynamics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- Zen, M.T., 1982. Menuju Kelestarian Lingkungan. (*Towards Environment Sustainability*) Yayasan Obor Indonesia dan Institut Teknologi Bandung. PT Gramedia, Jakarta.

## TABLE OF CONTENT

<b>PREFACE .....</b>	<b>i</b>
<b>TABLE OF CONTENT .....</b>	<b>ii</b>
<b>LIST OF TABLE.....</b>	<b>iv</b>
<b>LIST OF PICTURE .....</b>	<b>v</b>

## CHAPTER I INTRODUCTION

1.1. Background .....	I – 1
1.2. Rules and Regulations .....	I – 2
1.2.1. Laws .....	I – 2
1.2.2. Governmental Regulation .....	I – 5
1.2.3. Presidential Regulation .....	I – 7
1.2.4. Ministerial Regulation .....	I – 7
1.2.5. Presidential Decree .....	I – 8
1.2.6. Ministerial Decree .....	I – 8
1.2.7. Decree of The Chief of Environmental Impact Control Agency .....	I – 11
1.2.8. Decree of The Governor of West Java .....	I – 12
1.2.9. Regional Regulation .....	I – 12
1.3. Policy Basis for Environmental Management .....	I – 13
1.4. Aim and Purpose .....	I – 14
1.5. Use of Environmental Monitoring Plan .....	I – 14

## BAB II ENVIRONMENTAL MONITORING PLAN

2.1. Pre Construction Stage .....	II – 1
2.1.1. Land Acquisition .....	II – 1
2.1.1.1. Declining Income Level .....	II – 1
2.1.1.2. Community Restlessness .....	II – 2
2.2. Construction Stage .....	II – 2
2.2.1. Labor Recruitment and Personnel Mobilisation.....	II – 3
2.2.1.1. Increasing Job Opportunity .....	II – 3
2.2.1.2. Increased Level of Income .....	II – 6
2.2.1.3. Community Restlessness .....	II – 7
2.2.2. Equipment and Material Mobilisation .....	II – 8
2.2.2.1. Decreasing Air Quality.....	II – 8
2.2.2.2. Transportation Abnormality .....	II – 9
2.2.2.3. Decreasing Community Health Level .....	II – 10
2.2.3. Land Preparation .....	II – 12
2.2.3.1. Increasing Noise .....	II – 12
2.2.3.2. Sea Water Quality .....	II – 13
2.2.3.3. Change in Land Use System .....	II – 14
2.2.3.4. Increasing Flood Inundation .....	II – 15
2.2.3.5. Land Traffic Problems .....	II – 16
2.2.4. Development of Infrastructure and Facility (Jetty) .....	II – 19
2.2.4.1. Sea Water Quality .....	II – 19
2.2.4.2. Abnormality on Fishermen Transportation.....	II – 20
2.2.4.3. Increasing Number and Type of Flora and Fauna .....	II – 23
2.2.4.4. Increasing Income Level .....	II – 24
2.2.4.5. Problem for The Fishermen .....	II – 25

2.3.	Operational Stage .....	II – 26
2.3.1.	Labor Recruitment .....	II – 26
2.3.1.1.	Increasing Job Opportunity .....	II – 26
2.3.1.2.	Increasing Income Level .....	II – 27
2.3.1.3.	Community Restlessness .....	II – 29
2.3.2.	Coal Discharging .....	II – 32
2.3.2.1.	Degrading Sea Water Quality .....	II – 32
2.3.2.2.	Disturbance to The Fishermen .....	II – 33
2.3.2.3.	Abrasion and Accretion Problem .....	II – 34
2.3.3.	Generator Operation .....	II – 35
2.3.3.1.	Air Quality Degradation .....	II – 35
2.3.3.2.	Disturbance to The Flora and Fauna .....	II – 36
2.3.3.3.	Community Health and Environmental Health Degradation .....	II – 38
2.3.4.	Cooling Unit Operational .....	II – 39
2.3.4.1.	Sea Water Quality .....	II – 39
2.3.4.2.	Disturbance to Marine Lifeforms .....	II – 41
2.3.4.3.	Decreasing Income Level .....	II – 44
2.3.5.	Operation of Liquid Waste and Water Treatment .....	II – 45
2.3.5.1.	Decreasing Surface Water and Sea Water Quality .....	II – 45
2.3.6.	Coal Storage .....	II – 46
2.3.6.1.	Air Quality .....	II – 46
2.3.6.2.	Decreasing Sea Water Quality .....	II – 47
2.3.6.3.	Surface Water and Ground Water Quality .....	II – 49
2.3.6.4.	Disturbance to The Flora and Fauna .....	II – 52

**SUMMARY MATRIX OF PLTU INDRAMAYU 2 x 1.000 MW ENVIRONMENTAL MONITORING PLAN .....**

M-1

**BIBLIOGRAPHY .....**

D-1



**LIST OF TABLE**

Table 2.1.	Monitoring Location for Sea Water Quality Along The Jetty Location .....	II – 20
Table 2.2.	Ambient Sea Water Quality Standard .....	II – 40
Table 2.3.	Sea Water Quality Monitoring Location .....	II – 41
Table 2.4.	Monitoring Location for Surface Water and Ground Water .....	II – 49

**LIST OF PICTURE**

Figure 2.1.	Monitoring Location for Economic Social Aspect During Pre Construction Construction and Operational Stage .....	II – 5
Figure 2.2.	Monitoring Location for Landscape Change (Flood Inundation) During Construction Stage .....	II – 18
Figure 2.3.	Monitoring Location for Sea Water Quality During Construction Stage .....	II – 22
Figure 2.4.	Monitoring Location for Air Quality During Operational Stage .....	II – 31
Figure 2.5.	Monitoring Location for Sea Water Quality During Operational Stage .....	II – 43
Figure 2.6.	Monitoring Location for Surface Water and Ground Water Quality During Operational Stage .....	II – 51

# **CHAPTER I INTRODUCTION**

## **1.1. INTRODUCTION**

Development in Indonesia that is being actively implemented at this time aims at improving the welfare and quality of life of the people. Implementation of development on one hand is facing the issue of large population with high growth rates thus requiring better infrastructure. On the other hand, availability of natural resources is not increasing and is limited. Development activities and the increasing number of people can lead to increased pressure on natural resources.

Utilization of natural resources to improve the welfare and quality of life of the people must be accompanied by efforts to conserve the environment harmoniously in a balanced manner to support sustainable development. The development should be implemented in an integrated and comprehensive policy, taking into account the needs of the present and future generations. The important thing that should be observed in the integrated and total development is the environment. Therefore, the development intended must be environmentally sound and sustainable.

Construction of power plant installations is an inseparable part of development as the need for electricity will go in line with the increased activity and people's welfare. However, on the other hand, the construction of power plant may result in issues due to the cost needed and the labor requirements. The high costs will require reliable funding sources which must be found while labor-extensive project will lead to potential impacts on the environment.

At present PLTU Indramayu 2 x 1000 MW is about to be constructed to support the supply of electricity for Java and Bali. To anticipate the growing requirements for electricity, PT. PLN UIPJJB will increase the capacity by constructing PLTU Indramayu 2 x 1000 MW in West Java.

The construction of the Steam Power Plant which has a capacity of 2 x 1000 megawatts (MW) is planned to be built in the North Coast of Indramayu region, in Mekarsari, Patrol and Patrol Lor Villages, Patrol District, as well as Sumuradem Village Sukra District, Indramayu Regency. The electricity produced by the new power plant will be 8.4% and is going to be distributed directly through the Java - Bali interconnection system.

The aim of this study is to implement of sustainable development and wise and controlled utilization of natural resources. This study is needed in the planning of construction activities PLTU Indramayu 2 x 1000 MW in order to estimate the impact on the environment, both beneficial and adverse impacts.

Article 15 of Law No. 23 of 1997 states that every activity which is expected to produce significant impacts on the environment must be accompanied by an Environmental Impact Analysis Study. Implementation of the Environmental Impact Analysis is stipulated in Government Regulation No. 27 of 1999 and further in Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business and / or Activities that Must be Equipped by Environmental Impact Analysis dictating that the activities of planned construction of power plant with a capacity of over 100 MW shall be equipped with an Environmental Impact Analysis study.

## **1.2. LEGISLATIONS**

The preparation of this Environmental Monitoring Plan (RPL) refers to the legislations as follows:

### **1.2.1. Law**

- 1) Law of the Republic of Indonesia No. 1 of 1970 concerning Occupational Safety.  
Reason : As a reference in the construction of power plant with regard to the management of occupational safety impact.
- 2) Law No. 7 of 1981 concerning Compulsory Personnel Reporting.  
Reason : As a reference in the recruitment of workers for PLTU Indramayu 2 x 1000 MW.
- 3) Law of the Republic of Indonesia No. 5 of 1984 concerning Industry.  
Reason : As a reference in the construction of power plant with regard to industrial activities which will be built.
- 4) Law No. 1 of 1990 concerning Occupational Safety  
Reason : As a reference in the construction of power plant with regard to its Implementation which must meet safety requirements.
- 5) Law No. 5 of 1990 concerning Conservation of Natural Resources and Ecosystems.  
Reason : As a reference in the planning / conservation of natural resources related to impact management.
- 6) Law of the Republic of Indonesia No. 35 of 1991 concerning River.  
Reason : As a reference in the construction of the power plant with regard to the impact on the management of the river around the construction.
- 7) Law No. 3 of 1992, concerning Worker Social Security  
Reason : As a reference in the construction of power plant with regard to Social Security membership. Companies that employ workers should include them in the Social Security program

- 8) Law of the Republic of Indonesia No. 14 of 1992 concerning Traffic and Road Transportation.  
Reason : As a reference in the construction of power plant with regard to the impact of traffic management and road transportation around PLTU Indramayu 2 x 1000 MW.
- 9) Law of the Republic of Indonesia No. 21 of 1992 concerning Shipping.  
Reason : As a reference in the construction of power plant with regard to the management of traffic and impact of sea transport for the distribution of coal.
- 10) Law of the Republic of Indonesia No. 6 of 1993 concerning Climate Change.  
Reason : As a reference in the construction of the power plant with regard to the management of the impact of climate change as a result of construction activities PLTU Indramayu 2 x 1000 MW.
- 11) Law of the Republic of Indonesia No. 5 of 1994 concerning Ratification of the International Convention Regarding Biodiversity.  
Reason : As a reference in the construction of the power plant with regard to the management of the impact on flora and fauna.
- 12) Law of the Republic of Indonesia No. 5 of 1995 concerning Ratification of the Climate Convention.  
Reason : As a reference in the construction of power plant with regard to climate change.
- 13) Law of the Republic of Indonesia No. 6 of 1996 concerning Indonesian Waters.  
Reason : As a reference in the construction of power plant with regard to the activities of PLTU Indramayu 2 x 1000 MW in the area of Indonesian waters.
- 14) Law of the Republic of Indonesia No. 13 of 2003 concerning Manpower.  
Reason : As a reference in the construction of power plant with regard to the management of the impact of labor mobilization.
- 15) Law No. 7 of 2004 concerning Water Resources  
Reason : As a reference in the construction of power plant with regard to the use of water for the construction of PLTU Indramayu 2 x 1.000 MW.
- 16) Law No. 31 of 2004 concerning Fisheries.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of impacts.
- 17) Law No. 32 of 2004 concerning Regional Government (which has been amended by Government Regulation in Lieu of Law No. 3 of 2005).

- Reason : As a reference in the construction of power plant as it relates to the development policy in Indramayu Regency
- 18) Law No. 27 of 2007 concerning Management of Coastal Areas and Small Islands.  
Reason : As a reference in the management of PLTU Indramayu 2 x 1000 MW relating to the activities of PLTU Indramayu 2 x 1000 MW located in coastal areas.
- 19) Law No. 26 of 2007 concerning Spatial Planning.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to possible changes in land use due to the power plant.
- 20) Law No. 26 of 2008 concerning Regional Spatial Planning.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW related to spatial planning in the area of the power plant construction plan.
- 21) Law No. 30 of 2009 concerning Electricity.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the management of the impacts.
- 22) Law No. 32 of 2009 concerning Protection and Management of the Environment.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW relating to the obligation in the context of preparation of the EIA document for environmental management mainly due to the impacts caused by the project activity.
- 23) Law of the Republic of Indonesia No. 36 of 2009 concerning Health.  
Reason : As a reference in the construction of power plant with regard to the management of public health impact

#### **i. Government Regulation**

- 1) Government Regulation No. 13 of 1987 concerning Industrial Business License.  
Reason : As a reference for the permits in the construction of PLTU Indramayu 2 x 1000 MW
- 2) Government Regulation No. 6 of 1988 concerning Vertical Institutional Coordination in Regions.  
Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW as it relates to development policy in Indramayu Regency.
- 3) Government Regulation No. 10 of 1989 *juncto* Government Regulation No. 26 of 2006 concerning Provision and Use of Electric Power.  
Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.

- 4) Government Regulation No. 41 of 1993 concerning Road Transportation.

Reason : As a reference for the management of transportation used in PLTU Indramayu 2 x 1000 MW.

- 5) Government Regulation No. 43 of 1993 concerning Road Infrastructure and Traffic.

Reason : As a reference for the mobilization of facilities and infrastructure management in the activities of construction of PLTU Indramayu 2 x 1000 MW.

- 6) Government Regulation No. 69 of 1996 concerning Exercise of Rights and Performance of Duties as well as Forms and Procedures for Public Participation in Spatial Planning.

Reason : As a reference to the participation of the local community towards PLTU Indramayu 2 x 1000 MW.

- 7) Government Regulation No. 70 of 1996 concerning Seaport.

Reason : As a reference in the construction of jetties that will be used for the distribution of coal.

- 8) Government Regulation No.7 of 1999 concerning Preservation of Plants and Animals.

Reason : As a reference in environmental management so that the construction activities of PLTU Indramayu 2 x 1000 MW do not disturb plants and animals around the site

- 9) Government Regulation No. 8 of 1999, concerning use of plants and wildlife.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW so as to not disturb the plants and animals around the construction site.

- 10) Government Regulation No. 18 of 1999 *juncto* Government Regulation No. 85 of 1999 concerning Management of Hazardous and Toxic Waste.

Reason : As a reference in waste management mainly due to the impact caused by the project activity.

- 11) Government Regulation No. 19 of 1999 concerning Sea Pollution and / or Destruction Control.

Reason : As a reference in the solution in the event if issues / impact of activities on the sea around PLTU Indramayu 2 x 1000 MW.

- 12) Government Regulation No. 27 of 1999 concerning Environmental Impact Analysis.

Reason : As a reference in the process of document preparation and implementation of EIA studies of PLTU Indramayu 2 x 1000 MW.

- 13) Government Regulation No. 41 of 1999 concerning Air Pollution Control.

Reason : As a reference in the solution in the event of issues / impact of activities against air quality.

14) Government Regulation No. 47 of 1999 concerning Spatial Planning.

Reason : As a reference in the spatial change with the construction of PLTU Indramayu 2 x 1000 MW

15) Government Regulation No. 82 of 1999 concerning Water Transport.

Reason : As a reference in traffic management and mobilization of the power plant's raw materials by sea.

16) Government Regulation No. 81 of 2000 concerning Navigation.

Reason : As a reference for coordination with the sea transportation office on the management and monitoring of sea lanes to be used as a coal raw material supplier.

17) Government Regulation No. 74 of 2001 concerning Management of Hazardous and Toxic Materials (B3).

Reason : As a reference in waste management mainly due to the impact caused by the project activity.

18) Government Regulation No. 82 of 2001 concerning the Management of Water Quality and Water Pollution Control.

Reason : As a reference in the solution in the event of issues / impact of activities on water quality.

**i. Presidential Regulation**

1) Regulation of the President of the Republic of Indonesia No. 71 of 2006 concerning Assignment to PT. PLN (Persero) for Performing Accelerated Construction of Coal Power Plant.

Reason : As a reference for PT. PLN (Persero) to construct PLTU Indramayu 2 x 1000 MW.

2) Regulation of the President of the Republic of Indonesia No. 72 of 2006 concerning Coordinating Team for the Acceleration of Construction of Power Plant..

Reason : As a reference for PT. PLN (Persero) to immediately form a coordinating team in the construction of PLTU Indramayu 2 x 1000 MW.

**i. Ministerial Regulation**

1) Regulation of the Minister of Manpower and Transmigration No. 1 of 1980 concerning Occupational Safety and Health in Building Construction

Reason : As a reference in worker health and safety in the construction of PLTU Indramayu 2 x 1000 MW



- 2) Regulation of the Minister of Manpower No. 5 of 1985, concerning Lifting and Transporting Apparatuses.  
Reason : : As a reference in the use of Apparatuses, Junis Cranes, Dozers, Excavators, Fork-lifts which meet the requirements of K3.
- 3) Regulation of the Minister of Health No. 718/MENKES/PER/XII/1987 concerning Noise Related to Health.  
Reason : As a reference for the solution in the event of issue or impact of the activities mainly related to noise that can affect health.
- 4) Regulation of the State Minister of Agrarian / Head of BPN No. 1 of 1994 concerning Implementing Regulations of Presidential Decree No. 55 of 1993.  
Reason : As a reference for the solution in the event of issues / impact of activities related to land release / land acquisition.
- 5) Regulation of the Minister of Environment No. Kep. 08 of 2006 concerning Guidelines for the Preparation of Environmental Impact Analysis.  
Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.
- 6) Regulation of the Minister of Environment No. 11 of 2006 concerning Type of Business Plan and / or activities which must be equipped with EIA.  
Reason : As a reference that PLTU Indramayu 2 x 1000 MW project is an activity that must have EIA documents.
- 7) Regulation of the Minister of Environment No. 12 of 2006 concerning Licensing Requirements and Disposal of Wastewater to the Sea.  
Reason : As a reference for the solution in the event of issues / impact of activities primarily those related to the possibility of the waste from PLTU Indramayu 2 x 1000 MW.

#### **i. Presidential Decree**

- 1) Presidential Decree No. 04 of 1980 on Obligatory Manpower Report.  
Reason : As a reference in recruitment for PLTU Indramayu 2 x 1000 MW.
- 2) Presidential Decree No. 55 of 1993 on Land Procurement for Development for Public Interest.  
Reason : As a reference in the determination of land for the construction of PLTU Indramayu 2 x 1000 MW Indramayu
- 3) Presidential Decree No. 10 of 2000 concerning Environmental Impact Management Agency.

Reason : As a reference in the determination of regulatory, executive and reporting agency for the environmental impact control of PLTU Indramayu 2 x 1000 MW.

**i. Ministerial Decree**

1. Decree of the Minister of Manpower No. SE.OI/MEN/1978 concerning Ambient Air Quality Standards in Work Environment.

Reason : As a reference in the assessment of the environment, especially increase of ambient air pollution that can be caused by the construction activities of PLTU Indramayu 2 x 1000 MW.

2. Decree of the State Minister of Population and the Environment No. KEP-49/MENKLH/6/1987 concerning Determination of Significant Impacts.

Reason : As a reference in the assessment of environmental factors as activities that have an important impact.

3. Decree of the Minister of Environment No. KEP-14/MENLH/3/1994 concerning General Guidelines for the Preparation of Environmental Impact Analysis.

Reason : As a reference in the process of preparing the EIA document of PLTU Indramayu 2 x 1000 MW.

4. Decree of the Minister of Mining and Energy No: 103.K/008/M.PE/1994 concerning Supervision of the Implementation of RKL and RPL in the field of Mining and Energy.

Reason : As a reference in the process of monitoring the implementation of the RKL and RPL of PLTU Indramayu 2 x 1000 MW

5. Decree of the State Minister of Environment No. Kep. 13/MENLH/3/1995 concerning Emission Quality Standard from Immovable Sources.

Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.

6. Decree of the State Minister of Environment No. Kep. 51/MENKLH/10/ 1995 concerning Liquid Waste Quality Standard for Industrial Activities.

Reason : As a reference in the assessment of the environment, especially wastewater that can be caused by PLTU Indramayu 2 x 1000 MW.

7. Decree of the State Minister of Environment No. KEP-48/MENLH/XI/1996 concerning Quality Standard of Noise Level.

Reason : As a reference in the assessment of the environment, especially noise that can be caused by PLTU Indramayu 2 x 1000 MW.

8. Decree of the Minister of Environment No. KEP-49/MENLH/XI/1996 concerning Quality Standards of Vibration Levels.  
Reason : As a reference in the assessment of environmental conditions, especially the level of vibration that can be caused by PLTU Indramayu 2 x 1000 MW.
9. Decree of the Minister of Environment No. KEP-50/MENLH/XI/1996 concerning Baku Quality Standards of Odor.  
Reason : As a reference in the assessment of the environment, especially the odor that can be caused by PLTU Indramayu 2 x 1000 MW
10. Decree of the State Minister of Environment No. KEP-13/MENLH/III/1996 concerning Quality Standards of Emission from Immovable Sources.  
Reason : As a reference in the assessment of the environment, especially emissions from immovable sources that can be caused by PLTU Indramayu 2 x 1000 MW.
11. Decree of the Minister of Environment No. KEP-299/MENLH/11/1996 concerning Social Aspects in EIA study.  
Reason : As a reference in the assessment of the environment, especially the socioeconomic and cultural condition around the activities of PLTU Indramayu 2 x 1000 MW.
12. Decree of the State Minister of Environment No. KEP-45/MENLH/10/1997 concerning Air Pollution Quality Standards Index.  
Reason : As a reference in air pollution assessment based on the quality standards of air pollutants acceptable to the environment.
13. Decree of the State Minister of Environment No. KEP-02/MENLH/8/1998 concerning Guidelines for the Determination of Environmental Quality Standards.  
Reason : As a reference in the assessment of environmental conditions.
14. Decree of the Minister of Transportation No. KM-26 of 1998 concerning Seaport.  
Reason : As a reference for jetty construction activities of PLTU Indramayu 2 x 1000 MW
15. Decree of the Minister of Mining and Energy No. 1457K/28/MEN/2000 concerning Guidelines for the Preparation of Environmental Management Plan of Mining and Energy Activities.  
Reason : As a reference in the preparation of documents and implementation of the EIA study of PLTU Indramayu 2 x 1000 MW.
16. Decree of the Minister of Health No. 907 of 2002 concerning Conditions of Water Quality Monitoring.

Reason : As a reference in environmental assessment, especially with regard to the quality of water.

17. Decree of the Minister of Health No.1405 of 2002 concerning Health Requirements of Office and Industry.

Reason : As a reference in the assessment of the environment, particularly health in the surrounding environment, especially around the construction activities of PLTU Indramayu 2 x 1000 MW.

18. Decree of the Minister of Energy and Mineral Resources No. 1752.K/34/MEM/2002 concerning Implementation of Electricity Inspection.

Reason : As a reference in the assessment of the environment, especially the activities of electricity that may cause the impact of the activities of PLTU Indramayu 2 x 1000 MW.

19. Decree of the Minister of Environment No. 51 of 2004 concerning Sea Water Quality Standard.

Reason : As a reference in environmental assessment, especially the quality of sea water.

## **ii. Decree of the Head of Environmental Impact Controlling Agency**

- 1) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 056 of 1994 concerning Guidelines for the Determination of Significant Impacts.

Reason : As a reference in determining significant impacts.

- 2) Decree of the Head of the Environmental Impact Controlling Agency No. 01 of 1995. concerning Procedures and Technical Requirements for Storage and Collection of Hazardous and Toxic Waste Materials.

Reason : As a reference in the assessment of environmental conditions particularly hazardous and toxic waste that can be caused by PLTU Indramayu 2 x 1000 MW.

- 3) Decree of the Head of the Environmental Impact Controlling Agency No. Kep 04/BAPEDAL/09/1995 concerning Procedures and Requirements for Stockpiling Processing, Requirements for Ex- Location of Processing and Requirements for Ex Location of Hazardous and Toxic Waste Materials.

Reason : As a reference for environmental assessment mainly the result of processing of hazardous and toxic waste materials that can be caused by PLTU Indramayu 2 x 1000 MW.

- 4) Decree of the Director General of Electricity and Energy Development No. 75 – 12/008/6002/1995 concerning Implementing Guidelines and Environmental Monitoring of Electricity.

Reason : As a reference in the study of the impact of electricity.

- 5) Decree of the Head of the Environmental Impact Controlling Agency No. Kep. 205/BAPEDAL/07/1996 concerning Technical Guidelines for Controlling Air Pollution from Immovable Sources.

Reason : : As a reference in the study of the impact of air pollution.

- 6) Decree of the Head of the Environmental Impact Controlling Agency No. 299 of 1996 concerning Technical Guidelines of Social Aspects Assessment in the preparation of EIA.

Reason : As a reference in social impact assessment.

- 7) Decree of the Head of the Environmental Impact Controlling Agency No. Kep-124/12/1997 concerning Public Health Aspects Study in the Preparation of EIA.

Reason : As a reference in the study of health effects.

- 8) Decree of the Head of the Environmental Impact Controlling Agency No. 8 of 2000 concerning Public Involvement and Information Disclosure in the Process of Environmental Impact Analysis.

Reason : As a reference to the participation of the public in the EIA of PLTU Indramayu 2 x 1000 MW

#### **i. Decision of the Governor of West Java**

- 1) Regional Regulation of West Java Province No. 25 of 2002 concerning establishment of SOTK BAPEDAL of West Java Province.

Reason : As a reference in the study of the construction committee of PLTU Indramayu 2 x 1000 MW.

- 2) Regional Regulation of West Java Province No. 36 of 2002 concerning Spatial Planning.

Reason : As a reference in relation to the possibility of changes in land use due to PLTU Indramayu 2 x 1000 MW.

- 3) Regional Regulation of West Java Province Nomor : 02 of 2003 concerning General Spatial Plan of West Java Province.

Reason : Sebagai acuan dalam kaitannya dengan kemungkinan adanya perubahan penggunaan lahan akibat adanya pembangunan PLTU Indramayu 2 x 1.000 MW.

- 4) Regional Regulation of West Java Province No : 3 of 2004 concerning Management of Water Quality and Water Pollution Control.

Reason : As a reference in the impact assessment of water quality.

- 5) Regulation of the Governor of West Java No. 2 of 2006 concerning Coal Utilization.

Reason : As a reference in the study of the impact of coal fuel.

#### **i. Regional Regulation**

- 1) Regional Regulation No. 01 of 1996 concerning General Spatial Plan for Indramayu Regency.

Reason : As a reference in the construction of PLTU Indramayu 2 x 1000 MW in accordance with the Spatial Plan of Indramayu Regency

- 2) Circular Letter of the Regent of Indramayu No.660.1/882-LH/III/1997 concerning the Implementation of EIA studies, UKL and UPL.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 3) Decision of the Regent of Indramayu No. 660/Kep.265-Org/2000 concerning Establishment of the Audit Commission of the EIA and Environmental Management Plan / Environmental Monitoring Plan of Indramayu Regency.

Reason : As a reference in the process of establishing the EIA commission of PLTU Indramayu 2 x 1000 MW.

- 4) Regional Regulation of Indramayu Regency No. 26 of 2003 concerning Guidelines for the Implementation of Environmental Management and Utilization Efforts.

Reason : As a reference in the preparation of the EIA process of PLTU Indramayu 2 x 1000 MW.

- 5) Regional Regulation No. 5 of 2003, concerning Implementation of Manpower Administration in Indramayu Regency.

Reason : As a reference in the recruitment process of PLTU Indramayu 2 x 1000 MW

#### **a. FUNDAMENTAL ENVIRONMENTAL MANAGEMENT POLICY**

Natural resources are the basic capital of national development. However, natural resources are something limited in terms of quantity and quality while human needs of natural resources will always increase in line with the increased total population. Consumption and use of natural resources with no regard to the limited environmental capability will damage the environment and will consequently degrade environmental quality

The government has determined the policy for the management and collection of natural resources to increase people's livelihood, as indicated in Article 15 of Law No. 23 of 1997 and the Main Principles of State Administration (GBHN). Article 15 of Law No. 23 of 1997 dictates that any

activity suspected to cause significant impact to the environment must be completed with Environmental Impact Analysis (EIA) which is a tool for environmental management to support sustainable development by sustainable use of natural resources while GBHN dictates the harmonious relation between human and the surrounding environment.

The environmental impact analysis of PLTU Indramayu 2 x 1000 MW is done to meet the provisions of the legislations and to implement government policy on sustainable development.

## **b. PURPOSES AND OBJECTIVES**

The preparation of this environmental monitoring plan (RKL) is intended to provide guidance for the implementation of environmental monitoring from the planned activity of construction of PLTU Indramayu 2 x 1000 MW. The sections monitored are those affected or estimated to be affected by the positive or negative impact of the activity as stated in the EIA document.

Environmental monitoring is an integrated effort in the use, management, care, supervision, control and development of the environment so that natural resources potentials can be maintained and pollution or damage can be avoided or reduced.

This report is intended to prepare an environmental monitoring plan for the construction of PLTU Indramayu 2 x 1000 MW with the objectives as follows :

- a. To formulate the efforts to maintain environmental quality and supportability by using and preserving natural resources optimally.
- b. To formulate the measures to handle the negative impacts arising from the project activities and to develop positive impacts according to the applicable legislations
- c. To determine the agencies related in the environmental monitoring and mechanism of environmental monitoring

## **c. BENEFITS OF ENVIRONMENTAL MONITORING PLAN**

### ***For the Initiator***

The benefits of the environmental monitoring plan of the construction of PLTU Indramayu 2 x 1000 include:

- a. To be the guidance, guidelines and reference for monitoring the significant impact arising from the project activity so that they can be prevented or controlled and the positive impact can be increased.
- b. To be the guidelines and directives for the initiators on roles and responsibilities of environmental condition monitoring by coordination with the relevant agency.

***For the relevant agency***

The benefits of environmental monitoring for the relevant agencies include:

- a. To be recommendations for the decision makers, planners and relevant agencies in the construction of PLTU Indramayu 2 x 1000 MW to actualize an environmentally friendly development.
- b. To be the guidance and directives for the relevant agencies on the roles and responsibilities in environmental monitoring.

***For the Public***

The benefits of environmental monitoring for the public around the planned activity site of PLTU Indramayu 2 x 1000 MW include to be the guidance and directive for the public on their roles and responsibilities in environmental monitoring.



## **BAB II**

# **ENVIRONMENTAL MONITORING PLAN**

### **2.1. PRE CONSTRUCTION STAGE**

#### **2.1.1. Land Acquisition**

##### **2.1.1.1. Declining Income Level**

###### **A. Monitored Significant Impact**

Monitored significant impact is level of income lost due to land designation change, from farming land to building land for PLTU Indramayu 2 x 1000 MW.

###### **B. Source of Impact**

Land acquisition for PLTU Indramayu 2 x 1000 MW is regarded as source of impact.

###### **C. Monitored Environmental Parameter**

Monitored environmental parameters are:

1. Amount of income from land-owning community and peasant after land acquisition.
2. Allocation of compensation to buy another land.

###### **D. Purpose of Environmental Monitoring Plan**

Purpose of conducted monitoring activity is to find out the level of local resident's change in income and also the amount from compensation used to buy more land and for productive purposes.

###### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Data of declining income level and spending of compensation were obtained from on-field survey using interview technique upon project affected residents. Furthermore, the data is collected and analyzed in descriptive manner.

###### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village, Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District.

###### **3) Monitoring Term and Frequency**

Monitoring is conducted right after compensation is completed until the commencement of construction project, monitoring frequency on income level conducted once every 6 (six) months until the completion of construction stage.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

**2) Environmental Monitoring Inspector**

Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency are acted as inspector for income change monitoring and allocation for compensation.

**3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

**2.1.1.2. Community Restlessness****A. Monitored Significant Impact**

Monitored Significant Impact is the emergence of restlessness among the resident due to PLTU Indramayu 2 x 1000 MW development plan. Referred significant impact is restlessness among them whose land will be affected by land acquisition for PLTU Indramayu 2 x 1000 MW.

**B. Source of Impact**

Land acquisition activity is source of the impact.

**C. Monitored Environmental Parameter**

Monitored environmental parameters are intensity of complaint and protest made by resident around the project site.

**D. Purpose of Environmental Monitoring Plan**

The purpose of monitoring on community's perception are :

1. To identify resident's restlessness.
2. To identify effectiveness/success rate of environmental management implementation.

## **E. Environmental Monitoring Method**

### **1) Data analysis and Collecting Method**

Data on residents restlessness can be obtained by field observation with interview technique that involved local residents. Collected data will be analyzed in descriptive manner.

### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village, Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District as shown on Figures 2.1.

### **3) Monitoring Term and Frequency**

Monitoring is conducted during pre construction stage and perhaps still ongoing during project construction, monitoring will be held once every 3 (three) months since the commencement of on-field survey and publication of land acquisition period.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### **2) Environmental Monitoring Inspector**

Inspectors for this social restlessness monitoring activity are Environmental Affairs Service Office of Indramayu Regency, Social Affairs Service Office of Indramayu Regency, and Sukra and Patrol Sub-district Office.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## **2.2. CONSTRUCTION STAGE**

### **2.2.1. Labor Recruitment and Personnel Mobilisation**

#### **2.2.1.1. Increasing Job Opportunities**

##### **A. Monitored Significant Impact**

Monitored significant impact is opportunity to have job in the project.

## **B. Source of Impact**

Source of impact is PLTU Indramayu 2 x 1000 MW constructing activity which requires labor for implementing the construction activity.

## **C. Monitored Environmental Parameter**

Monitored environmental parameters are amount and status of employment of local labor involved in the project activity and increasing level of income of residents around the project site.

## **D. Purpose of Environmental Monitoring Plan**

The purpose of this job opportunity monitoring activity is to identify number of involved local labor and amount of wage received by local labor.

## **E. Environmental Monitoring method**

### **1) Data Analysis and Collecting Method**

Data on job opportunity and social resentment can be obtained through field observation with interview technique involving local residents, collected data will be analyzed in quantitative and descriptive manner.

### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village, Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District.

### **3) Monitoring Term and Frequency**

Monitoring conducted since the labor recruitment period during project construction stage, it will be held once every 6 (six) months.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

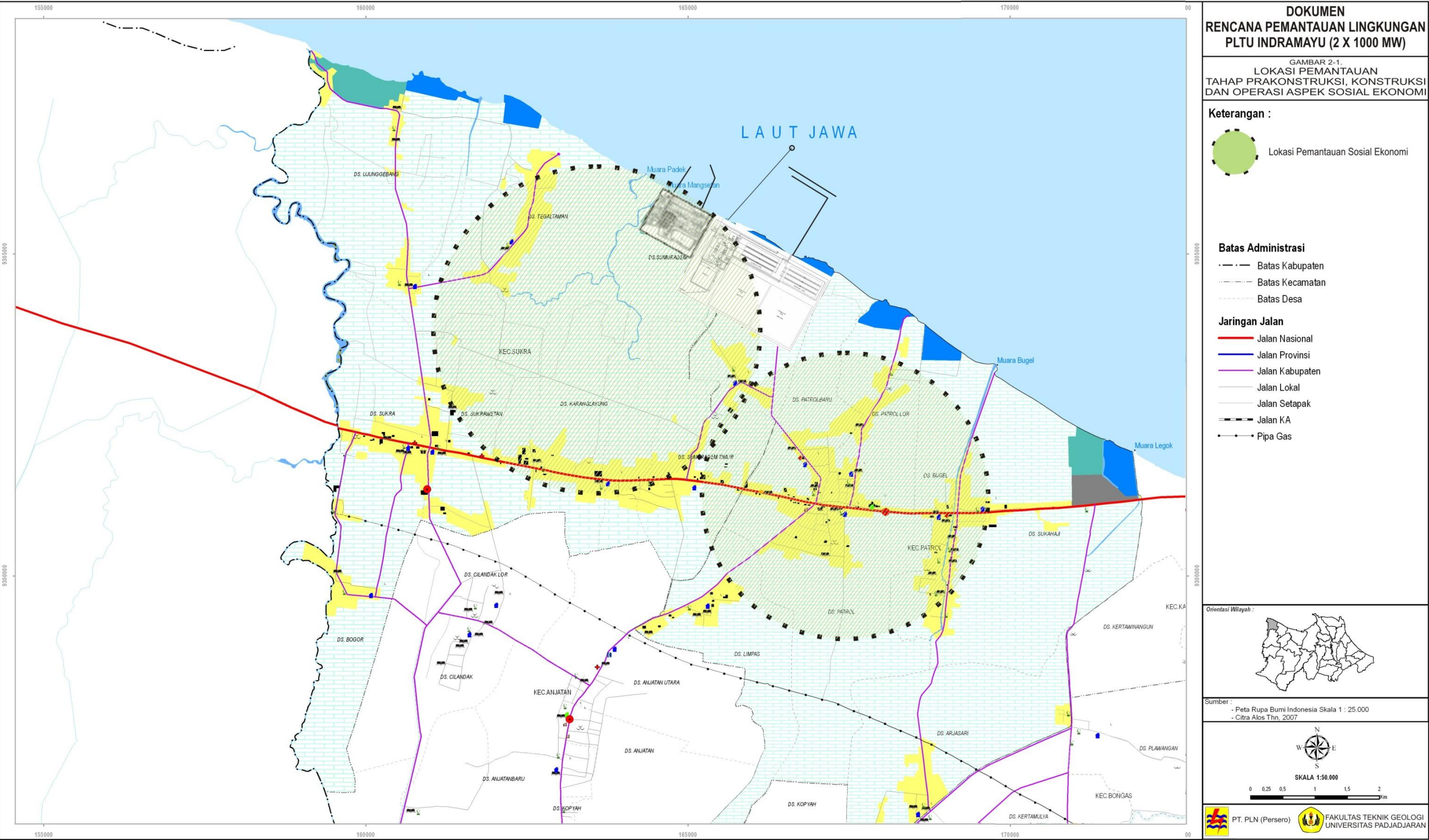
Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### **2) Environmental Monitoring Inspector**

Environmental Affairs Service Office of Indramayu regency, Manpower and Transmigration Service Office of Indramayu Regency, Patrol and Sukra Sub-District Office will act as inspectors for this job opportunity monitoring activity.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.



### **2.2.1.2. Increased Level of Income**

#### **A. Monitored Significant Impact**

Monitored significant impact is increasing job opportunity due to personnel mobilisation and labor recruitment in the development activity of PLTU Indramayu 2 x 1000 MW.

#### **B. Source of Impact**

Source of impact is the existence of labor in project site who are in need of various services that has the potential in causing economic activity.

#### **C. Monitored Environmental Parameter**

Monitored environmental parameters are:

1. Increasing income of residents around the project site.
2. Development of economic activity sector around the project site.

#### **D. Purpose of Environmental Monitoring Plan**

The purpose of this job opportunity monitoring activity is to identify level of income of local residents as well as identify type of business activity and number of involved residents in the local business activity.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Data on job/business opportunity and social resentment can be obtained through field observation with interview technique that involved local residents, collected data will be analyzed in descriptive manner.

##### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village, Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District.

##### **3) Monitoring Term and Frequency**

Monitoring will be conducted since the recruitment of labor during project construction, frequency of job opportunity monitoring activity will be held once every 6 (six) months.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

##### **2) Environmental Monitoring Inspector**

The inspector of this job opportunity and business opportunity monitoring activities are Environmental Affairs Service Office of Indramayu regency and Manpower and Transmigration Affairs Service Office of Indramayu Regency.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### **2.2.1.3. Community Restlessness**

##### **A. Monitored Significant Impact**

Monitored significant impact is restlessness from the local residents emerged from the increasing job opportunity on the project site that is more favorable for the visitor instead of local residents.

##### **B. Source of Impact**

Source of impact is failure to involve the local residents in the PLTU Indramayu 2 x 1000 MW development activity.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameter is dissatisfaction and resentment from local residents to the amount of visitor involved in project activity.

##### **D. Purpose of Environmental Monitoring**

The purpose of this job opportunity monitoring is to identify level of dissatisfaction from local residents.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Data on job/business opportunity and social resentment can be obtained through field observation with interview technique that involved local residents, collected data will be analyzed in descriptive manner.

###### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village, Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District.



### 3) Monitoring Term and Frequency

Monitoring will be conducted since the recruitment of labor during project construction, frequency of job and business opportunity monitoring activity will be held once every 6 (six) months.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### 2) Environmental Monitoring Inspector

Environmental Affairs Service Office of Indramayu Regency, Manpower and Transmigration Affairs Service Office of Indramayu Regency and Sukra and Patrol Sub-District Office are act as inspectors for this community restlessness monitoring activity.

### 3) Reporting of Environmental Monitoring Result

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## 2.2.2. Equipment and Material Mobilisation

### 2.2.2.1. Decreasing Air Quality

#### A. Monitored Significant Impact

Monitored significant impact is decreasing air quality particularly ash,  $\text{SiO}_2$ ,  $\text{SO}_2$  and  $\text{NO}_x$  and heavy metals which are caused by material and equipment mobilisation activity.

#### B. Source of Impact

Source of impact of decreasing air quality is material and equipment mobilisation activity for PLTU Indramayu 2 x 1000 MW development.

#### C. Monitored Environmental Parameter

Monitored environmental parameter is air quality parameter in accordance with emission standard as stated in The Decree of Minister of Environment No. Kep-13/MENLH/3/1995 and Government Regulation No. 41 Tahun 1999.

#### D. Purpose of Environmental Monitoring

Purpose of air quality monitoring is to identify the ambient of air quality and emission.

## **E. Environmental Monitoring Method**

### **1) Data Collecting Method**

Data collecting activity conducted by measuring the air quality ambient to be compared with required standard.

### **2) Environmental Monitoring Location**

Monitoring location is planned to be along the road that is used for equipment and materials mobilisation of PLTU Indramayu 2 x 1000 MW development.

### **3) Monitoring Term and Frequency**

Environmental monitoring is conducted prior to equipment and materials mobilisation activity and will be repeated once every six months during construction stage.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Environmental monitoring executor during operational stage is PT. PLN Java-Bali Grid Network Construction Main Unit.

### **2) Environmental Monitoring Inspector**

Environmental monitoring inspector is Environmental Affairs Service Office of Indramayu regency.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## **2.2.2.2. Transportation Abnormality**

### **A. Monitored Significant Impact**

Occuring impact is increasing traffic and possibility for traffic accident due to equipment and materials mobilisation activity. The environment that is predicted to be affected are drivers, passengers, and residents along the equipment and materials mobilisation route.

### **B. Source of Impact**

Impact in form of increasing traffic and accident due to equipment and materials mobilisation activity during construction.

**C. Monitored Environmental Parameter**

Monitored environmental impact is the increasing traffic-jam intensity and frequency of occurred traffic accident.

**D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring plan is to identify traffic and accident frequency caused by equipment and materials mobilisation activity.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Adopted method are field observation and traffic counting.

**2) Monitoring Location**

Monitoring Location took place on the entrance way of PLTU Indramayu 2 x 1000 MW, and North Coast national road between Indramayu - Jakarta.

**3) Monitoring Term and Frequency**

Environmental monitoring will be conducted prior to equipment and materials mobilisation activity and repeated once every six months during construction stage.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

**2) Environmental Monitoring Inspector**

Acting as environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Transportation Affairs Service Office of Indramayu regency.

**3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

**2.2.2.3. Decreasing Community Health Level**

**A. Monitored Significant Impact**

Estimated emerging impact during equipment and materials mobilisation is resident's health problems particularly upper digestion infection (ISPA) caused by ash/dust from material transportation activity.

**B. Source of Impact**

As the source of impact of resident's health problem and environmental health is flying ash/dust from equipment and material mobilisation activity.

**C. Monitored Environmental Parameter**

Impact parameter is health complaint caused by ash and vehicle exhaust fume.

**D. Purpose of Environmental Monitoring**

Purpose of environmental monitoring is to identify disease transformation caused by equipment and material mobilisation activity.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Environmental monitoring regarding air quality conducted by data collecting method upon particular disease from Sukra and Patrol Community Health Center and analysis of such disease pattern.

**2) Environmental Monitoring Location Hidup**

Environmental monitoring took place in Community Health Center within study area (Community Health Center of Patrol and Sukra Sub-District).

**3) Monitoring Term and Frequency**

Environmental monitoring conducted during equipment and materials mobilisation activity, repeated once every three months

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

**2) Environmental Monitoring Isecur**

Inspectors for environmental monitoring are Environmental Affairs Service Office of Indramayu regency, and Health Office of Indramayu Regency.

**3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### **2.2.3. Land Preparation**

#### **2.2.3.1. Increasing Noise**

##### **A. Monitored Significant Impact**

Monitored significant impact is increasing noise on location planned for project site and its surrounding which is estimated to occur continuously during land preparation process for the development of PLTU Indramayu 2 x 1000 MW.

##### **B. Source of Impact**

Source of impact of increasing noise is equipment operational activity during land preparation for the development of PLTU Indramayu 2 x 1000 MW.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameter is noise level parameter due to land preparation activity.

##### **D. Purpose of Environmental Monitoring**

Purpose of noise level monitoring is to identify environmental quality.

##### **E. Environmental Monitoring Method**

###### **1) Data Collecting Method**

Data collecting is conducted by measuring the noise level to be compared with the required standard.

###### **2) Environmental Monitoring Location**

Planned location for environmental monitoring on air quality will be done in several place around the location of land preparation, namely: project site, around Sumuradem Village Sukra Sub-District, Patrol Lor Village, Patrol Baru, Mekarsari Sub-District of Patrol.

###### **3) Monitoring Term and Frequency**

Air quality monitoring period conducted at least during ongoing land preparation activity, namely prior to such activity and then repeated once every 3 (three) months.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Environmental monitoring executor during operational is PT. PLN Java-Bali Grid Network Construction Main Unit.

### **2) Environmental Monitoring Inspector**

Environmental monitoring inspector is Environmental Affairs Service Office of Indramayu regency.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## **2.2.3.2. Sea Water Quality**

### **A. Monitored Significant Impact**

The land preparation activity is affecting the sea water quality in form of sea water turbidity on project site and its surrounding due to land-filling activity.

### **B. Source of Impact**

Source of impact on declining sea water quality is land preparation activity that using land-filling method.

### **C. Monitored Environmental Parameter**

Monitored environmental impact is the increasing of TSS, TDS and sea water turbidity.

### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring plan is to identify the level of sea water pollution due to land preparation activity.

### **E. Environmental Monitoring Method**

#### **1) Data Analysis and Collecting Method**

Applied method for data collection is as follows :

- On-field sea water sampling to be analyzed in laboratory and compared with the applicable standard based on the Decree of Minister of Environment No. 51/MENLH/2004 on Sea Water Standard. Some of the parameters will be measured

directly on-site such as pH level and temperature.

- Water quality sampling based on stratification.
- For marine benthos, sampling will be obtained from the sea to be analyzed regarding its diversity.

## **2) Monitoring Location**

Hold on water surface in location and around the location of land preparation.

## **3) Monitoring Term and Frequency**

Environmental monitoring will be conducted during land preparation activity with once every 6 (six) months of monitoring period.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### **2) Environmental Monitoring Inspector**

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## **2.2.3.3. Change in Land Use System**

### **A. Monitored Significant Impact**

Land preparation activity such as land-filling or excavating process for 327 hectares PLTU Indramayu 2 x 1000 MW is estimated to cause change in land use system which is triggering the development of its surrounding area.

### **B. Source of Impact**

Source of impact of change in land use system is the development of PLTU Indramayu 2 x 1000 MW and its facilities and infrastructures.

### **C. Monitored Environmental Parameter**

Monitored environmental impact is the change in land use system and the development around the site of PLTU Indramayu 2 x 1000 MW.

#### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring plan is to identify the change and development of land use system around the PLTU Indramayu 2 x 1000 MW in accordance with existing spatial layout plan.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Adopted method is on-site observation and secondary data collecting from Regional Planning and Development Agency of Indramayu Regency which will be analyzed in descriptive manner.

##### **2) Monitoring Location**

Environmental monitoring location took place in project site and its surrounding, particularly in Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District and Sumuradem Village Sukra Sub-District.

##### **3) Monitoring Term and Frequency**

Environmental monitoring will be held since construction stage to operational stage and hold annually.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

##### **2) Environmental Monitoring Inspector**

As the inspector for environmental monitoring are Environmental Affairs Service Office of Indramayu regency, Regional Planning and Development Agency of Indramayu Regency and Land Office of Indramayu Regency.

##### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.



#### **2.2.3.4. Increasing Flood Inundation**

##### **A. Monitored Significant Impact**

Land preparation activity such as land-filling and excavating is estimated to cause impact to the landscape and causing inundation/flood during rainy season and tide period because the project site is directly blocking the existing, but not well-managed, drainage system.

##### **B. Source of Impact**

Source of impact for inundation/flood is land-escalating activity ( $\pm 2$  m) of 327 hectares project site. This activity would cause flood in the area surrounding the project site.

##### **C. Monitored Environmental Parameter**

Monitored environmental impact is the increasing flood frequency due to rain fall and tide period.

##### **D. Purpose of Environmental Monitoring Plan**

Purpose of this environmental monitoring plan is to identify the flood frequency.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Adopted method is on-field observation and secondary data collection to be analyzed in descriptive manner.

###### **2) Monitoring Location**

Environmental monitoring location is on project site (land filling/preparation site) and residence, particularly in Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District and Sumuradem Village Sukra Sub-District.

###### **3) Monitoring Term and Frequency**

Environmental monitoring will be held on construction stage. Conducted once every year during rainy season.

##### **F. Environmental Monitoring Institution**

###### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

###### **2) Environmental Monitoring Inspector**

As the inspector for environmental monitoring are Environmental Affairs Service Office of Indramayu regency Water and Mining Resources Affairs Service Office of Indramayu

regency.

### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### **2.2.3.5. Land Traffic Problems**

##### **A. Monitored Significant Impact**

Monitored significant impact is increasing traffic level and the damages on road structure caused by piled-up soil transportation for land preparation for the development of PLTU Indramayu 2 x 1000 MW.

##### **B. Source of Impact**

Impact in form of increasing traffic level and road damage due to piled-up soil transportation for land preparation for the development of PLTU Indramayu 2 x 1000 MW.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameter is increasing traffic volume and damages on road structure.

##### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring plan is to identify traffic volume and road damages level caused by piled-up soil transportation activity.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Adopted method is on-field observation and traffic counting.

###### **2) Monitoring Location**

Monitoring Location took place on the entrance way to the Steam Power Plant, and North Coast national road between Indramayu - Jakarta.

###### **3) Monitoring Term and Frequency**

Environmental monitoring will be held during land preparation activity with monitoring period is once every 6 (six) months.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

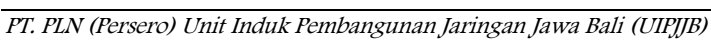
Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

**2) Environmental Monitoring Inspector**

Inspectors of environmental monitoring are Environmental Affairs Service Office of Indramayu regency and Transportation Affairs Service Office of Indramayu regency.

**3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.



## **2.2.4. Development of Facility and Infrastructure(Jetty)**

### **2.2.4.1. Sea Water Quality**

#### **A. Monitored Significant Impact**

With the ongoing activity of main building development in water area such as jetty, it is predicted to cause significant impact upon sea water quality such as water turbidity near activity site which also cause marine diversity problems and abnormality on fishermen activity.

#### **B. Source of Impact**

Source of impact of degrading sea water quality is main building development in water area such as jetty.

#### **C. Monitored Environmental Parameter**

Monitored environmental parameters are increasing TSS level, TDS level and sea water turbidity.

#### **D. Purpose of Environmental Monitoring Plan**

Purpose if this environmental monitoring plan is to identify sea water pollution level and main building development activity (piling) on sea water such as jetty.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Applied method for data collection is as follows :

- On-field sea water sampling to be analyzed in laboratory and compared with the applicable standard based on the Decree of Minister of Environment No. 51/MENLH/2004 on Sea Water Standard. Some of the paramaters will be measured directly on-site such as pH level and temperature.
- Water quality sampling based on stratification.
- For marine benthos, sampling will be obtained from the sea to be analyzed regarding its diversity.
- Interview with the fishermen.

##### **2) Monitoring Location**

Environmental monitoring location took place on location listed for jetty construction, first stage monitoring point (Table 2.1) and as shown by Figures 2.3.

**Table 2.1. Monitoring Location for Sea Water Quality Along The Jetty Location**

No.	Location Code	Sea Location
1	A	Coast where Jetty construction started
2	B	500 m from Coast where Jetty construction started
3	C	1000 m dari from Coast where Jetty construction started
4	D	1500 m dari from Coast where Jetty construction started
5	E	Coal discharge
6	F	Fishing area by fishermen

### 3) Monitoring Term and Frequency

Environmental monitoring is conducted since Jetty construction, once every 6 months.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### 2) Environmental Monitoring Inspector

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## 2.2.4.2. Gangguan Transportasi Nelayan

### A. Monitored Significant Impact

Monitored significant impact is disturbance caused by facility and infrastructure development activity to fishermen's activity.

### B. Source of Impact

Source of impact against the fishermen due to jetty development activity has caused problem to the fishermen activity and they have to take further detour.

### C. Monitored Environmental Parameter

Monitored environmental parameter is additional time and cost borne by the fishermen due to further and longer route taken by them.

**D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring is to identify the disturbance level from facility and infrastructure development activity, particularly in jetty development, towards fishermen mobility.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Data collection regarding disturbance against fish catching activity will be conducted through on-field survey and interview with the fishermen, collected data will be analyzed in descriptive manner.

**2) Monitoring Location**

Monitoring is conducted particularly in Patrol Lor sub-district where the resident dominantly worked as fishermen around the jetty area.

**3) Monitoring Term and Frequency**

Monitoring is conducted from construction stage to operational period.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

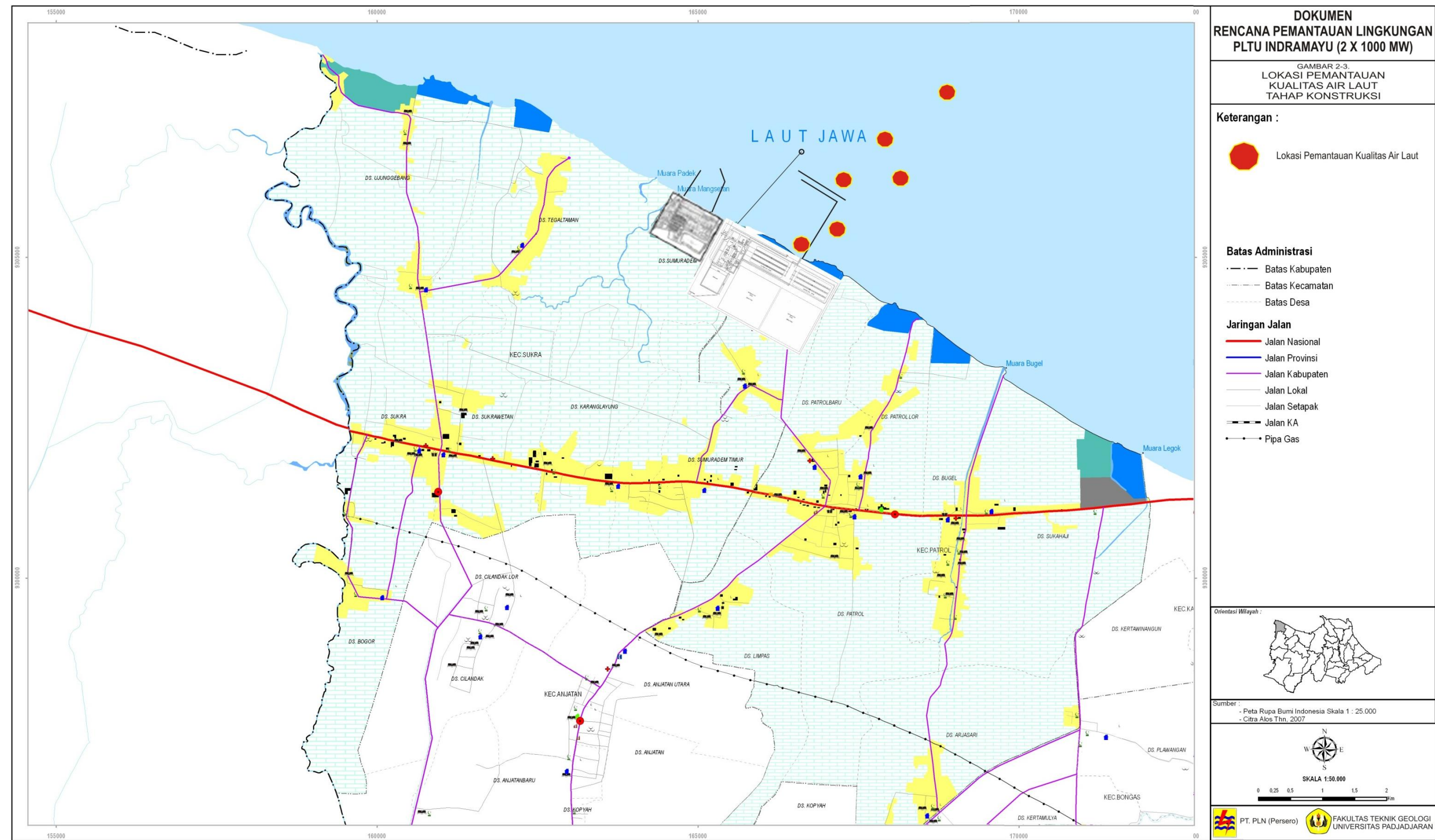
**2) Environmental Monitoring Inspector**

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

**3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.







### **2.2.4.3. Increasing Number and Type of Flora and Fauna**

#### **A. Monitored Significant Impact**

Monitored significant impact is increasing number of flora in form of diversity, composition and population.

#### **B. Source of Impact**

Source of Impact is planting activity on open green area.

#### **C. Monitored Environmental Parameter**

Monitored Environmental Parameter is composition of type, number of type and population of planted plant as well as its condition.

#### **D. Purpose of Environmental Monitoring**

Purpose of this monitoring is to identify the diversity, type composition and its growth cycle.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Data collection is conducted with observation and inventory process of bio-diversity emphasized on type and number. Analysis will be based on variety and abundance index.

##### **2) Environmental Monitoring Location**

Monitoring is conducted on activity site and its surrounding / open green area of PLTU Indramayu 2 x 1000 MW.

##### **3) Monitoring Term and Frequency**

Monitoring is conducted since construction stage until operational stage, once every 6 months period.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Environmental monitoring executor which is begin during the development of open green area, is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

##### **2) Environmental Monitoring Inspector**

As the inspector for environmental monitoring are Environmental Affairs Service Office of Indramayu regency and Agriculture and Husbandry Affairs Service Office of Indramayu regency.

### 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### 2.2.4.4. Increasing Income Level

##### A. Monitored Significant Impact

Monitored significant impact is increasing number of job and business opportunity in service sector that causing significant increase on resident's income level since the arrival of labors for PLTU Indramayu 2 x 1000 MW development project.

##### B. Source of Impact

As the Source of Impact is : labors accumulation in the project site of PLTU Indramayu 2 x 1000 MW.

##### C. Monitored Environmental Parameter

Monitored Environmental Parameter are :

- Amount of increased resident's income level during the ongoing PLTU Indramayu 2 x 1000 MW development activity.
- Type of business that is developed around the location of PLTU Indramayu 2 x 1000 MW.

##### D. Purpose of Environmental Monitoring Plan

The purpose of monitoring is to identify level of increasing income as well as type of business developed by the resident in relation with the existence of PLTU Indramayu 2 x 1000 MW.

##### E. Environmental Monitoring Method

###### 1) Data Analysis and Collecting Method

Data on incomes and developed business type can be obtained from on-field observation and interview with local residents, data will be analyzed in descriptive manner.

###### 2) Monitoring Location

Environmental monitoring location is particularly in Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District and Sumuradem Village Sukra Sub-District.

### 3) Monitoring Term and Frequency

Monitoring is conducted since the activity on Indramayu 2x1000 MW Steam Power Plant begin until the completion of project construction activity. Monitoring activity is conducted once prior to construction activity and repeated once every 6 (six) months.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### 2) Environmental Monitoring Inspector

As the inspector for environmental monitoring on income level change and developing business type are Environmental Affairs Service Office of Indramayu regency and Economic and Social Affairs Service Office of Indramayu regency.

### 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## 2.2.4.5. Problems for the Fishermen

### A. Monitored Significant Impact

Monitored significant impact is disturbance caused by the development of facility and infrastructure to the fishermen's activity.

### B. Source of Impact

Source of Impact of disturbance towards the fishermen because the location for fishing is affected by the jetty development activity.

### C. Monitored Environmental Parameter

Monitored Environmental Parameter is abnormality on fishermen's activity during fish-catching.

### D. Purpose of Environmental Monitoring Plan

Purpose of environmental monitoring plan is to identify disturbance level of facility and infrastructure development activity, jetty in particular, towards fishermen's activity.

### E. Environmental Monitoring Method

**1) Data Analysis and Collecting Method**

Data collection on disturbance towards fishing activity can be done through on-site observation and interview with fishermen, collected data will be analyzed in descriptive manner.

**2) Monitoring Location**

Monitoring is conducted particularly in Patrol Lor sub-district where the resident dominantly worked as fishermen around the jetty area.

**3) Monitoring Term and Frequency**

Monitoring conducted from the beginning of construction stage until the beginning of operational stage.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

**2) Environmental Monitoring Inspector**

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

**3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

**2.3. OPERATIONAL STAGE****2.3.1. Labor Recruitment****2.3.1.1. Increasing Job Opportunity****A. Monitored Significant Impact**

Monitored significant impact is job opportunity to be hired in the project.

**B. Source of Impact**

Assource of impact is labor requirement for operational activity of PLTU Indramayu 2 x 1000 MW.

**C. Monitored Environmental Parameter**

Monitored Environmental Parameter is amount and employment status of local labor involved in project activity as well as increasing level of income of local resident around the project area.

**D. Purpose of Environmental Monitoring Plan**

Purpose of job opportunity monitoring is to identify involvement amount and salary received by the local labor.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Data on job opportunity can be obtained through interview with residents live around the project area, management of PLTU Indramayu 2 x 1000 MW, and Regional Government. Collected data will be analyzed in qualitative and descriptive manner.

**2) Monitoring Location**

Environmental monitoring location is particularly in Sumuradem Village Sukra Sub-District, Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District.

**3) Monitoring Term and Frequency**

Monitoring is conducted since the recruitment of labor at the beginning of project operational, frequency of job opportunity monitoring is once every 6 (six) months.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

**2) Environmental Monitoring Inspector**

Environmental Affairs Service Office of Indramayu regency, Manpower and Transmigration Service Office of Indramayu Regency, Patrol and Sukra Sub-District Office will be act as inspectors for this job opportunity monitoring activity.

**3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

**2.3.1.2. Increasing Income Level**

**A. Monitored Significant Impact**

Monitored significant impact is developing job opportunity caused by personnel mobilisation and labor recruitment in the operational activity of PLTU Indramayu 2 x 1000 MW.

**B. Source of Impact**

Source of impact is the existence of labor in project site who are in need of various services that has the potential in causing economic activity that can be utilized by the local residents around the project site.

**C. Monitored Environmental Parameter**

Monitored Environmental Parameter are :

- Increasing income of residents around the project site.
- Development of economic activity sector around the project site which are utilized by local residents around the project area and its surrounding.

**D. Purpose of Environmental Monitoring Plan**

The purpose of this job opportunity monitoring activity is to identify increasing level of income of local residents as well as identify type of business activity and number of involved residents in the local business activity.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Data on resident's income and developed business type can be obtained from observation and interview with local residents, collected data will be analyzed in descriptive manner.

**2) Monitoring Location**

Environmental monitoring location is particularly in Sumuradem Village Sukra Sub-District, Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District.

**3) Monitoring Term and Frequency**

Monitoring is conducted since the labor recruitment and during project operational stage, frequency of income and business type developed by the local residents monitoring is conducted once every 6 (six) months.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network

Construction Main Unit as initiator.

## **2) Environmental Monitoring Inspector**

As the inspector for this increasing level of income and development of business opportunity monitoring are Environmental Affairs Service Office of Indramayu regency and Economic Affairs Service Office of Indramayu regency.

## **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### **2.3.1.3. Community Restlessness**

#### **A. Monitored Significant Impact**

Monitored impact is restlessness within the local residents caused by job opportunity recruitment during operational stage for operational and maintenance labor of PLTU Indramayu 2 x 1000 MW.

#### **B. Source of Impact**

Source of Impact is failure to involve local residents in the PLTU Indramayu 2 x 1000 MW development activity.

#### **C. Monitored Environmental Parameter**

Monitored Environmental Parameter is dissatisfaction and resentment of local residents against visitor who are hired as labor in project activity.

#### **D. Purpose of Environmental Monitoring Plan**

Purposes of environmental monitoring are :

1. Identify the resident's perception on labor recruitment and to identify whether or not there is complaint from local resident regarding labor recruitment for PLTU Indramayu 2 x 1000 MW activity.
2. To identify effectiveness/success rate of environmental management implementation.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Adopted method is on-field observation and interview with local residents, collected data will be analyzed in descriptive manner.

##### **2) Monitoring Location**

Environmental monitoring location is particularly in Sumuradem Village Sukra Sub-District, Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District.

### **3) Monitoring Term and Frequency**

Environmental monitoring is conducted once every 3 (three) months during operational stage.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity, commenced during probation period, is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

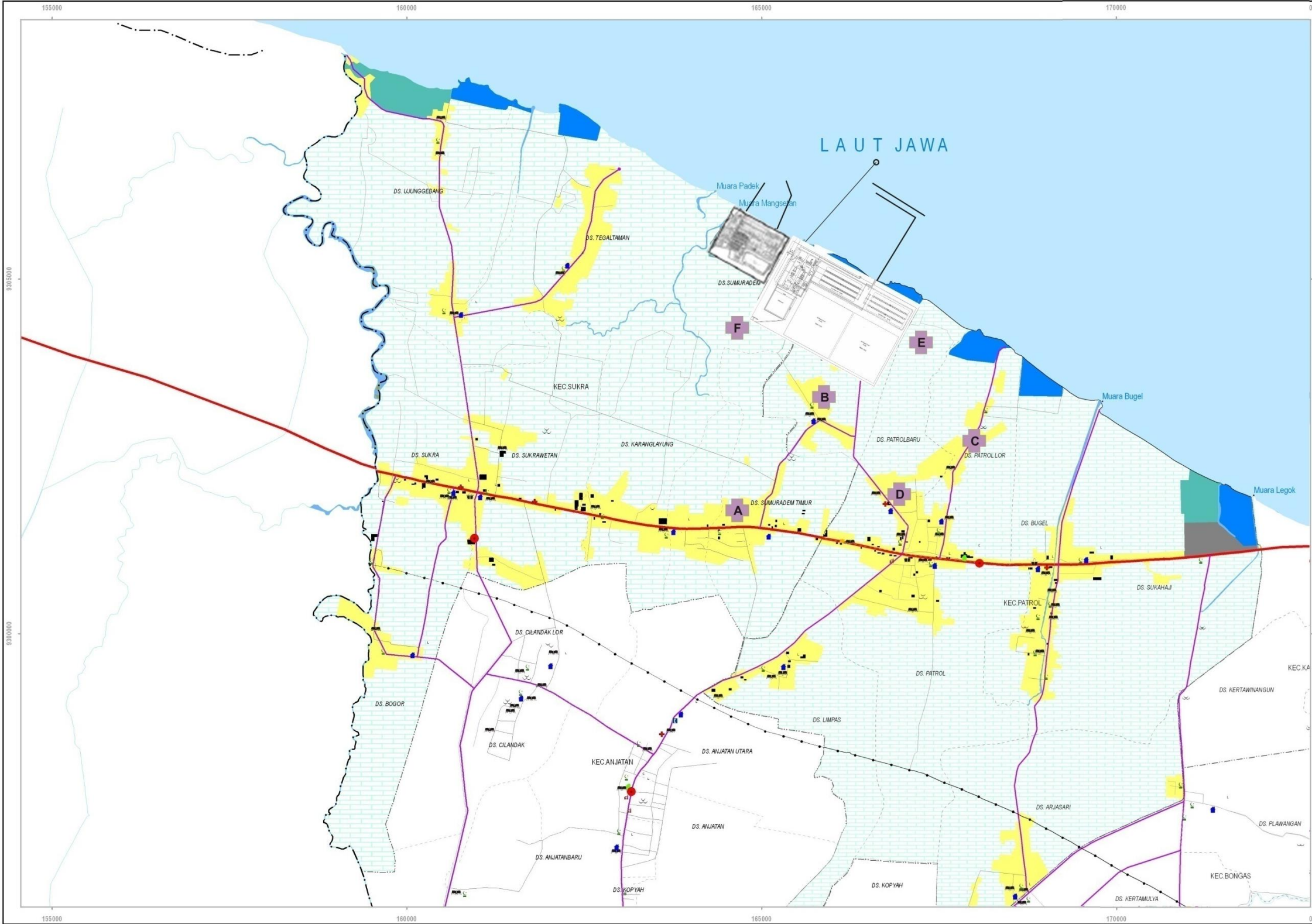
### **2) Environmental Monitoring Inspector**

Environmental Affairs Service Office of Indramayu regency, Manpower and Transmigration Service Office of Indramayu Regency, Patrol and Sukra Sub-District Office will be act as inspectors for this monitoring activity.

### **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.





**DOKUMEN**  
**RENCANA PEMANTAUAN LINGKUNGAN**  
**PLTU INDRAMAYU (2 X 1000 MW)**

GAMBAR 2-4.  
LOKASI PEMANTAUAN  
KUALITAS UDARA  
TAHAP OPERASI

**Keterangan :**

 Lokasi Pemantauan Kualitas Udara  
A : Desa Sumuradem  
B : Desa Mekarsari  
C : Desa Patrol Lor  
D : Desa Patrol Lor Baru  
E : Sekitar Tapak Proyek PLTU Indramayu  
F : Jalan Masuk PLTU Indramayu

**Batas Administrasi**

 Batas Kabupaten  
 Batas Kecamatan  
 Batas Desa

**Jaringan Jalan**

 Jalan Nasional  
 Jalan Provinsi  
 Jalan Kabupaten  
 Jalan Lokal  
 Jalan Setapak  
 Jalan KA  
 Pipa Gas

**Orientasi Wilayah :**



**Sumber :**

 PT. PLN (Persero) FAKULTAS TEKNIK GEOLOGI  
UNIVERSITAS PADJADJARAN

### **2.3.2. Coal Discharging**

#### **2.3.2.1. Degrading Sea Water Quality**

##### **A. Monitored Significant Impact**

Estimated impact that could happen and require continuous observation during operational stage of PLTU Indramayu 2 x 1000 MW is degradation of sea water quality particularly caused by coal spill-over on the water around the outfall area which is affecting marine life form.

##### **B. Source of Impact**

Source of Impact of sea water quality degradation is coal discharging activity.

##### **C. Monitored Environmental Parameter**

Monitored Environmental Parameter is increasing turbidity level and chemical parameter.

##### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring is to identify sea water pollution in order to determine the right measurement in preventing environmental damage.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Applied method will be sea water sampling. Result of chemical, physical, and life form measurements in the laboratory will be compared with sea water standard based on the Decree of Minister of Environment No. 51/MENLH/2004 on sea water standard.

###### **2) Monitoring Location**

Environmental monitoring location will be along jetty development route, on first monitoring point and as shown in Figures 2.3.

###### **3) Monitoring Term and Frequency**

Sea water quality monitoring will be conducted during operational stage of generator unit, with repetition once every 3 (three) months.

##### **F. Environmental Monitoring Institution**

###### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity, commenced during probation period, is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

###### **2) Environmental Monitoring Inspector**

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### **2.3.2.2. Disturbance to The Fishermen**

##### **A. Monitored Significant Impact**

Monitored significant impact is disturbance caused by coal discharging and transporting activities towards fishermen's activities.

##### **B. Source of Impact**

Source of Impact of disturbances to the fishermen are damage on catching device, traffic blockades and risk of collision with transporting vessel.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameters are damage on catching device, traffic blockades and risk of collision with coal transporting vessel.

##### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring is to identify level of disturbance, damages, and accident happened to the fishermen due to coal transporting activity.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Data collecting activity regarding disturbance on fishing activity will be conducted through on-field survey and interview with fishermen, collected data will be analyzed in descriptive manner.

###### **2) Monitoring Location**

Monitoring is conducted particularly in Patrol Lor sub-district where the resident dominantly worked as fishermen around the jetty area and sailing route

### 3) Monitoring Term and Frequency

Monitoring conducted during the operational stage of PLTU Indramayu 2 x 1000 MW, from the beginning of coal transporting activity until the end of operational period.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### 2) Environmental Monitoring Inspector

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## 2.3.2.3. Abrasion and Accretion Problem

### A. Monitored Significant Impact

Beach abrasion in the location of PLTU Indramayu 2 x 1000 MW and beach abrasion around the location of PLTU Indramayu 2 x 1000 MW.

### B. Source of Impact

Source of Impact of beach abrasion are building and operating jetty.

### C. Monitored Environmental Parameter

Monitored environmental parameter is the width and length of abrasion.

### D. Purpose of Environmental Monitoring Plan

Purpose of environmental monitoring plan is to identify progress of ongoing abrasion in beach area and its surrounding.

## E. Environmental Monitoring Method

### 1) Data Analysis and Collecting Method

Data collection is conducted through measurement and mapping of abrasion event.

## 2) Monitoring Location

Monitoring conducted along the coast line of PLTU Indramayu 2 x 1000 MW and its surrounding area.

## 3) Monitoring Term and Frequency

Monitoring is conducted during the operational stage of PLTU Indramayu 2 x 1000 MW at least once a year.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit as initiator.

### 2) Environmental Monitoring Inspector

As the environmental monitoring inspectors are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

## 2.3.3. Generator Operation

### 2.3.3.1. Air Quality Degradation

#### A. Monitored Significant Impact

Monitored significant impact is air quality degradation, particularly dust,  $\text{SiO}_2$ ,  $\text{SO}_2$  and  $\text{NO}_x$  and heavy metals which is happening continuously as long as the operation period of PLTU Indramayu 2 x 1000 MW.

#### B. Source of Impact

Source of Impact of air quality degradation is operational activity of Indramayu 2 x 1000 MW steam Power Plant during coal combustion process.

#### C. Monitored Environmental Parameter

Monitored environmental parameter is air quality parameter based on emission standard from the Decree of Minister of Environment No. Kep-13/MENLH/3/1995 and

Government regulation No. 41 of 1999.

#### **D. Purpose of Environmental Monitoring**

Purpose of environmental monitoring is to identify ambient air quality and emission.

#### **E. Environmental Monitoring Method**

##### **1) Data Collecting Method**

Data collection method conducted by measuring ambient air quality to be compared with required standard.

##### **2) Environmental Monitoring Location**

Planned environmental monitoring location regarding air quality impact will took place in several locations, namely: stack and around the Sumuradem Village, Sub-District of Sukra, Patrol Lor Village, Patrol Baru Village, and Mekarsari Village Sub-District of Patrol.

##### **3) Monitoring Term and Frequency**

Air quality monitoring period is as long as the PLTU Indramayu 2 x 1000 MW is operating, monitoring will be held once every 3 (three) months.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity during operational period is PT. PLN Java-Bali Grid Network Construction Main Unit.

##### **2) Environmental Monitoring Inspector**

Monitoring inspector is Environmental Affairs Service Office of Indramayu regency.

##### **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### **2.3.3.2. Disturbance to the Flora and Fauna**

##### **A. Monitored Significant Impact**

Monitored impact is troubled flora and fauna caused by ash/dust originating from coal combustion process for operating PLTU Indramayu 2 x 1000 MW.

**B. Source of Impact**

Source of Impact of troubled flora and fauna in land is flying ash/dust from operating stack of PLTU Indramayu 2 x 1000 MW.

**C. Monitored Environmental Parameter**

Monitored environmental parameter is floral damage in form of planting problems chlorosis and necrosis as well as reduced cultivated plant productivity after exposed to dust,  $\text{SiO}_2$ ,  $\text{NO}_x$  and  $\text{SO}_x$  originated from operating PLTU Indramayu 2 x 1000 MW.

**D. Purpose of Environmental Monitoring**

Purpose of environmental monitoring is to identify flora and fauna degradation level as well as reduced cultivated plants productivity.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Data collection is conducted with observation and inventory process of bio-diversity emphasized on type and number. Analysis will be based on variety and abundance index.

**2) Monitoring Location**

Environmental monitoring is particularly conducted in Sumuradem Village Sukra Sub-District, Mekarsari Village, Patrol Lor Village, Patrol Baru Village Patrol Sub-District.

**3) Monitoring Term and Frequency**

Environmental monitoring will be held once every 3 (three) months during operational period.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

**2) Environmental Monitoring Inspector**

As the inspector for environmental monitoring are Environmental Affairs Service Office of Indramayu regency and Agriculture and Husbandry Affairs Service Office of Indramayu regency.

**3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of

Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### **2.3.3.3. Community Health and Environmental Health Degradation**

#### **A. Monitored Significant Impact**

Estimated impact that is going to emerge during operational stage of PLTU Indramayu 2 x 1000 MW unit is community health problem, especially upper digestion infection due to ash/dust from coal combustion process.

#### **B. Source of Impact**

As the source of impact of community health and environmental health problem is flying ash/dust from coal combustion process.

#### **C. Monitored Environmental Parameter**

Impact parameter is health complaints caused by fly ash ( $\text{SiO}_2$ ).

#### **D. Purpose of Environmental Monitoring**

Purpose of conducted environmental monitoring is to identify transformation in disease pattern.

#### **E. Environmental Monitoring Method**

##### **1) Data Collecting and Analysis Method**

Environmental monitoring upon air quality is conducted by collecting data related to disease history from Community Health Center of Sukra and Patrol as well as analyzing the trend of disease pattern.

##### **2) Environmental Monitoring Location Hidup**

Environmental monitoring conducted in Community Health Center within study area (Community Health Center of Patrol and Sukra Sub-District).

##### **3) Monitoring Term and Frequency**

Environmental monitoring conducted once a year during operational stage of PLTU Indramayu 2 x 1000 MW.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.



## 2) Environmental Monitoring Inspector

Inspectors for this environmental monitoring activity are Environmental Affairs Service Office of Indramayu regency, and Health Office of Indramayu Regency.

## 3) Reporting of Environmental Monitoring Result

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### 2.3.4. Cooling Unit Operational

#### 2.3.4.1. Sea Water Quality

##### A. Monitored Significant Impact

Estimated impact that could happen and require continuous observation during operational stage of PLTU Indramayu 2 x 1000 MW is degradation of sea water quality particularly caused by the arising sea water temperature on the water around the outfall area.

##### B. Source of Impact

As the source of impact regarding degrading sea water quality is: **Heat waste** originated from the cooling system process which is still discharging hot waste to the sea.

##### C. Monitored Environmental Parameter

Monitored environmental parameter is: sea water temperature based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms.

##### D. Purpose of Environmental Monitoring Plan

Purpose of environmental monitoring plan is:

1. To identify the sea water quality.
2. To monitor disposed water temperature from cooling unit and generator wastewater quality (effluent).

##### E. Environmental Monitoring Method

##### 1) Data Analysis and Collecting Method

Applied method is by conducting sea water sampling and liquid waste from cooling

system. Analysis result will be compared to the standard based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms. (Table 2.2.).

## 2) Environmental Monitoring Location

Environmental monitoring location (Figure 2.5) of sea water quality monitored from around inlet, outlet and jetty (Table 2.3.).

**Tabel 2.2. Ambient Sea Water Quality Standard**

No	Parameter	Unit	Standard*)
<b>A</b> PHYSICS			
1.	Brightness (insitu)	meter	C : > 5 M : - L : > 3
2.	Odor (insitu)	-	Natural
3.	Turbidity	NTU	< 5
4.	Suspended Solid Material (TSS)	mg/l	C : 20 M : 80 L : 20
5.	Temperature (insitu)	°C	C : 28-30 M : 28-32 L : 28-30
6.	Oil Layer (insitu)	-	None
7.	Salinity	‰	C : 33-34 M : 34 L : 33-34
<b>B.</b> CHEMICAL			
1	pH (26 °C)	-	7 – 8,5
2	Dissolved Oxygen (DO) insitu	mg/l	> 5
3	COD	mg/l	20
4	Amonia total (NH <sub>3</sub> -N)	mg/l	0,3
5	Phosphate (PO <sub>4</sub> -P)	mg/l	0,015
6	Nitrate (NO <sub>3</sub> -N)	mg/l	0,008
7	Cyanide (CN)	mg/l	0,5
8	Sulfide (H <sub>2</sub> S)	mg/l	0,01
9	Phenol	mg/l	0,002
10	Surfactan anion (MBAS)	mg/l	1,0
11	Oil & Fat	mg/l	1,0
12	Quiksilver (Hg)	mg/l	0,001
13	Chromium VI (Cr 6 <sup>+</sup> )	mg/l	0,005
14	Arsen (As)	mg/l	0,012
15	Cadmium (Cd)	mg/l	0,001
16	Copper (Cu)	mg/l	0,008
17	Lead (Pb)	mg/l	0,008
18	Zinc (Zn)	mg/l	0,05
19	Nickel (Ni)	mg/l	0,05
<b>C.</b>			
1.	Coliform (total)	MPN/100ml	None
2.	Pathogen Bacterial	Sel/100ml	None

Remark : \*) KEP 51/MENLH/2004 for Marine Lifeforms

< = Less Than  
 C = Natural Coral  
 M = Mangrove  
 L = Lamun

**Table 2.3. Sea Water Quality Monitoring Location**

No.	Location Code	Location
1	A	Beach Adjacent to Mekarsari Village
2	B	Beach in outlet of <b>heat waste</b>
3	C	Beach 1 Km from outlet of <b>heat waste</b>
4	D	Beach in outlet of liquid waste treatment
5	E	Beach 1 Km from liquid waste treatment
6	F	Beach Adjacent to Sumuradem Village
7	G	Beach Adjacent to Patrol Lor Village
8	H	Beach Adjacent to Patrol Baru Village

### 3) Environmental Monitoring Period

Environmental monitoring period is during operational stage, conducted once every 3 months.

## F. Environmental Monitoring Institution

### 1) Environmental Monitoring Executor

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

### 2) Environmental Monitoring Inspector

As the inspectors for water quality monitoring are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### 3) Reporting of Environmental Monitoring Result

Report on the result of water quality monitoring will be submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### 2.3.4.2. Disturbance to Marine Lifeforms

**A. Monitored Significant Impact**

Monitored significant impact is decreasing number of marine lifeforms due to increasing sea water temperature in the water around outfall area.

**B. Source of Impact**

As the source of impact of degrading sea water quality is: **Heat waste** originated from the cooling system process which is still discharging hot waste to the sea.

**C. Monitored Environmental Parameter**

Monitored Environmental Parameter is marine lifeform biodiversity and sea water temperature based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms. (Table 2.2.).

**D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring plan is :

1. To monitor the temperature of heat waste of water waste from cooling unit.
2. To identify the impact of heat waste to the marine lifeforms biodiversity.

**E. Environmental Monitoring Method****1) Data Analysis and Collecting Method**

Applied method is by sea water and marine lifeforms sampling in the outlet and its surrounding area. Analysis result will be compared to the standard based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms. (Table 2.2.).

**2) Environmental Monitoring Location**

Environmental monitoring location is as shown by Figure 2.5., (Table 2.3.), namely, monitored around inlet and outlet.

**3) Environmental Monitoring Period**

Environmental monitoring period is during operational stage and conducted once every 3 months.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

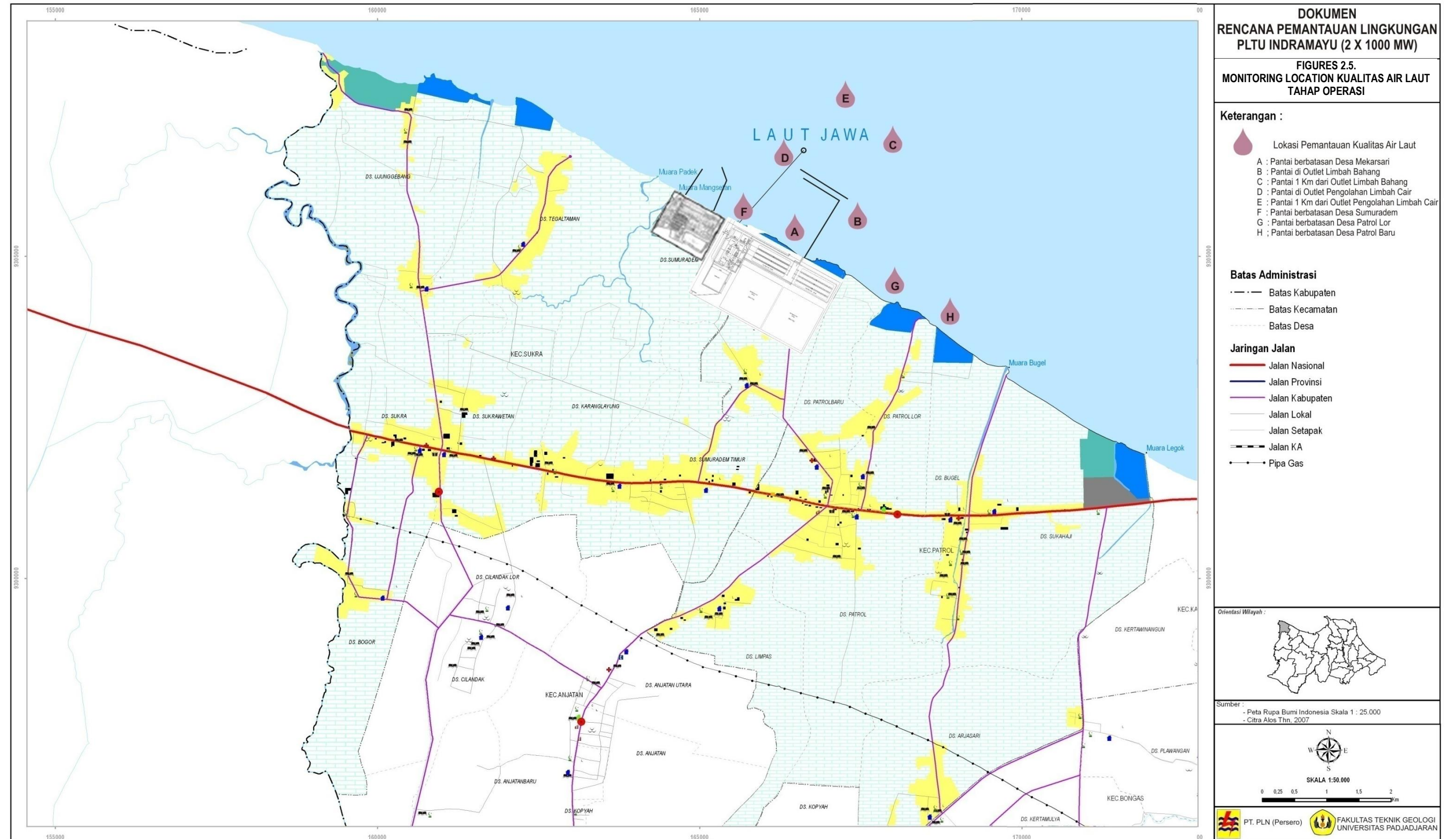
Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

**2) Environmental Monitoring Inspector**

As the inspectors for water quality monitoring are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### **3) Pelaporan hasil Pemantauan Lingkungan Hidup**

Report on the result of water quality monitoring will be submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.



### **2.3.4.3. Decreasing Income Level**

#### **A. Monitored Significant Impact**

Monitored significant impact is the decreasing of income level caused by decreasing amount of fish caught due to marine environmental change.

#### **B. Source of Impact**

As the source of impact is: disposed heat waste from the cooling unit process of PLTU Indramayu 2 x 1000 MW.

#### **C. Monitored Environmental Parameter**

Monitored Environmental Parameter is :

1. Reduced amount of fish caught by the fishermen after the disposal of heat waste.
2. Change in caught fish type after the disposal of heat waste.

#### **D. Purpose of Environmental Monitoring Plan**

The purpose of monitoring is to identify the change on fishermen's level of income after the disposal of heat waste.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Data on declining level of income and caught fish will be collected through on field observation and interview with project affected residents, collected data will be processed and analyzed in descriptive manner.

##### **2) Monitoring Location**

Monitoring is conducted particularly in Sumuradem Village of Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village of Patrol Sub-District.

##### **3) Monitoring Term and Frequency**

Monitoring is conducted after the disposal of heat waste and hold during the operational period of PLTU Indramayu 2 x 1000 MW, monitoring frequency of income level hold once every 6 (six) months during operational period of PLTU Indramayu 2 x 1000 MW.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

## **2) Environmental Monitoring Inspector**

As the inspector for monitoring on changes on level of income and allocation for compensation are Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu regency.

## **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### **2.3.5. Operation of Liquid Waste and Water Treatment**

#### **2.3.5.1. Decreasing Surface Water and Sea Water Quality**

##### **A. Monitored Significant Impact**

Monitored impact is decreasing surface water and sea water quality which is particularly caused by the disposal of oily waste water, boiler water disposal (blowdown) and liquid domestic waste disposal.

##### **B. Source of Impact**

As the source of impact of decreasing surface water and sea water quality is seepage of waste water from Integrated Waste Water Treatment Installation.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameter is parameter included in liquid waste standard such as temperature, pH, COD, BOD, phenol, oil and fat.

##### **D. Purpose of Environmental Monitoring**

Purpose of environmental monitoring is to identify sea water quality in connection with the operation of PLTU Indramayu 2 x 1000 MW.

##### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Environmental monitoring is conducted by water sampling activity and laboratory analysis. Result of analysis will be compared with sea water standard based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms, while the effluent of liquid waste is based on the Decree of Minister of Environment No: Kep-51/MENLH/10/1995 on Liquid Waste Standard for



Industrial Activity.

## **2) Environmental Monitoring Location**

Environmental monitoring is conducted within project site, namely, on the Waste Water Treatment Installation outlet.

## **3) Environmental Monitoring Period**

Environmental monitoring activity will be conducted during the operational period of PLTU Indramayu 2 x 1000 MW once every 3 (three) months.

## **F. Environmental Monitoring Institution**

### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

### **2) Environmental Monitoring Inspector**

As the inspectors for this environmental monitoring are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and

## **2.3.6. Coal Storage**

### **2.3.6.1. Air Quality**

#### **A. Monitored Significant Impact**

Monitored significant impact is decreasing air quality particularly in dust,  $\text{SiO}_2$ ,  $\text{SO}_2$  and  $\text{NO}_x$  and heavy metals which is estimated to occur continuously during the operational stage of PLTU Indramayu 2 x 1000 MW.

#### **B. Source of Impact**

Source of Impact of decreasing air quality is air-borne coal ash particle from ash disposal area.

#### **C. Monitored Environmental Parameter**

Monitored environmental parameter is concentration of particulate in ambient air based on

the standard stipulated by the Government Regulation No. 41 of 1999.

#### **D. Purpose of Environmental Monitoring**

Purpose of this environmental monitoring is to identify the possibility of ambient air quality parameter change within the project site and its surrounding area and so it will not exceed the applicable standard.

#### **E. Environmental Monitoring Method**

##### **1) Data Collecting Method**

Data collecting activity is conducted with measuring the ambient air quality and compare it with the required standard (Government Regulation No.41 of 1999).

##### **2) Environmental Monitoring Location**

Planned location for environmental monitoring is including several places such as ash disposal area and its surrounding.

##### **3) Monitoring Term and Frequency**

Environmental monitoring period conducted as long as the operational term of PLTU Indramayu 2 x 1000 MW, conducted once every 3 (three) months.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity during operational stage is PT. PLN Java-Bali Grid Network Construction Main Unit.

##### **2) Environmental Monitoring Inspector**

Inspector for monitoring activity is Environmental Affairs Service Office of Indramayu regency.

##### **3) Reporting of Environmental Monitoring Result**

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

### **2.3.6.2. Decreasing Sea Water Quality**

#### **A. Monitored Significant Impact**

Estimated impact that will be occurred during the PLTU Indramayu 2 x 1000 MW operating

stage is decreasing sea water quality which is particularly caused by leach water from coal ash in ash disposal.

#### **B. Monitored Source of Impact**

As the source of impact of decreasing surface water and sea water quality is the seepage of leach water from the coal ash deposit yard.

#### **C. Monitored Environmental Parameter**

As the impact parameter is sea water standard based on the Decree of Minister of Environment No: Kep-51/MENLH/2004 on sea water standard Schedule III for marine lifeforms, while the effluent of liquid waste is based on the Decree of Minister of Environment No: Kep-51/MENLH/10/1995 on Liquid Waste Standard for Industrial Activity.

#### **D. Purpose of Environmental Monitoring Plan**

Purpose of environmental monitoring is to identify even the smallest possibility of surface water and sea water caused by the seepage of leach water from the coal ash deposit yard.

#### **E. Environmental Monitoring Method**

##### **1) Data Analysis and Collecting Method**

Data collecting method is conducted by sea water sampling and laboratory analysis. Result of laboratory analysis will be compared with existing water quality standard.

##### **2) Environmental Monitoring Location**

Environmental monitoring is conducted in Plawad and Bugel river as well as marine area near the site location of PLTU Indramayu 2 x 1000 MW project.

##### **3) Environmental Monitoring Period**

Environmental monitoring hold as long as the operational period of steam power plant and conducted once every 3 (three) months period.

#### **F. Environmental Monitoring Institution**

##### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

##### **2) Environmental Monitoring Inspector**

As the inspectors for this environmental monitoring are Environmental Affairs Service Office of Indramayu regency and Marine and Fishery Affairs Service Office of Indramayu Regency.

### 3) Reporting of Environmental Monitoring Result

Result of environmental monitoring activity will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.

#### 2.3.6.3. Surface Water and Ground Water Quality

##### A. Monitored Significant Impact

Monitored significant impact is decreasing surface water and ground water quality.

##### B. Source of Impact

The most important source of negative impact is contamination by leach water originated from coal deposit yard.

##### C. Monitored Environmental Parameter

Monitored parameter is surface water and ground water quality based on the decree of Minister of Environment No. 51 / Men LH/2004 and Government Regulation No.82 of 2001.

##### D. Purpose of Environmental Monitoring Plan

Purpose of environmental monitoring plan is :

1. To identify the surface water and ground water quality and ensure its quality to comply with the required standard.
2. To identify the success rate of environmental management implementation.

##### E. Environmental Monitoring Method

###### 1) Data Analysis and Collecting Method

Applied method is :

- On site surface water and ground water direct sampling by using water sampler and grab sampling method.
- Laboratory analysis for surface water and ground water samples including physical, chemical, and biological aspects with APA and SNI standard. The result will be compared with the decree of Minister of Environment No. 51 / Men LH/2004.
- Interview with the fishermen (nekton)

###### 2) Monitoring Location lingkungan

Monitoring Location for surface water and ground water quality:

**Table 2.4. Monitoring Location for Surface Water and Ground Water**

No.	Location Code	Location
1	A	Plawad River
2	B	Bugel River
3	C	Observation Well
4	D	Residents' Well

**3) Environmental Monitoring Period**

Environmental monitoring period for surface water and ground water will be conducted during operational stage of PLTU Indramayu 2 x 1000 MW with monitoring period once every 3 (three) months.

**F. Environmental Monitoring Institution****1) Environmental Monitoring Executor**

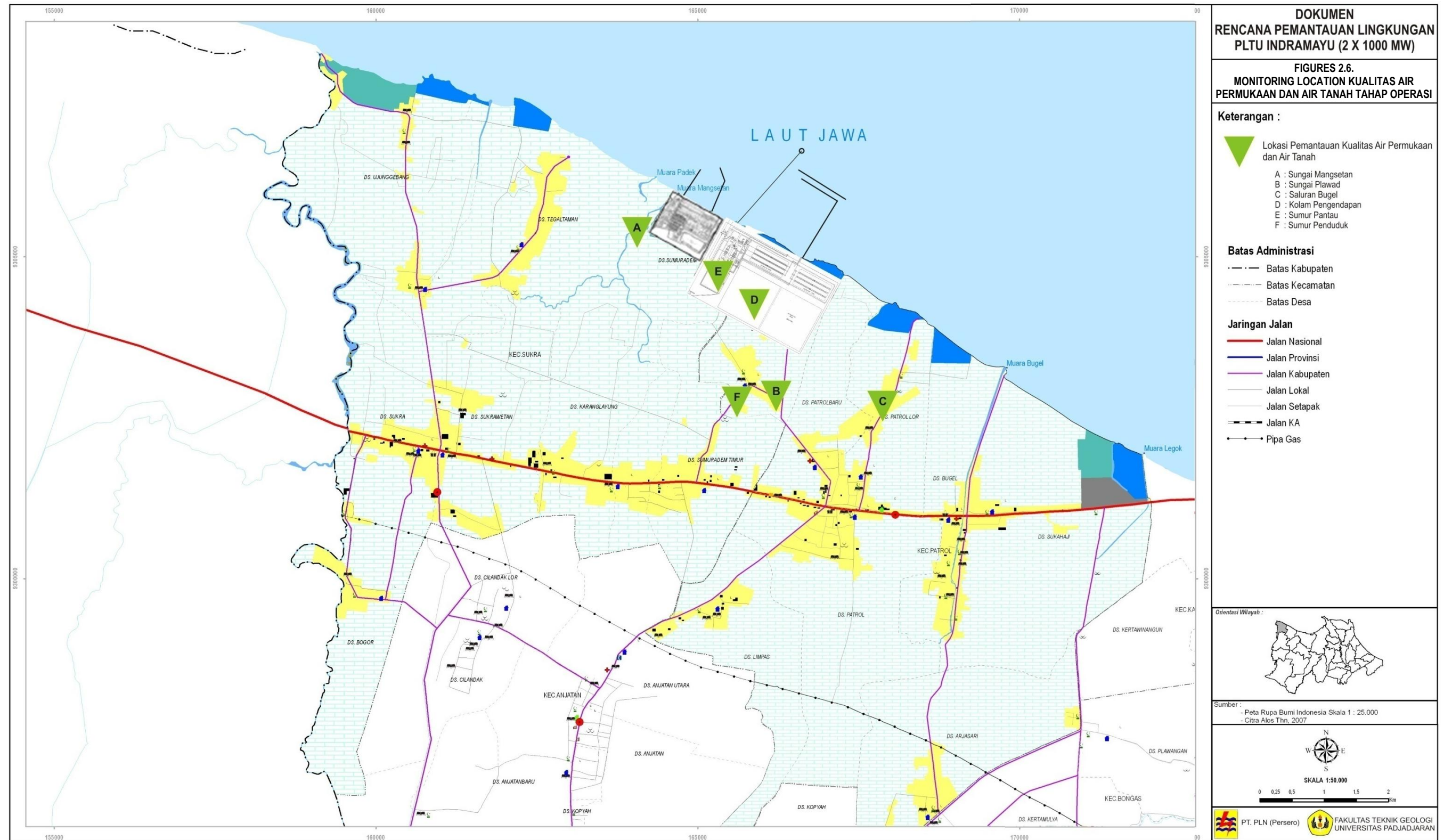
Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

**2) Environmental Monitoring Inspector**

Inspectors for surface water and ground water quality monitoring are Environmental Affairs Service Office of Indramayu regency and Health Office of Indramayu Regency.

**3) Reporting of Environmental Monitoring Result**

Surface water and ground water quality monitoring result will be reported to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and Energy Utilisation of Ministry of Energy and Mineral Resources.



#### **2.3.6.4. Gangguan Terhadap Flora dan Fauna**

##### **A. Monitored Significant Impact**

Estimated impact that will be occurred during operational stage of Steam Power Plant unit is disturbance on flora and fauna due to ash/dust originated from coal ash deposit yard.

##### **B. Source of Impact**

As the source of impact of disturbed land flora and fauna is flying ash/dust originated from coal ash deposit yard and operating Steam Power Plant.

##### **C. Monitored Environmental Parameter**

Monitored environmental parameter is the occurrence of plant problem.

##### **D. Purpose of Environmental Monitoring**

This environmental monitoring is conducted to level of pollution around the Steam Power Plant area and to identify the disturbance on flora/fauna caused by coal ash pollution.

##### **E. Environmental Monitoring Method**

###### **1) Data Analysis and Collecting Method**

Air quality monitoring conducted by observation and inventory process of biodiversity emphasized on type and number. Analysis will be based on variety and abundance index.

###### **2) Environmental Monitoring Location**

Monitoring location is around the location of PLTU Indramayu 2 x 1000 MW (Sumuradem Village Sukra Sub-District, Mekarsari Village, Patrol Lor Village, and Patrol Baru Village Patrol Sub-District).

###### **3) Monitoring Term and Frequency**

Environmental monitoring conducted once every 6 months during operational period.

##### **F. Environmental Monitoring Institution**

###### **1) Environmental Monitoring Executor**

Executor for this environmental monitoring activity is PT. PLN Java-Bali Grid Network Construction Main Unit.

###### **2) Environmental Monitoring Inspector**

Inspectors for environmental monitoring activity are Environmental Affairs Service Office of Indramayu regency and Agriculture Office of Indramayu Regency.

### **3) Reporting of Environmental Monitoring Result**

Reporting is submitted to the Regent, Environmental Affairs Service Office of Indramayu regency and Social Affairs Service Office of Indramayu Regency and Regional Agency for Environmental Management of West Java and General Directorate of Electricity and



## Matrix of Summary of Environmental Monitoring Plan of the Activities of PLTU Indramayu 2 x 1.000 MW

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
<b>2.1. Preconstruction Phase</b>										
<b>2.1.1. Land Acquisition</b>										
2.1.1.1.	Decreased Income Level	Land acquisition activities	<ul style="list-style-type: none"> <li>Amount of income levels of landowners and tenants of land after land acquisition.</li> <li>Use of the compensation money to buy land</li> </ul>	To know the rate of change in people's income and determine the amount of compensation used to buy more land or for productive purposes	Field surveys by interviewing the residents affected by the project, then the data is processed and analyzed descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, and Patrol Baru Villages Patrol District	Up to the construction phase, conducted once every 6 (six) months until the completion of the construction phase	PT. PLN UIPJJB	Environmental Office, and Social Office of Indramayu Regency	Regent of Indramayu, Environmental Office and Social Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.1.1.2.	Public unrest	Land acquisition activities	Intensity of complaints, protests and public complaints about the project	<ul style="list-style-type: none"> <li>To know the public unrest.</li> <li>To assess the effectiveness / success of the implementation of environmental management.</li> </ul>	Field surveys by interviewing the residents affected by the project, then the data is processed and analyzed quantitatively and descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, and Patrol Baru Villages Patrol District	During the pre-construction stage and up to the construction phase of the project, done once every three (3) months from the time of field survey up to the dissemination of land acquisition	PT PLN UIPJJB	Environmental Office of Indramayu Regency, and Social Office of Indramayu Regency, Offices of Sukra and Patrol District.	Regent of Indramayu, Environmental Office and Social Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
										Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.2. Construction Phase</b>										
<b>2.2.1. Recruitment of Workers and Personnel Mobilization</b>										
2.2.1.1	Increased Employment Opportunities	Recruitment of workers	Number and status of local workers absorbed and increased incomes in the vicinity of the project	To know the number of local workers and local workers' wages	Field observations by interview with the local community, then the data is analyzed descriptively and quantitatively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, and Patrol Baru Villages Patrol District	During the construction phase, monitoring conducted once every 6 (six) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency. Office of Manpower and Transmigration of Indramayu Regency, Offices of Sukra & Patrol District	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.1.2	Increased Income Level	Existence of workers in the project area that require a wide range of services, giving rise to economic activities	<ul style="list-style-type: none"> <li>Increased income of residents around the project.</li> <li>Growing fields of economic activity in the project area.</li> </ul>	To know the citizen's income level, type of business activity and number of people absorbed in the business activities in the local area	Field observations by interview with the local community, then the data is analyzed descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, and Patrol Baru Villages Patrol District	During the construction phase, monitoring conducted once every 6 (six) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency. Office of Manpower and Transmigration of Indramayu	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
										(The Ministry of Energy and Mineral Resources)
2.2.1.3	Public unrest	Non-absorption of the local population in the construction activities of PLTU Indramayu 2 x 1,000 MW	Sense of discontent and jealousy of the local population to the number of labor migrants absorbed in the project activities	To know the level of dissatisfaction of the local community	Field survey by interview, then the data is analyzed descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor, and Patrol Baru Villages Patrol District	During the construction phase, monitoring conducted once every 6 (six) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency. Office of Manpower and Transmigration of Indramayu Regency, Offices of Sukra & Patrol District	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.2.2. Mobilization of Equipment and Materials</b>										
2.2.2.1.	Decreased air quality	Activities of mobilization of equipment and materials	Parameters of air quality in accordance with the Emissions standard under Decree of the Ministry of Environment No. Kep-13 / MENLH / 3/1995, the Government Regulation No. 41 of 1999	To know the ambient air quality and emissions	To measure the ambient air quality, then compare it with the required quality standard	In the lane used for the transport of equipment and materials	To be done before the mobilization of equipment and material and thereafter every six months during the construction phase	PT. PLN UIPJJB	Environmental Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
										Resources)
2.2.2.2	Disruption to Transportation	Increased frequency of traffic and risk of accidents due to the mobilization of equipment / material	Increased congestion intensity and frequency of traffic accidents and damage to roads	To determine the level of congestion, traffic accidents and road damage	Field observations of road damage and traffic counting	Performed on the entrance of PLTU Indramayu 2 x 1,000 MW and Pantura	Before the mobilization of equipment and materials, once every six months during the construction phase	PT PLN UIPJJB	Environmental Office of Indramayu Regency and Transportation Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.2.3.	Decreased Public Health	Ash / dust fly derived from the mobilization of equipment and material	Health complaints caused by dust and vehicle exhaust	To determine changes in disease due to the mobilization of equipment and material	Data collection on cases of disease from Sukra and Patrol Public Health Centers and analysis of trends in disease patterns	Implemented in health centers in the study area (Patrol and Sukra Health Centers)	During the mobilization of equipment and materials, conducted once every three months	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Health Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.3. Land Preparation										

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
2.2.3.1.	Increased Noise	Operational activities of equipment for land preparation	. Level of noise due to land preparation	To determine the quality of the environment	To measure the level of noise, then compare it with the quality standard required	At the project site, and in the area around Sumuradem village Sukra District, Patro Lor Village, Patro Baru Village, Mekarsari Village Patrol District	Carried out at least during the land preparation activities namely before the activity starts, and conducted once every three months 3 (three)	PT. PLN UIPJJB	Environmental Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.3.2.	Seawater quality	Land preparation activities with piling up	Increased TSS, TDS and turbidity of seawater	To determine the level of pollution of sea water from the land preparation activities	<ul style="list-style-type: none"> <li>Sampling of sea water analyzed in the laboratory and compared to the standard quality. parameters of pH and temperature measurement directly in the field</li> <li>Sampling of water quality taken by stratification</li> <li>Aquatic biota (benthos) is sampled from the sea and analyzed. Then its value of diversity is</li> </ul>	In water bodies in and around the location of land preparation	Performed at the time of land preparation activities with 6 month monitoring period	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
					calculated					
2.2.3.3.	Change of land allocation	Construction of PLTU Indramayu 2 x 1000 MW and its facilities and infrastructure	Changes in land use and development of the area around the location of PLTU Indramayu 2 x 1000 MW	To know the changes and development of land use around PLTU Indramayu 2 x 1000 MW in accordance with the Spatial Plan	Direct observation in the field and collecting secondary data to be analyzed descriptively	At the project site and its surroundings and in Mekarsari, Patrol Lor, Patrol Baru Villages Patrol District and Sumuradem Village Sukra District	Since the construction phase to operations. Conducted once a year	PT PLN UIPJJB	Environmental Office of Indramayu Regency, Environmental Monitoring Office of Indramayu Regency and Land Agency of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.3.4.	Increased Flood	Occurrence of inundation / flood of activity increase in height (+ 2m) of the project site area of 327 hectares in the area of the project site	Increased frequency of flooding due to rain and sea tide	To know the frequency of floods	Direct observations in the field and collecting secondary data to be analyzed descriptively	At the project site and its surroundings and in Mekarsari, Patrol Lor, Patrol Baru, Patrol District and Sumuradem Village, Sukra District	Performed at the construction stage and performed once a year during the rainy season	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Water Resources and Mining of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.3.5.	Disruption to land traffic flow	Increased traffic flow and road	Increased volume of traffic and damage to	To know the increased volume	By observations field and	Performed on the entrance	During the land preparation	PT. PLN UIPJJB	Environmental Office of Indramayu	Regent of Indramayu,

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
		damage as a result of transportation of piled up soil	road network	of traffic and level of damage to roads caused by the transportation of piled up materials	traffic counting	towards the power plant, and Jalur Pantura (province) Indramayu - Jakarta	activities up to the monitoring period of 6 (six) months		Regency and Transportation Office of Indramayu Regency	Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.2.4. Construction of Facilities and Infrastructures (Jetty)</b>										
2.2.4.1.	Seawater quality	Construction of main buildings such as jetty	Increased TSS, TDS and turbidity of seawater	To know the level of pollution of sea water	<ul style="list-style-type: none"> <li>Sampling of sea water, analyzed in the laboratory and compared to the standard quality. parameters of pH and temperature measurement are done directly in the field</li> <li>Sampling of water quality is taken by stratification</li> <li>Aquatic biota (benthos) is sampled from the sea and analyzed. Then its value of diversity is</li> </ul>	at the jetty construction site	Since the construction of the jetty with a 6-month monitoring period	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
					calculated					
2.2.4.2.	Disruption to Fishermen Transportation	Jetty construction activities	Additional time and costs needed by fishermen due to increasingly further area that must be taken	To know the interference level of construction of infrastructure, especially the construction of Jetty on the mobility of fishermen	Collection of disruption data on fishing business, conducted by field survey and interview with fishermen, analyzed descriptively	Patrol Lor District in which some of its people work as fishermen around the Jetty	From the construction until the operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.2.4.3.	Increased type and number of Flora and Fauna	Planting of plants in open green space	Composition of species, number of species and populations of plants planted, as well as the condition	To know the diversity of species, species composition and growth	Observation and inventory of species diversity and number, Analysis of the indices of diversity and abundance.	At the site activities and its surroundings / RTH PLTU Indramayu.	Since the construction phase to the operation phase with a period of once every 6 months.	PT PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Agriculture and Breeding of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.2.4.4.	Increased income level	Accumulation of workers in project	Income level of the residents after the	To know the increased revenue	Field survey with interview and field	Sumuradem Village Sukra	Since the start of activities of	PT PLN UIPJJB	Environmental Office of Indramayu	Regent of Indramayu,



No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
		construction site of PLTU 2 x 1000 MW	ongoing activities of construction of PLTU Indramayu 2 x 1000 MW. ▪ Types of businesses that thrive in the vicinity of PLTU Indramayu 2 x 1000 MW	and business types developed by the community with the presence of PLTU Indramayu 2 x 1000 MW	observations techniques of the population, then the data is processed and analyzed descriptively	District, Mekarsari Village, Patrol Lor, and Patrol Baru, Patrol District	PLTU Indramayu 2x1000 MW up to the construction phase. monitoring once before the construction activities, and performed every 6 (six) months.		Regency and Economic and Social Office of Indramayu Regency	Environmental Office of Indramayu Regency, Social Office of Indramayu Regency the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.2.4.5.	Disruption to fishermen	Jetty construction activities	Disruption to fishermen business in catching fish	To know the level of disturbance of construction of facilities and infrastructure	Field survey and interview to fishermen, then the data is analyzed descriptively	Patrol Lor District in which some of its people work as fishermen around the Jetty	From the construction until the operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.3. Operation Phase</b>										
<b>2.3.1. Recruitment of Workers</b>										
2.3.1.1.	Increased employment	Labor requirements for the operational activities of PLTU	Number and working status of local labor recruited in the project	To know the amount of recruitment and	Interview with the communities around the project,	Sumuradem Village Sukra District,	Since recruitment in the operational phase of the	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, Office of	Regent of Indramayu, Environmental Office of Indramayu

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
	opportunity	Indramayu 2 x 1000 MW	activities as well as the increased income of residents around the project	the value of the wages earned by local workers	management of PLTU Indramayu 2 x 1000 MW, and the Local Government Local, and the result is analyzed descriptively and quantitatively	Mekarsari Village, Patrol Lor, and Patrol Baru, Patrol District	project with the frequency of monitoring once every 6 months		Manpower and Transmigration of Indramayu Regency, Office of Sukra and Patrol Districts.	Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.1.2.	Increased income level	Presence of workers in the project area, causing economic activity used by communities around the project	<ul style="list-style-type: none"> <li>Increased income of residents around the project.</li> <li>Expanding fields of economic activity used by residents in the project area and the surrounding</li> </ul>	To know the economic increase of the society, types of business activities and number of people absorbed in business activities in the local area	Field survey with interview techniques to the local community, then the data is analyzed descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District	since recruitment and during the operational phase with the frequency of monitoring once every conducted 6 (six) months	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Economic Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.3.1.1.	Public unrest	Non recruitment of local people in the power plant construction activities	Discontent and jealousy of the local population to the number of migrant labors absorbed in the project activities.	<ul style="list-style-type: none"> <li>To know the protest of public discontent.</li> <li>To assess the effectiveness / success of the implementation of environmental</li> </ul>	Field survey with interview techniques, involving the local community, then the data is analyzed descriptively	Sumuradem Village Sukra District, Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District	Conducted once every three (3) months during the operation	PT PLN UIPJJB	Environmental Office of Indramayu Regency. Office of Manpower and Transmigration of Indramayu Regency, Offices of Sukra & Patrol District.	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
				management.						Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
<b>2.3.2. Loading and Unloading of Coal Fuel</b>										
2.3.2.1	Decreased Sea Water Quality	Activities of coal loading and unloading	Increased turbidity and chemical parameters	To know the pollution of sea water	Sea water sampling, and measurement of physical and chemical parameters and biota in the laboratory compared to the quality of sea water quality standard	At the location of the jetty	Operational phase of generating units, each period of once every 3 (three) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.2.2.	Disruption to fishermen	Damage to fishing gear, barriers of smooth traffic and risk of collision with freighter	Damage to fishing gear, traffic gridlock and collision with freighter	To know the levels of disturbances, damage and accidents suffered by fishermen as a result of coal transportation	Field survey and interview techniques to fishermen, then the data is analyzed descriptively	Patrol Lor District in which some of its people work as fishermen around the Jetty	During the operation, since the coal transportation until the end of the operations	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
										of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.3.2.3.	Disruption due to Abrasion	Jetty building and operations	Coastal abrasion	To know the coastal abrasion event	Measurement and mapping	project site and surrounding	During the operation of PLTU Indramayu 2 x 1000 MW	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.3.3. Plant Operation</b>										
2.3.3.1	Decline in air quality	Operation activities of PLTU Indramayu 2 x 1000 MW during the coal combustion process	Parameters of air quality in accordance with the emission quality standard under Decree of the Ministry of Environment No. Kep-13 / MENLH / 3/1995, Government Regulation No. 41 of 1999	To know the ambient air quality and emissions	By performing ambient air quality measurements, then comparing it with the quality standard required	In the chimney (stack) and in Sumuradem Village Sukra District, Patro Lor Village, Patro Baru, Mekarsari Village Patro District. Patro	Performed so long as PLTU Indramayu 2 x 1000 MW is in operation, the period is performed once every 3 (three) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
						Baru Patrol District				of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.3.2.	Disturbance to flora and fauna	Ash / dust coming from the chimney (stack) of the operation of PLTU Indramayu 2 x 1000 MW	Disruption to plant (chlorosis and necrosis) and decreased productivity of cultivated plants due to exposure to dust, SiO <sub>2</sub> , NO <sub>x</sub> and SO <sub>x</sub> derived from the operation of PLTU Indramayu 2 x 1000 MW	To know the degree of damage to the flora and fauna as well as a decrease in crop productivity	Observation and inventory of species diversity and number. Analysis of the diversity and abundance indices	Sumuradem Village Sukra District, Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District	Conducted once every three (3) months during the ongoing operation	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, Office of Agriculture and Breeding of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.3.3.3.	Decreased public health and the environment	Ash / dust from the combustion of coal	Health complaints caused by fly ash (SiO <sub>2</sub> )	To know the changes in disease patterns	Collection of data on cases of disease from Sukra and Patrol Health Centers and analysis of trends in disease patterns	Implemented in health centers in the study area (Patrol and Sukra Districts Health Centers)	During the operational phase of PLTU Indramayu 2 x 1000 MW, once a year	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, and Health Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
<b>2.3.4. Operation of Cooling Unit</b>										
2.3.4.1	Seawater Quality	Waste heat from the cooling system	Sea water temperature pursuant to Decree of the State Minister of Environment No Kep-51/MENLH/2004.	<ul style="list-style-type: none"> <li>To know the quality of sea water.</li> <li>To monitor the temperature of waste water from the cooling unit and the quality of wastewater of the plant. (effluent).</li> </ul>	Sampling of seawater and wastewater from the cooling system and laboratory analysis of the samples of sea water and waste water from the cooling system	Around the inlet and outlet	In the operational phase and the period is done once every 3 months	PT PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.4.2.	Disruption to marine life	Heat waste originating from the cooling system that still emits heat waste to the sea	Diversity of marine life, sea water temperature based on Decree of the State Minister of Environment No. Kep-51/MENLH/2004	<ul style="list-style-type: none"> <li>To monitor the temperature of the heat waste from the waste water cooling unit.</li> <li>To know the heat waste impact on the level of diversity of marine biota</li> </ul>	Sampling of seawater and marine life in the outlet and the surrounding areas, compared with the quality standard in Decree of the State Minister of Environment No. Kep-51 / MENLH / 2004	Around the inlet, outlet	Operational stage and performed once every 3 months	PT. PLN UIPJJB	Environmental Office of Indramayu Regency and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
2.3.4.3.	Decreased income levels	Effluent heat waste from the cooling	Amount of reduction in fish catches obtained	To know the rate of change of the	Field survey with interview	Sumuradem Village Sukra	During ongoing operations after	PT. PLN UIPJJB	Environmental Office of Indramayu	Regent of Indramayu, Environmental Office

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
		unit of PLTU Indramayu 2 x 1000 MW	after the ongoing disposal of heat waste. ▪ Changes in the type of fish catch after the ongoing disposal of heat waste	income of fishermen after the ongoing disposal of heat waste	techniques to the population affected by the project, then the data is processed and analyzed descriptively	District, Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District	heat waste disposal, with the frequency of the monitoring carried out once every 6 months during the operational period		Regency and Social Office of Indramayu Regency	of Indramayu Regency, Social Office of Indramayu Regency Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.3.5. PLTU Unit Operation</b>										
2.3.5.1	Decreased Surface Water and sea water quality	Parameters within the quality standard of liquid waste (temperature, pH, COD, BOD, phenol, oil and greaset)	Seawater quality due to the operation of PLTU Indramayu 2 x 1.000 MW.	To know the quality of sea water due to the operation of PLTU Indramayu 2 x 1000 MW	Water sampling and laboratory analysis and analysis by comparing the sea water quality standards and effluen standards	Project site location namely the WWTP outlet	During the operational period of PLTU Indramayu 2 x 1000 MW with a period of once every 3 (three) months	PT. PLN UIPJJB	Environmental Office of Indramayu Regency, and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources)
<b>2.3.6. Coal Storage</b>										
2.3.6.1.	Air quality	Particulate of coal ash in the ash disposal area carried by wind	Particulate concentrations in the ambient air in accordance with the standards PPRI No. 41	To know the possibility of changing parameters of the ambient air quality	Taking measurements of ambient air quality to be compared with the quality	Ash disposal area and the surrounding	During the operational period of PLTU Indramayu 2 x 1000 MW with a period of once	PT PLN UIPJJB	Environmental Office of Indramayu Regency.	Regent of Indramayu, Environmental Office of Indramayu Regency, the

No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
			of 1999	in the project site and its surroundings in order not to exceed the provisions of the applicable standard	standard required		every 3 (three) months			Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.6.2.	Decreased seawater quality	Influx of leachate derived from coal ash storage	Seawater quality standard refers to Decree of the State Minister of Environment No. Kep-51 / MENLH / 2004 while wastewater effluent refers to Decree of the State Minister of Environment No. Kep-51 / MENLH / 10/1995	To know the slightest possibility of contamination of surface water and sea water due to ingress of water leachate derived from coal ash storage	Seawater sampling and laboratory analysis. After that, the results of laboratory tests are compared with the water quality standards	Plawad and Bugel Rivers, sea waters near the site of PLTU Indramayu 2 x 1.000 MW	During the operational period of PLTU Indramayu 2 x 1000 MW with a period of once every 3 (three) months	PT. PLN UIPJJB	Environmental Office of Indramayu Regency , and Office of Fishery and Marine of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.6.3	Surface water and ground water quality	Pollution by leachate derived from coal ash storage	Surface water and ground water quality refers to Decree of the State Minister of Environment No. 51 / Men LH/2004 dan PPRI No.82 tahun 2001	<ul style="list-style-type: none"> <li>To know the quality of surface water and groundwater to conform to the quality standards required.</li> <li>To know the successful implementation of</li> </ul>	<ul style="list-style-type: none"> <li>Sampling of surface water and ground water directly in the field using the water sampler with grab sampling method.</li> <li>Laboratory analysis of samples of surface water and groundwater</li> </ul>	Plawad and Bugel Rivers, monitoring wells and wells of the people	During the operational period of PLTU Indramayu 2 x 1000 MW with a period of once every 3 (three) months	PT PLN UIPJJB	Environmental Office of Indramayu Regency, and Health Office of Indramayu Regency.	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General



No	Significant Impact Monitored	Significant Impact Sources	Parameter Monitored	Monitoring Objectives	Monitoring Methods			Monitoring Agency		
					Collection Method and Data Analysis	Location	Time and Period	Executive Agency	Supervising Agency	Reporting Agency
1	2	3	4	5	6	7	8	9	10	11
				environmental management	covering the physical, chemical and biological aspects with APA standards and SNI compared with Decree of the Minister of Environment No.51 / MENLH / 2004 ▪ Interviews with fishermen (nekton)					of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).
2.3.6.4	Disruption to flora and fauna	Disruption to terrestrial flora and fauna is the disruption of terrestrial flora and fauna due to the ash / dust fly ash derived from coal storage and operation of plant	Growth disturbances	To know the occurrence of pollution levels in the plant environment and to determine the occurrence of disturbance to flora / fauna due to coal ash contamination	Observation and inventory of species diversity and number	At the location of PLTU Indramayu 2 x 1000 MW (Sumuradem Village Sukra District, Mekarsari, Patrol Lor and Patrol Baru Villages, Patrol District)	every 6 months during the period of operation	PT PLN UIPJJB	Environmental Office of Indramayu Regency	Regent of Indramayu, Environmental Office of Indramayu Regency, the Environmental Management Agency of West Java Province, and Directorate General of Electricity and Energy Utilization (The Ministry of Energy and Mineral Resources).

## BIBLIOGRAPHY

- Anonymous, 1976. Quality Criteria for Water Environmental Protection Agency. U.S. Department of Commerce National Technical Information Service, Washington D.C.
- Bockris, J.O.M., 1977. Environmental Chemistry, Plenum Press, N.Y. and London.
- Canter, L.W., 1977. Environmental Impact Assessment. McGraw-Hill Book Company, New York.
- [CERC] Coastal Engineering Research Center, 1984. Shore Protection Manual Volume I, Fourth Edition. Washington: U.S. Army Coastal Engineering Research Center.
- Djajadiningrat, Surna T and Harry Harsono Amir, 1991. Penilaian Secara Cepat Sumber-sumber Pencemaran Air, Tanah dan Udara (*Quick Assessment on The Source of Water, Soil and Air Pollution*). Gadjah Mada University Press.
- Djajadiningrat, Surna T. Ed, 1990. Kualitas Lingkungan di Indonesia 1990 (*Indonesian Environmental Quality in 1990*). Kantor Menteri Negara Kependudukan dan Lingkungan Hidup (*Office of The Minister of Population and Environment*).
- Elliot, J.M., 1971. Some Method for The Statistical Analysis of Sample of Benthic Invertebrate, Scientific Publication: 148p.
- Fandeli, Chafid, 2000. Analisis Mengenai Dampak Lingkungan dan Pemaparannya dalam Pembangunan. Cetakan Revisi (*Analysis on Environmental Impact and Its Explanation in Development. Revised Edition*), Liberty. Jogjakarta.
- Hadi, Soedharto P., 2002. Aspek Sosial EMDAL: Sejarah, Teori dan Metode. Cetakan 2, (*Social Aspect of Environmental Impact Assessment: History, Theory and Method. 2<sup>nd</sup> Edition*) Gadjah Mada University Press. Jogjakarta.
- Horikawa, K., 1988. Nearshore Dynamics and Coastal Processes. University of Tokyo Press, Japan.
- Koentjaraningrat, 1989. Metode-metode Penelitian Masyarakat. (*Methods for Community Research*) Gramedia, Jakarta.
- Leopold, L.B., F.E. Clarke, B.B. Kinslow and J.R. Burslem, 1971. A Procedure for Evaluating Environmental Impacts. US Geological Survey, Washington D.C.
- Mahida, U.N., 1992. Pencemaran Air dan Pemanfaatan Limbah Industri. (*Water Pollution and Industrial Waste Utilization*) Rajawali Press, Jakarta.
- Munn, R.E., 1979. Environmental Impact Assessment: Principles and Procedures. John Wiley and Sons, New York.
- Newell, G.E. and R.C. Newell, 1963. Marine Plankton, A Practical Guide, 2<sup>nd</sup> Edition. Hutchinson Educational, Ltd. London.
- Nybakken, J.W., 1992. Biologi Laut: Suatu Pendekatan Ekologis. (*Marine Biology : an Ecological Approach*) PT Gramedia, Jakarta.
- Odum, E.P., 1971. Fundamental Ecology. 3<sup>rd</sup> Edition. Toppan Company Ltd. Tokyo.
- Row, J.B. and D.C. Wooten, 1980. Environmental Impact Analysis Handbook.
- Said, Nusa Idaman, 1999. Kesehatan Masyarakat dan Teknologi Peningkatan Kualitas Air. (*Community Health and Technology of Water Quality Improvement, Directorate of Environmental Technology of BBPT*), Jakarta.
- Sasongko, D.P., Agus H., Nasio A.H., and Agus S., 2000. Kebisingan Lingkungan. (*Environmental*

- Noise) Badan Penerbit Universitas Diponegoro, Semarang.
- Soeratno, Gunawan, 1990. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) Gadjah Mada University Press. Jogjakarta.
- Soemarwoto, Otto, 1991. Analisis Mengenai Dampak Lingkungan. (*Analysis on Environmental Impact*) GadjahMada University Press. Jogjakarta.
- Tjitrosoepomo, G., 1996. Morfologi Tumbuhan. (*PlantMorphology*) Gadjah Mada University Press. Jogjakarta.
- U.S. Army Corps of Engineers, 1984. Shore Protection Manual. Coastal Engineering Research Center, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Estimation of Nearshore Waves. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2002. Water Wave Mechanics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Coastal Sediment Properties. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Longshore Sediment Transport. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- U.S. Army Corps of Engineers, 2003. Surf Zone Hydrodynamics. Engineers and Design. Coastal Engineering Manual, Washington D.C.
- Zen, M.T., 1982. Menuju Kelestarian Lingkungan. (*Towards Environmental Sustainability*) Yayasan Obor Indonesia dan Institut Teknologi Bandung. PT Gramedia, Jakarta.