UNIT INDUK PEMBANGUNAN
JAWA BAGIAN TENGAH I

P L N

ENVIRONMENTAL AND SOCIAL BASELINE REPORT

UPPER CISOKAN PUMPED STORAGE (UCPS)
HYDROPOWER PROJECT 1040 MW

UNIVERSITAS PADJADJARAN (UNPAD)

FAKULTAS TEKNOLOGI INDUSTRI PERTANIAN

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Chapter I. Introduction

1.1 Background

The construction of power plant installations is an inseparable part of the overall development. This is because the demand for electricity is in line with the increased activity and quality of the people's welfare.

One of the ways to supply electricity is by adding generators. To increase electricity supply in the Java-Bali electricity system, PT PLN (Persero) plans to add renewable power plants, one of which is the planning of the construction of the 1040 MW Upper Cisokan Pumped Storage Hydroelectric Power Plant. The location of the hydropower plant is in the areas of West Bandung District and Cianjur District with an area of around 720 Ha including the construction of dams, transmission lines, power plants, access roads, mines, and other additional activities.

The existence of this plant is expected to be an additional energy supply for peak loads with lower production costs and is environmentally friendly. This project uses funding from the World Bank, so the requirements require the preparation of ESIA and ESMP studies.

In 2009, PLN completed completion of the ESIA and EMP. Besides, the UCPS hydropower plant also has an environmental permit and AMDAL, RKL and RPL by statutory provisions in Indonesia. The ESIA and EMP report must be further updated in the form of an updated ESIA, ESMP and SCMP Report to reflect the impact assessment to date, taking into account: i) changes to the project design (if any); ii) current environmental and social conditions; iii) World Bank Environmental and Social Framework (ESF) requirements.

1.2 Goals

Consultancy Services Baseline Report Review and Update Study of the ESIA, ESMP, SCMP PLTA Upper Cisokan Pumped Storage 1040 aims to identify baseline data on the latest environmental and social conditions in the project affected area within UCPS and transmission line areas.

1.3 Scope of Work

The scope of the baseline report is as follows :

1. Reviewing ESIA and ESMP documents including the implementation of RKL-RPL, BMP documents and reports as well as project-related documents such as bidding documents and related contractor documents;
2. Conducting environmental and social surveys of important environmental components in the area affected by the project;
3. Conduct interviews and consultations with key stakeholders such as PLN, contractors, affected communities, experts and other parts of the project organization to obtain relevant information regarding the status of the project;
4. Presenting in the form of Indonesian and English version of the Baseline Report;

Chapter II. Project Description

2.1 Introduction

The Upper Cisokan Pumped Storage (UCPS) hydropower project is a hydroelectric power plant that has a maximum generating capacity of 4 x 260 MW and a maximum pumping capacity of 4 x 275 MW. The Cisokan UCPS hydropower plant will be built on the Cisokan River, a tributary of the Citarum River. Location The project is located in West Java Province, about 180 km southeast of Jakarta.

The Upper Cisokan area was identified as a suitable area to be used as a Pumped Storage Hydroelectric Power Plant in 1985. Following a feasibility study in 1993-1995 and an analysis of impacts and the environment in 1998, Indonesia's economy was affected by the wider Asian economic crisis. The level of electricity demand stopped and the project was not continued. In 2007, a detailed design was carried out, an updated environmental impact assessment was submitted to the local government and an ANDAL environmental approval was approved for the Upper Cisokan Pumped Storage Hydroelectric Power Plant.

The Cisokan UCPS hydropower project has two dams. A 75.5 m high dam will be built across the Cirumamis River, a tributary of the Cisokan River, while a 98.0 m high dam will be built across the Cisokan River itself. The upper and lower reservoirs each have an active capacity of 10 million m3.

The turbine/generator release capacity is 432 m3/s. At maximum capacity, the generator duration is 6.5 hours and the pumping duration is 8.25 hours. Water will be released through turbines from the upper reservoir to the lower reservoir, to produce electricity during peak hours. Water stored from the lower reservoir will be pumped back to the upper reservoir during peak hours, using energy supply from the baseload power plant. By doing this, the proposed project can provide maximum power demand from 1,100 MW to 1,040 MW with more than 2,000 MW ranges that can be adjusted to the Java-Bali power system to be connected by a 500 kV transmission line.

This chapter presents details of the design, general layout and key components, construction design, as well as details on how the hydropower plant will be operated.

2.2 Location, Accessibility, Layout

The Upper Cisokan Pumped Storage (UCSP) Hydroelectric Power Plant Project is located in two districts namely West Bandung District and Cianjur District, West Java Province. Located between 107°.11'.00 "-107 °.29'.00" East and 6°.55'.00 "- 7°.00'.00" LS. Saguling Hydropower Station is ±30 Km to the North. UCPS Cisokan is equipped with 2 dams namely Upper dam located in West Bandung District and Lower dam located in Cianjur District and West Bandung District. Upper Cisokan Hydroelectric Power Plant is located near the Saguling Hydroelectric Power Plant and Cirata Hydroelectric Power Plant. The Saguling Hydroelectric Power Plant is ±15 km to the east of the Upper Cisokan Hydroelectric Power Plant, while Cirata Hydroelectric Power Plant is ±30 km to the North.

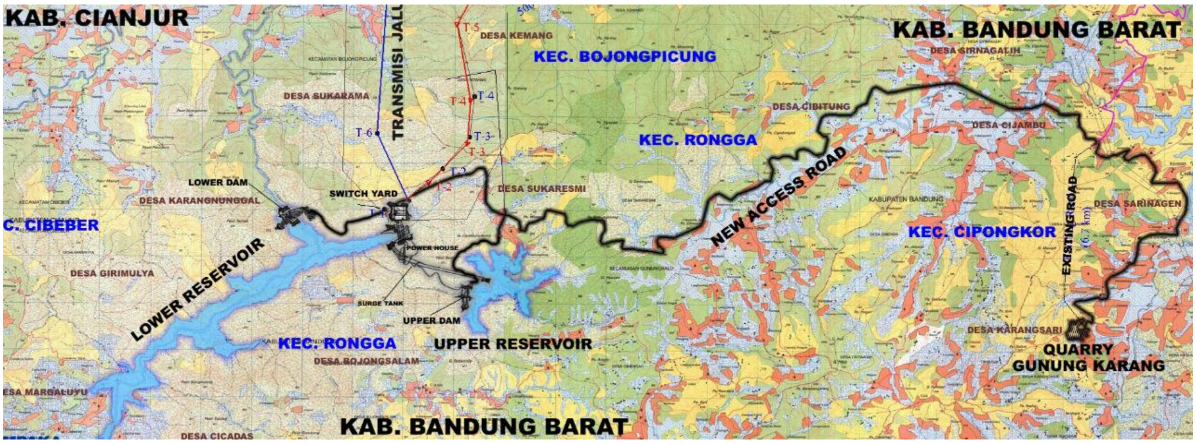


Figure 1. UCPS Project Location

Access to the Cisokan UCPS project location can be achieved in two directions, namely:

1) Location of the Upper Dam

a. Bandung-Cimareme (City of Cimahi) ±20 Km, asphalt road can be passed by 4-wheeled vehicles.
b. Cimareme-Gunung Halu ±35 Km, asphalt road can be passed by 4-wheeled vehicles.
c. Gunung Halu-Bojong Salam Village ±7 km of paved road and ±5 km of rocky road, can be passed by 4-wheeled vehicles.
d. Bojong Salam Village-Project location ±4 km via the footpath.
e. Cipari junction-via the access road to the project site ±20 km

2) Location of the Lower Dam

a. Cianjur-Cibeber ±20 km, asphalt road can be passed by 4-wheeled vehicles.
b. Cibeber-Cibaregbeg ±10 km, asphalt road can be passed by 4-wheeled vehicles.
c. Cibaregbeg-Cibule ±5 km, rocky dirt road, can be passed by 4-wheeled vehicles.
d. Cibule-Project location ±3 km to 6 km, footpath to Cisokan.
e. Cipari junction-via the access road to the project site ±27 km

Or it can also be reached through the following channels:

a. Cianjur-Ciranjang ±20 km, through asphalt road can be passed by 4-wheeled vehicles.
b. Ciranjang-Jati ±7.5 km, the asphalt road is poorly maintained and in damaged condition, can be passed by 4-wheeled vehicles.
c. Jati Sukarama ±6 km, t asphalt road repaired by the District Government. Cianjur, can be passed by 4-wheeled vehicles.
d. Sukarama-Kampung Cisero ±5 km, a rocky road with a width of a small road, easier when using a 2-wheeled vehicle.
e. Cisero-Project location ±4 km, footpath along the Cisokan River.
f. Ciparu junction-via road access to the project site, can be passed by large vehicles

The project will include the construction of a dam and upper reservoir, a reservoir and lower dam, surge tanks, penstock and tailrace tunnels, underground powerhouses, tailraces, underground power plants, switchyards, access roads, administrative buildings and transmission lines. A Quarry owned by PLN will be used as a source of rock and basic materials, while excavated waste materials from tunnels and powerhouses will be stored and stabilized in the project area. The layout of the project construction building location is shown in the figure below.

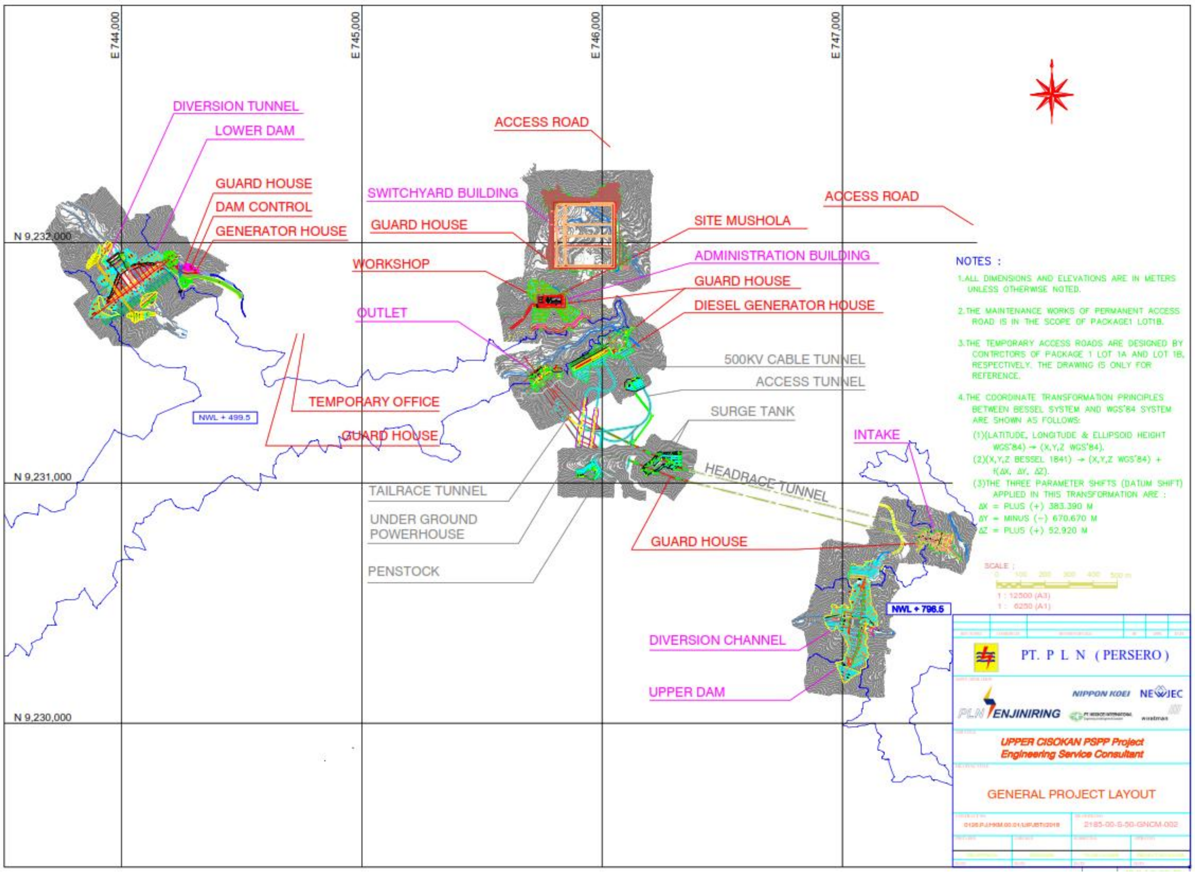


Figure 2. Construction site on the Upper Cisokan Hydroelectric Power Plant

2.3 Design, Size, and Capacity

2.3.1 Main Design Features of Hydropower

The Main Features to be built in the Upper Cisokan Hydroelectric Power Plant project is a 75.5 m high dam built on the Cirumamis River, with a watershed of 10.5 km2 and the surface area of the reservoir when the maximum high-water level is 0.8 km2. Operational advance fluctuations between the highest and lowest water levels are 19 m. The upper dam body will be built from concrete compacted with Concrete Gravity (RRC) type.

The 98.0 m high down/down dam will be built on the Cisokan River, with a watershed of 374.0 km2 and reservoir surface area when the highest water level is 2.6 km2. The difference in water level at the time of operation between the highest water level and the lowest water level is 4.5m. The dam body will be built from concrete which is compacted with Concrete Gravity (RRC) type.

The power plant has a capacity of 1,040 MW (260 MW x 4 units) and a pump capacity of 1,100 MW, is placed in an underground power station. The tunnel will connect the power station with the reservoir. A switchyard and administration office will complete the hydroelectric power station. The duration of generation is 6.5 hours/ day and the pump duration at the time of maximum input is 8.5 hours/day.

Two 500 kV transmission lines connect the Upper Cisokan Hydroelectric Power Plant to the 16 km Cibinong-Saguling network and the 16 km long Tasik-Depok network. Some other buildings to be built are surge tanks, penstock and tailrace tunnels, underground powerhouses, tailrace, underground power plants, switchyards, access roads, administrative buildings and transmission lines. A coral mountain owned by PLN will be used as a source of rock and basic materials, while excavated waste materials from tunnels and powerhouses will be stored and stabilized in the project area.

During construction, the project will include temporary work areas, *penstock* storage and manufacturing areas, concrete processing areas, asphalt processing sites, barracks/basecamps and office buildings. Infrastructure such as electricity, fuel, drinking water and sanitation will be provided.

Details of the main features that will be built in the UCPS Cisokan hydropower project are shown in the table below.

Table 1 Main Features of Upper Cisokan Pumped Storage Hydroelectric Power Plant

I. Generating Data		**Score**	
Installed Power Plant Capacity - (MW)		1,040 (260 MW x 4 units)	
Average Cycle Capacity		1,030 (257.5 MW x 4 units)	
Maximum Input - Pump (MW)		1,100 (275 MW x 4 units)	
Turbine Maximum Discharge (m^3 / sec)		108 per unit	
Maximum Gross Head (m)		301,5	
Minimum Gross Head (m)		278	
Loss Head, Generation (m)		10	
Difference in water level - generator (m)		276	
Duration of Electric Power when maximum output (hours/day)		6.5	
Maximum pump duration when input (hours/day)		8.5	
II. Scale and Reservoir Hydrology		**Upper Reservoir**	**Lower Reservoir**
River		Cirumamis River	Cisokan River
Watershed upstream of the dam (km^2)		10.5	374.0
Surface area of the reservoir when the water is high (km^2)		0.8	2.6
High water level (HWL) (m)		796.5	499.5
Low water level (LWL) (m)		777.5	495.0
Effective reservoir depth (m)		19.0	4.5
Active storage (m^3)		10,000,000	10,000,000
Total volume (m^3)		14,000,000	63,000,000
Average flow of incoming water from the river (m^3/sec)		0.4	14.9
Flood design (PMF) (m^3/sec)		300	1,740
III. Major Civil Contruction			
1)	**Dam**	Upper Dam	Lower Dam
	Type	Concrete Gravity (RRC)	Concrete Gravity (RRC)
	Height (m)	75.5	98.0
	Dam peak length (m)	375	294
	Dam peak elevation (m) MASL	800.5	503.0
	Dam Body Volume (m^3)	369,00	508,000

2)	**Spillway**	Upper dam	Lower dam
	Tipe Normal Discharge capacity m3/det) Gate Type Dimensions Height x Width (m) Amount	Centre overflow 230 No Gate - -	Centre overflow 1,220 Radial gates 13.5 x 10.0 2
3)	**Intake**		
	Type Gate Amount	Side Intake Steel wheeled type gate 2	
4)	**Circular Headrace Tunnel**		
	Length (m) Inner diameter (m) Amount	Kurang lebih, 1,217 (No. 1), 1,158 (No. 2) 7.4 circular section 2	
5)	**Surge tanks**		
	Type Inner Diameter (m) Height (m) Amount	Restricted orifice type with upper chamber 15.0 78 m(No.1), 81 m(No.2) 2	
6)	**Penstock**		
	Planted *Penstocks* Steel Pipes Length (m) Inner Diameter (m) Thickness (mm) Amount	Planting steel pipe 475 ~ 529 (unit 1 = 475 m, 2 = 485 m, 3 = 517 m, 4 = 529 m 5.9 ~ 4.17 ~ 3.1 20 ~ 52 2 (ID = 5.9 m), 4 (ID = 4.17 ~ 3.1m)	
7)	**Underground Powerhouse**		
	Cave profil type Height (m) Max Width (m) Length (m)	Bullet shape 51.15 26 156.6	
8)	**Tailrace Tunnel (water channel)**		
	Length (m) Inner Diameter (m) Amount	Estimate. 268m (No. 1), 241m (No.2), 211 m (No. 3), 186 m (No.4) 5,2 m 4	
9)	**Outlet**		
	Type Gate amount	Side Outlet Steel Wheeled-type gate 4	
IV. Electro-Mechanical Equipment			
1)	**Turbine Pump**		
	Type Rated Net Head/ Min Pump Head (m) Maximum Turbine Release/ Maximum Pump Release (m3/s) Rated Out/ Turbine Shaft Output Max. Pump Input (MW) Rated Speed (rpm) amount	Vertically, one stage Francis Reversible type 276 / 296 108 / 90 269 / 275 300 4	
2)	**Generator-Motor**		

	Type Rated Generator Output (MVA) Motor Input (MW) Rated Voltage (kV) Rated Power Factor Rated Frequency (Hz) Rated Speed (rpm) Number of Units	Vertical Shaft, 3-Phase AC synchronous 300 2 18 0.9 50 300 4
3)	**Generator Transformer**	
	Type Rated Power (MVA) Rated Frequency (Hz) Rated Voltage LV Winding (kV) HV Winding (kV)	3-Phase OFWF 300 50 18 (Generator Motor Voltage) 500
4)	**Switchyard**	
	Type Rated Voltage (kV) Number of Feeders	Outdoor (AIS) Breaker and Half(1[1]) 500 8
V. Transmision Line		
1)	to Jalur Saguling – Cibinong	
	Voltase Length	500 kV 16 km
2)	to Jalur Tasik- Depok Line	
	Voltage Length	500 kV 16 km
VI. Preparation Work		
1)	**Land Aacquisition**	
	Upper Reservoir Lower Reservoir Disposal Area Access Road : a) Existing road (6.7 km) b) New road (27.4 m) Transmission lines (31 km) Base camp Resettlement Area	105 ha 356 Ha 79 Ha - - 107 ha 105 ha - 40 ha
2)	**Access Road**	
	Existing Road New road	6.7 km long, 8 m wide 27.4 km long, 8 m wide
3)	**Base Camp**	
	Area of land Area of building	10 ha 5000 m^2
4)	**Distribution Line**	
	Length of lines Voltage	35 km 20 kV

Sumber: PLNEnjiniring/Nippon Koei/Newjec Inc., 2019

2.3.2 Upper and Lower Reservoir Dam

The ability of electricity generation will be determined by the difference in height (head) between the upper and lower reservoirs, which is on average as high as 276 m. The upper dam will be placed on the Cirumamis River, approximately 200 m downstream from the river meets the Cirumamis River with the Cidongke River. The 75.5 m high dam will fill a reservoir of 14,000,000 m^3 with a surface area capacity of 80 Ha.

The lower dam will be placed on the Cisokan River, approximately 1 km is downstream from the river meeting the Cisokan River with the Cilengkong River. The location of the dam is approximately 3.5 km is downstream of the upper dam river, and the reservoir will be filled with water from the Cisokan and Cilengkong rivers. The 98 m high dam will fill a reservoir of 63,000,000 m^3 with a surface area of 260 Ha.

Both reservoirs will have 10,000,000 m^3 of active storage, which will provide a sufficient amount of water for the power plant of 1,040 MW with a maximum electricity generation time of 6.5 hours. Both reservoirs are planned to have a greenbelt around the edge of the beach with a vertical height of 5m from the water level that will be owned and managed by PLN.

Both dams will be built using the roller-compacted concrete (RCC) method. Dams have been designed according to the standards of the Japan National Committee on Large Dams (JAN-COLD). Both are designed to accommodate 1 in 10,000 years via the spillway and are designed for a seismic zone rated 4 for the area. Based on an average erosion design of 1.86 mm/km2/year, the flow of water that enters and exits from both outlets of both structures will continue to work and be clean of sediment for 50 years.

The design of the dam and reservoir locations will be shown in Appendix 1 and Appendix 2. Temporary work areas such as barracks/base camps and some concrete buildings are shown in Appendix 3.

A. Pre-Construction Work in the River

Temporary river diversion will be conducted in each dam area to deflect the river around the work area. When the dam has been built, and before water storage begins, river diversion will be stopped.

Pre-construction work on the upper dam will involve diversion of the river to install a new dam storage area then dig most of the cliffs and river banks before installing the foundation and construction of the RCC structure. A chute and underground channel will be built to carry the diverted water around the construction area and back down the river. Rock drills, *bulldozers* and *excavators* will be used to dig dry rivers and riverbank materials.

Pre-construction works for under river dams will require more preparation due to the size of the river and the remaining landslides at the dam site.

On the riverbank, there are deep deposits (more than 15m) of sand and boulders, at least as big as 6m which is the result of a recent landslide. The material has piled up from the bottom of the river and is shaped like a dam. The storage of this material is thought to cause difficulties during excavation to create a temporary dam (Cofferdam) and the dam itself. For this reason, the designers recommend to blow up large stones before installing dams.

Due to the soft material on the river bank, and due to the amount of potential current in the Cisokan River, the engineers have designed an initial temporary dam (Cofferdam) with excavated material, to then be built a cofferdam from the RCC to protect the main dam construction area. A dividing tunnel will be built to divert downstream during the construction of the lower dam. Tunnels will be drilled, not blown up, and built with concrete construction.

B. Dam Construction

Dam construction will be carried out 24 hours a day, 7 days a week during the placement of the RCC. In the RCC process the concrete must be shed and compacted continuously to minimize cooling on the joint. Transport of the RCC mixture to the dam from the concrete plant will be carried out using large trucks. RCC concrete placement can still be done during rain with an intensity of 5mm/day.

Concrete manufacturing activities with a capacity of 120m^3/day with a storage warehouse that can accommodate a load of 1,600 tons are provided to meet operational needs for 24 hours. The building will have a storage capacity of approximately 300 tons of cement and fly ash on each working day, so the warehouse has five days of storage time. Meanwhile, the power plant will be turned on by a solar generator.

60m^3/day concrete production is planned to meet the usual mix of concrete that will be used for other activities, with a 500-ton capacity cement storage building will be needed. A 6m3 concrete mixer truck will bring mortar to the location. The location of making concrete can be seen in Appendix 3.

C. Reservoir Preparation

Before inundation, the reservoir area must first be stabilized, cleared of vegetation and also cleared of potential pollution sources.

First of all, clearing of vegetation will be done by cutting down trees and other plants using a sewing machine. Small plants, agricultural products, bushes, etc. will be cleaned using heavy equipment. The community will still have access to these plants; the rest of the material will be buried and stabilized, or burned, outside the flooding area.

Sources that make water contamination (MCK channels, fuel storage, workshops, and fish ponds) will be repaired and graves will be relocated.

D. Preparation of the Green Belt Area

A reservoir has a *greenbelt* or green area management along the perimeter, approximately 5m above the highest water level, in each reservoir. This section will be revegetated to achieve three objectives: building boundaries for communities to access reservoir areas, habitat restoration and habitat control.

Restored vegetation is native species that can provide native fauna habitat, and stabilize soil to prevent erosion. Revegetation activities will start from the construction stage (to provide as long as possible for vegetation formation) and continue the program until the operational stage. A restoration plan will be implemented as part of the Biodiversity Management Plan (an additional plan of the Environmental Management Plan project).

When the reservoir is operating, access to the reservoir for any purpose will not be permitted, to avoid or minimize the number of sinking incidents or other accidents. There are no boating, freshwater aquaculture, fishing and other businesses in the reservoir or near the reservoir.

Safeguards and safeguards will be documented in the Reservoir Management Plan (an additional plan of the Environmental Management Operational Plan) and include:

- Revegetation of *greenbelt* areas with native species to overcome erosion and sediment control, and to provide forests as habitat for wild animals. The *greenbelt* area will be managed by PLN and the community will not get access to enter.
- Routine patrols carried out in the *greenbelt* and reservoir areas by security staff and evacuated communities.
- A warning alarm will be set before the power plant or pump to indicate whether the water level is rising or falling in the reservoir.
- Warning signs will be placed at a certain distance at the edge of each reservoir, and at locations around local roads and footpaths, which explain that there is no community access to the reservoir and that it is dangerous because water levels can rise without warning.
- A regular education program (started during the construction phase) to explain to local communities how the reservoir will be operated, and what security risks there are.

2.3.3 Tunnel and *Power House*

During the electricity generation process, water will be piped from the upper reservoir through connection (*inlets*), *headrace tunnels* and *penstock pipes* to turbines in underground powerhouses. From the power plant, water will be channelled through the tunnel to the *outlet* in the lower reservoir. These are collectively called '*waterways*' along with the waves in the tunnel.

Power plants and transformers will be placed underground, along with control rooms, offices, warehouses, guard posts and parking lots. Access to the powerhouse will be through the tunnel road. Two other tunnels are needed for ventilation and cable.

Waterways, underground power generation tunnels, holes for transformers and access tunnels will be excavated using a combination of blasting, drilling and excavation. Work will start from the bottom up. Excavated material will be taken from the portal to be discharged by the river in Appendix 3. To stabilize the rock, injection of cement (*grouting*), rock anchor (*rock bolt*) will be used. After the stabilization process, concrete spray (*shotcrete*) or concreting will be carried out to strengthen the tunnels and holes that are formed. *Penstock pipes* will be made of steel.

A concrete plant, with a capacity of 60m^3/day, will be placed as shown in Appendix 3 to supply concrete in *waterways* and power plant construction.

2.3.4 Cable Terminator Yard, Switchyard and Administration Building

The yard terminator cable is approximately 4,080 m^2 at the entrance of the tunnel cable. The length of the switchyard is 71,225 m^2. The administrative building above ground level will consist of the main administration building, switchyard control, dam control, workshop and garage, guardhouse, prayer room, temporary project post and housing. See Appendix 2 for construction sites and buildings.

Clearing vegetation and digging is needed in order to get a flat area for these facilities. Excavated materials and other parts of the work (such as tunnel excavation and power station) will likely be used here as fill soil.

2.3.5 Transmission Line

Two 500kV transmission lines will connect the Upper Cisokan Power Plant with the Java-Bali Grid on the Saguling-Cibinong network in the North (15.5 km and 15.9 km). The total length of the new transmission is 31.4 km, and the 'free space' corridor is 34 km wide. These towers and corridors will require approximately 100.3724 ha of land consisting of agricultural and plantation land. The path will be shown in Appendix 4 and Appendix 5. The connection location on the grid has been chosen with detailed modelling on the Java-Bali network, to maximize the efficiency of the Upper Cisokan Pumped Storage Hydroelectric Power and the limitations and also redundancy of the existing transmission network system.

A. Design

The transmission infrastructure has been designed according to codes and standards (PLN / Newjec, 2007d). The steps below have been agreed to be carried out on the 500kV transmission line

- Technical aspects; (planned transmission network length, topography, soil character);
- Minimize the length of the path;
- Avoid settlement, agriculture and consent structures; and
- Environmental aspects - such as vegetation, habitat and airflow.

82 new towers/towers will be built along the track. The ideal location for each tower has been determined through a land survey, based on topography, land use and access to the location and location of the tower will be determined through negotiations with the landowner. A location of 0.0625 ha is required for each tower.

The new network will support networks that are already on the network at each tower site in each network. There will be no more electricity infrastructure needed.

B. Construction

Work preparation to build a tower will regulate vegetation, levelling and excavation for the foundation. No new roads are needed to reach the tower, but a path will be needed through the mixed forest. All construction equipment and materials will be sent by medium-sized trucks as close to the tower area as possible. From the road to the tower area, the equipment will be sent by motorbike or manually by the worker, where the foundation and tower will be built in the area.

After the tower is built, the network will be assembled and stockpiled. The circuit will be carried out from ground level; the main cable will be used to pull the power cable from one tower to the next tower. The construction period is expected to run for 12-18 months.

2.3.6 Access and Temporary Road

Access road is the road used to transport construction materials to the UCPS Cisokan hydropower development site. The total delivered road is 33.7 km with a total of 27 km of new roads from the Cipari Intersection to the project site, 6.7 km upgrading the existing road from the Quarry towards the Cipari Intersection. In addition, there are a number of temporary narrow roads built around the project area, for access to the dam site, gates, workers' camps and bases, etc.dll.

A. Location and Design of Access Road

The existing road from the Quarry to Cipari Intersection in Cipari Village (existing road) along the 6.7 km is widened and technically strengthened, with new asphalt and traffic safety features. Meanwhile, from the intersection of Cipari Village to the location of the upper and lower dams along 27 km is a new road. The existing road and new road locations are shown in the image below.

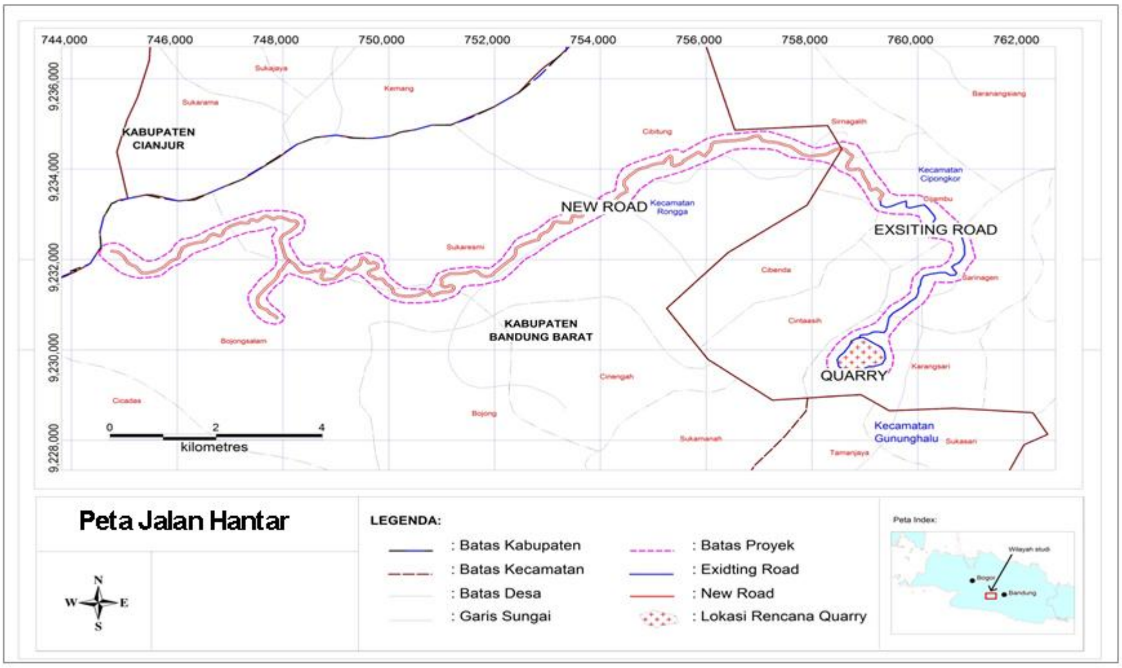


Figure 3. Map of Access Road

The width of the new road has a minimum width of parallel for security and technical needs based on the detailed technical design of the road (as large as 20 m which is a permissible slope but, in some areas, can reach 70 m where steep sloping land requires more). This path is chosen based on topography and land use, to minimize social problems and environmental disturbance as much as possible. This path passes through different dense areas and mostly avoids rice fields. Six bridge poles are built along the path and will be designed according to the standard design of roads in Indonesia.

The roads have been designed to accommodate transportation construction needs:

- Movement of civil engineering contractors
- Transport of rock staples for Dam-RCC construction and concrete manufacturing, and Movement of electrical and mechanical contractors

The existing road conditions are full of people; many buildings are a few meters from the existing road. Along the path there are three separate schools and volleyball courts owned by one school. At present, the road is used by pedestrians, motorists, car drivers and small trucks.

B. Constructions of Access Road

Construction of new roads begins with the measurement of road alignment, land acquisition, land clearing for houses, pile excavation work, road construction work, pavement work, and bridge construction work. The surrounding land along the main access road is generally hilly with a bumpy topography. For flat topographical conditions, the conditions for new road construction are the same as for existing roads. While the regions that have steep topography at an elevation between 700 m-750 m will be adjusted to the condition of the excavation or the existing pile for the area. The maximum width of the land required is up to 70 m. The construction of new haul roads uses rock bottom with a volume of around 148,000 m^3 (98,000 m^3 for sub-base and + 50,000 m^3 for base coarse).

In general, the specifications for the hauling road are as follows:

- Total planned road length: ±33.7 km
- Improvement of existing roads: 6.7 km
- New road construction: ±27 km
- Road width (new and existing) = 8 m+3 m median road (for road shoulder & water channel)
- ROW width of freed roads: 15-50 m
- Type of construction = asphalt

Until now, the construction of the new road from the Cipari intersection to the lower dam as far as 27 km has been completed. With the condition of the road has been completely filtered. In addition, landslide-prone areas beside roads have been strengthened using civil engineering. The latest road conditions are as follows.

Figure 4. Condition of Hauling Road (may, 2020)

C. Internal/Temporary Road Construction

Small roads will be built along the working area, between the access road, the place of making concrete, dams, tunnels, tunnel entrances and other working areas. Approximately 5,000 m of the road will be built towards the upper dam area, and the 16,000 m road in the upper and lower dam area, works using electric saws, bulldozers, excavators and rollers. More than 6,000 m of temporary roads will be needed during the construction of water drainage facilities. These roads are between 6 and 10 m wide and will continue from the new access road.

Blasting might be needed to access the left bank of the river from a lower dam. Except for a small portion of the road leading to the horizontal tank area, these roads will not be paved but will be repaired using a compacted excavated rock.

Chapter III. Baseline Report Assesment Methodology

3.1 Introduction

The method for preparing baselines for environmental aspects in the Cisokan UCPS project area is generally carried out by means of desk studies using data sources from study reports and measurement data carried out by PT. PLN (Persero) from 1998-2019. All data are analyzed and compiled by considering conformity or relevance of previous data to current conditions. Some data identified are still lacking, data collection will be done through library research, search from relevant agencies, and also direct measurements in the field. Stages of implementing the baseline environmental data are as follows:

1. Inventory environmental monitoring reports and study reports relating to environmental aspects that have been carried out at UCPS Cisokan. The source of the report was obtained from PT PLN (Persero), in this case through PT. PLN (Persero) the Cisokan UCPS unit and PT PLN Enjiniring.
2. Identifying environmental monitoring reports and study reports relating to environmental aspects at UCPS Cisokan to determine the availability, condition of data, and relevance of data to current conditions. The identification results are used to determine what data will be used, and which data needs to be updated. Conduct an inventory of identification data to follow up with data searching as well as to determine data sources from the relevant agencies. Some data that requires direct confirmation in the field is inventoried and then compiled in the fieldwork plan.
3. Collecting data from relevant agency sources outside of PT PLN (Persero) and conducting data collection directly in the field.
4. Data on inventory results from environmental monitoring reports, study reports, library studies, related institutions outside PT PLN (Persero) and the results of direct measurements in the field are then compiled into an environmental baseline.

3.2 Environmental Baseline Assessment

A baseline assessment is an environmental assessment based on the actual study location or can be stated as the baseline environment. The baseline environment is an environmental condition at the starting point before the activity which becomes the reference point in the ongoing policy and development analysis. The baseline condition is a portrait of both biotic and abiotic environmental conditions that build the ecosystem in the study area. Development, directly and indirectly, provides changes to the physical, abiotic and social environments. Possible changes are identified by impact analysis.

The impact of UCPS development on patterns of environmental dynamics is an important parameter in determining the impact and management efforts and mitigation of potential changes in the baseline. Identification of environmental baseline that will be the baseline of activities requires the right stages and methods in order to get the characteristics of the baseline that reflects the conditions of actual region. The initial parameters that can be analyzed to get the characteristics and determination of the baseline are the parameters determining environmental changes, namely the abiotic, biotic, and social environment. Environmental parameters used to collect the baseline that is useful for analysis include; climate, topography, landscape and relief, hydrology and environmental quality.

3.2.1 Physical Characteristics

A. Climate

Climate data is obtained from the closest station to the study area so that the location characteristics are in line with the actual climate in the study area. Climate variables used include the temperature of the region with parameters of temperature, wind direction, wind speed and rainfall.

Data sources used for climate analysis are climate data from related agencies that provide climate data, among others, the Meteorology, Climatology and Geophysics Agency (BMKG), PT PJB Cirata Reservoir Management Agency, Cirata III BPJB III, PT Indonesia Power manager of Saguling Hydroelectric Power Plant, Research and Development Center PUPR Water Resources (Pusair).

Climate and weather data sources are still tabular, in order to obtain regional climate information, climate data that are tabular in nature with a reference source are the point/location of observation, then it needs to be converted into spatial/spatial information. There are several ways to convert one-point tabular data into regional data, among others;

1. Calculation of regional average climate data using rational methods. This calculation is done by averaging the climate value at the stations in the study area.
2. Calculation of the regional climate average from tabular to spatial data can be done using the *Thiessen polygons* method. Calculation of rainfall is done by calculating the potential of the area formed by the polygon approach. The assumption underlying the use of *Thiessen Polygons* in climate analysis is that each point will contribute value to the nearest area.
3. Calculation of climate averages by making *Isohyet* maps of climate information so that a gradation of temperature or climate is obtained by modelling digital isohyets.

In the spatial analysis of village-based areas, the climate value that has been converted into spatial data is overlaid with village boundaries to obtain the climate value of each village. Climate data is very useful in agricultural cultivation.

The climatology data update is performed for monthly temperature parameters, and rainfall uses the latest trend data until 2019. Regional temperature data is obtained from temperature data of several location points and then arithmetically averaged to obtain the regional temperature at UCPS Cisokan. Rainfall data in the Cisokan UCPS region was obtained from CHRIPS *(Climate Hazard Infrared Precipitation with Station*) data, which is rainfall data that utilizes infrared waves and rain stations with a spatial resolution of 0.05^0 (per pixel) or about 5 km x 5 km to estimate rainfall values sustainable in a region. Rainfall data displayed is annual and monthly rainfall data for the last ten years (2009-2019).

Distribution of annual rainfall obtained from annual rainfall data at the rainfall gauge station then interpolated to obtain the spatial distribution pattern of rainfall characteristics using *Isohyet* method, then classification is carried out to obtain the annual rainfall distribution class.

B. Topography and Slopes

Topographic and landscape environmental baseline is very important as information about the potential of the region in general, especially in the analysis of the ability of the land to determine the index of environmental services. The topography and land boundaries of the area are the factors determining ecoregions which have specific characteristics.

Topographical and landscape characteristics affect the carrying capacity of the land, because each topography and landscape determine the ability of the land to provide natural resources.

Topographic and landscape data are obtained from the relevant agencies that provide landscape and topography maps, however, if the landscape map is not available it can be derived through a landscape or topographic determinant, that is, a land contour map from an earth map, geological information, slope and association with the position and characteristics of the drainage area.

Topographic and landscape spatial data were obtained from the results of a study conducted by PT PLN (Persero) with the correction and addition of the latest information as revised data. Topographic and landscapes are information that is not dynamic, because the dynamics of the formation of landscapes in geological periods, so it can take very long, so the data obtained from previous studies are still very relevant, but once the landscape changes very quickly if natural disasters occur in a large area, it will give a fast new formation.

Making slope maps digitally can be done with geographic information system software. Basic information used in this process is land height or contour data from the earth map. Land contour data in digital topographical maps are usually made in vector format, therefore it is necessary to convert the format to raster (*pixel-based*) format so that digital modelling can be done. Modelling altitude information using three-dimensional digital analysis is changed from elevation raster data to a three-dimensional (3D) model or *digital terrain model*. The results of the *digital terrain model* process are height distribution maps which give the impression of terrain relief with a three-dimensional impression. Determination of the slope is done by doing digital modelling through dydx filtering so that the information on the slope can be obtained by calculating the tangent formula. The slope can be in percent or degree for each pixel. Reclassification is carried out to group data that have the same slope or almost the same refers to the standard slope classification. The standard slope classification in Indonesia can use slope classification according to the Ministry of Environment and Forestry or other agencies, but in general, the division of slope classes is relatively the same. The division of land slope class is presented in Table 2.

Table 2 Slope Classification

No	Classification Class	Slope (%)
1	Flat	0-<8
2	Sloping	8-<15
3	Tilted	15-<25
4	Very Tilted	25 - =< 40
5	Steep	>40

Slope map results of the digital modelling process are obtained by changing the slope map back in raster format into a vector slope map format. In detail, the process of making slope maps is presented in Figure 5 below.

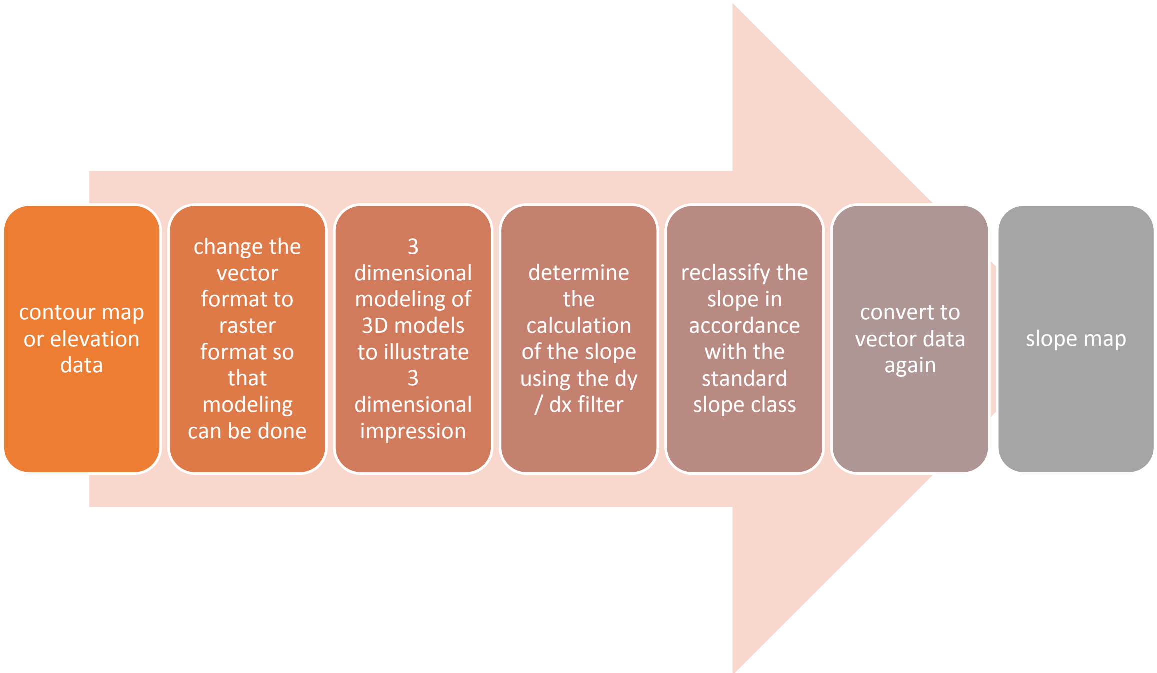


Figure 5 The Process of Making a Slope Map Using Digital Spatial Data Modeling

The digital slope map results in distribution patterns according to the data source used, accuracy depends on the data source used but has easiness in determining the characteristics of the information to be displayed as well as ease of reprocessing.

Field observations are used to test the reliability of data that has been obtained from agencies or data that is processed using digital spatial analysis. The two data being compared are data from digital processing sourced from PLN and the results of the analysis conducted using DEMNAS (*Seamless Digital Elevation Model and National Bathymetry*). The results of the comparison show that the slope map digital analysis results obtained from PLN have a form that is less appropriate to the condition actual because the possibility of the grid being used is too large and no screening is done, so the concept that real world is continuous is lacking in attention.

The results of the process of making a slope map digitally are presented in the next chapter, while a slope map from the spatial data provider agency is presented in Figure 6.

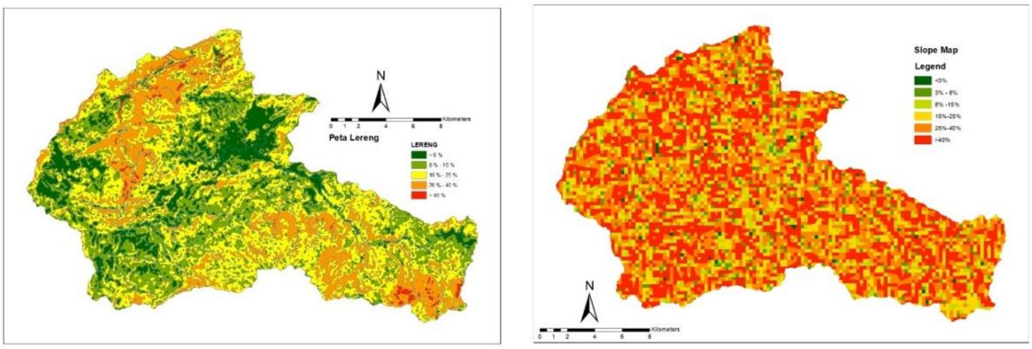


Figure 6 Cisokan Watershed Slope Map (Left: Scale 1: 25,000; Right: Analysis of Satellite Imagery)

C. Geology and Hydrogeology

Geological and hydrological data are needed in the study of impact analysis and carrying capacity, especially in determining ecoregions because geological characteristics determine the environmental characteristics of the region. The process of rock formation and the geological formations forming the study area determine the characteristics of the landscape, the land that is formed which will determine the potential capacity of the land area.

Geology and hydrogeology are parameters whose changes are not dynamic. So that the baseline geological and hydrogeological data were obtained from secondary data from the study of PT PLN (Persero) in the 2013 watershed study document and the 2019 geology review report document.

D. Soil

Soil spatial distribution information data is needed in determining the potential of land resources that can be developed in the study area. Soil characteristics provide information about, erosion, soil capability and land suitability for certain land uses. Soil information needed is soil type, soil texture and depth of soil solum.

Soil baseline data is taken from secondary data in a 2013 study watershed study report. Classification this type of soil is grouped against groups that have the same characteristics to the sensitivity of soil erosion by water and each group is given a score according to the classification of soils in Indonesia. Classification of soil types to erosion sensitivity by water adopted in Indonesia can be seen in Table 3 below.

Table 3. Classification of soil types and score values in Indonesia

Class	**Type of Soil**		***score***
	Name	**Level of Damage**	
1	Alluvial, Glei soil, Planosol, Gray Hydromerf, Lateric water	Not sensitive	15
2	Latosol	Quite sensitive	30
3	Brown forest soil, non calcic brown, mediteran	More sensitive	35
4	Andisol, Laterit, Grumusol, Podsol, Podsolic	Sensitive	60
5	Retosol, Litosol, Organosol, Renzina	Very sensitive	75

The soil characteristics data of the Cisokan watershed area used is the result of a scale-scale land survey from the Center for Soil Research with a scale of 1: 250,000.

3.2.2 Hydrology

The catchment area is identified by determining the watershed boundaries through digitization using a topographic map (Map of Indonesian Earth) Scale 1: 25,000. River network characteristics are identified using a map and validated directly in the field.

Baseline data condition of groundwater level and quality were retrieved by using periodic direct field measurements conducted by PT. PLN (Persero) in the RKL-RPL document. Data from the measurement of groundwater level and groundwater quality from the RKL-RPL document in each location are then tabulated to be a trend data for each semester within a certain period of time. The results of monitoring groundwater quality are then compared with the quality standards for clean water in the Minister of Health Regulation Number: 416/MenKes/PER/IX/1990 regarding Requirements and Supervision of Water Quality.

Baseline data Estimated discharge was taken from the results of the study by PT. PLN (Persero) in 2019. Observations were made at the Manglid and Cisokan Weir discharge stations throughout 2015-2018. Low flow rate at UCPS was influenced by the water demand in the Cisokan Dam which is located downstream of the Cisokan River. Debit from UCPS must meet the needs of the Cisokan Dam as the main beneficiary of the Cisokan River flow with the main designation, namely agriculture.

Based on the study of PT. PLN (Persero) in 2019, the peak discharge flow at the lower DAM UCPS was approached with the flood discharge probability of the Cirata Dam design. Analysis on the upper DAM is not possible to calculate using design flood discharge modelling because the area is relatively small, so the flood discharge approach is carried out by means of a daily maximum discharge analysis from the discharge measuring station. The results of the modelling analysis are then compared with the flood discharge method based on the Indonesian National Standard (SNI) No. 2415: 2016.

River water quality is also a part in the identification of environmental baseline, which will be a reference in the introduction of impacts and environmental management because water quality is one indicator of environmental dynamics due to the process of changing activities that occur in the watershed area.

3.2.3 Settlement, Land Use, and Infrastructure

A. Land Use Updates

Land use is a form of human adaptation to environmental conditions to obtain their needs or can also be a form of anthropology. Information on the distribution of land use conditions in the study area is needed to determine the dynamics of land-use change, land use distribution patterns and types of land use that will be used in impact and mitigation analysis and management models. The multi-year land use information is one of the main data in land-use change analysis and advanced analytics that require land use information. Therefore, the latest land use information is a major need in resource analysis, so updating land use data is a key activity in the preparation of environmental baseline.

Land use data updating is an activity of identifying the distribution of land use types that occur in the field by conducting a field survey. The mapping of land use distribution through a field survey takes quite a long time, so the data updating activity is carried out by making improvements to data from previous land use data. Improving previous land use data through identifying land uses from potential data sources including satellite imagery data coupled with field surveys will be very helpful.

Land use update mapping activities include data collection or data acquisition, data analysis, key interpretation, image interpretation for land use identification, field survey as a validation and verification effort and the last activity is the latest land use reconstruction. The flow diagram of land use update activities is shown in the figure below.

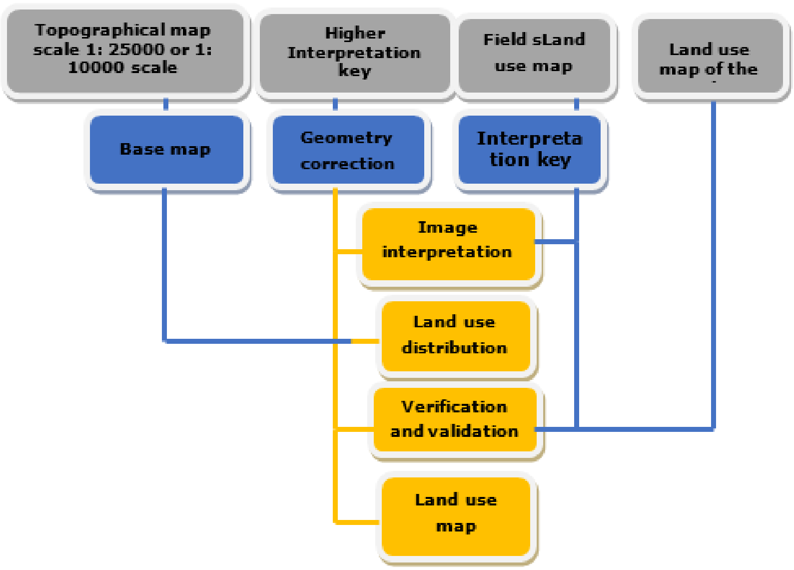


Figure 7 Flow Chart of Land Use Renewal Activities

The basic data in this activity is the data of land use distribution in the study area using high-resolution image data so that the condition of usage distribution can be known the latest land to the previous land use distribution. High-resolution imagery that is used as main data includes Google satellite imagery of various years and DEMNAS satellite imagery obtained from the page that provides the data.

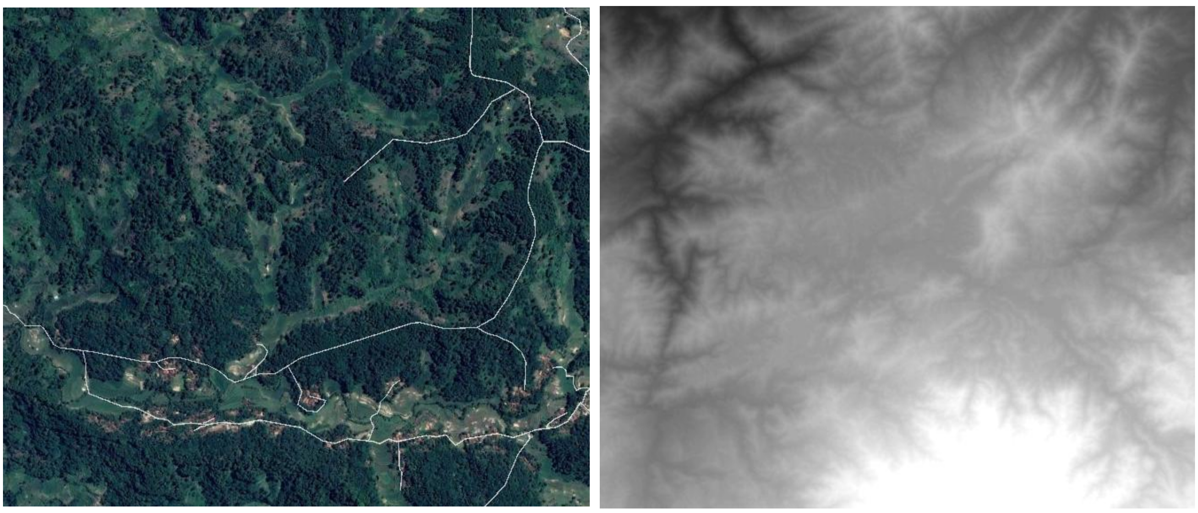


Figure 8 *High Resolution Image: Google Satellite Image (Left) and DEMNAS (Right)*

High-resolution satellite imagery is a remote sensing data that records the earth's surface information as a whole according to its sensor system. Sensors used at high resolutions typically use colored panchromatic sensors so that it is very easy to identify land use visually. Other spatial data used are 1: 25000 scale earth maps and top 1: 10000 topographic maps as the base map. The base map is created to refer to field activities so that a new map is created. The base map contains general information that is often used in making maps including roads and rivers.

Satellite images that are downloaded often have a limited area, so it needs to be merged to become a complete map for later interpretation of the image. Image interpretation can also be done separately, then merging or composite is carried out. Data from the interpretation of high-resolution images are used as input data for land use information, and then validation is performed to test the correctness of the interpretation results.

The interpretation of *IKONOS* imagery uses elements of interpretation, due to the diversity of land cover and the detailed data that will be needed. The elements of interpretation are used in interpretation but the use of key interpretations is very useful to facilitate identification of land use.

Geometry correction is performed to obtain an image that is really in the same and congruent with the base map data used. Geometry correction is used to reduce errors due to relief and the influence of earth geometry due to differences in map/image projections used. Geometry correction is also used when the image is not in the form of one scene, so when the map is joined, the map does not have any shifting. Correction of the geometry is done by determining the reference point that shows the same position between the image and the map, usually an easily recognizable shape. After each point in the image can be known its position on the map, the coordinates of the reference point in the image are synchronized with the coordinates on the map, and then rectification or improvement position of the image coordinates to map coordinates.

C. Compilation of Interpretation Keys

Making spatial data through visual interpretation based on high-resolution image information recording the study area requires an understanding of the location so that the interpretation results are better. Recognition of objects in the image through visual observation to obtain conclusions of the object types observed especially land use is done with the element of interpretation approach. The interpretation element is the form and visual elements that are used as search parameters to get the conclusion of the type of land use being searching for. The interpretation element used in the investigation of the type of land use namely; hue, texture, shape, size, site and association. In order to better identify the types of land use, interpretation can be done by creating interpretation keys.

The key interpretation is an explanation of the interpretation elements of an object that are known in the field as a reference in determining the type of an object when interpreting images. The key to interpretation is to guide the investigation of land use types based on field data and interpretation elements. The location for making the interpretation key is to choose the location which is the study area and is expected to represent other locations.

The majority of mixed garden land use has a light green to old visual hue with a rather rough texture that shows the canopy of varied plants, located near rivers or on slopes with high slope. The use of paddy fields or cultivated agricultural land can be identified with green to brown by forming squares and regular patterns or line patterns that form staircases.

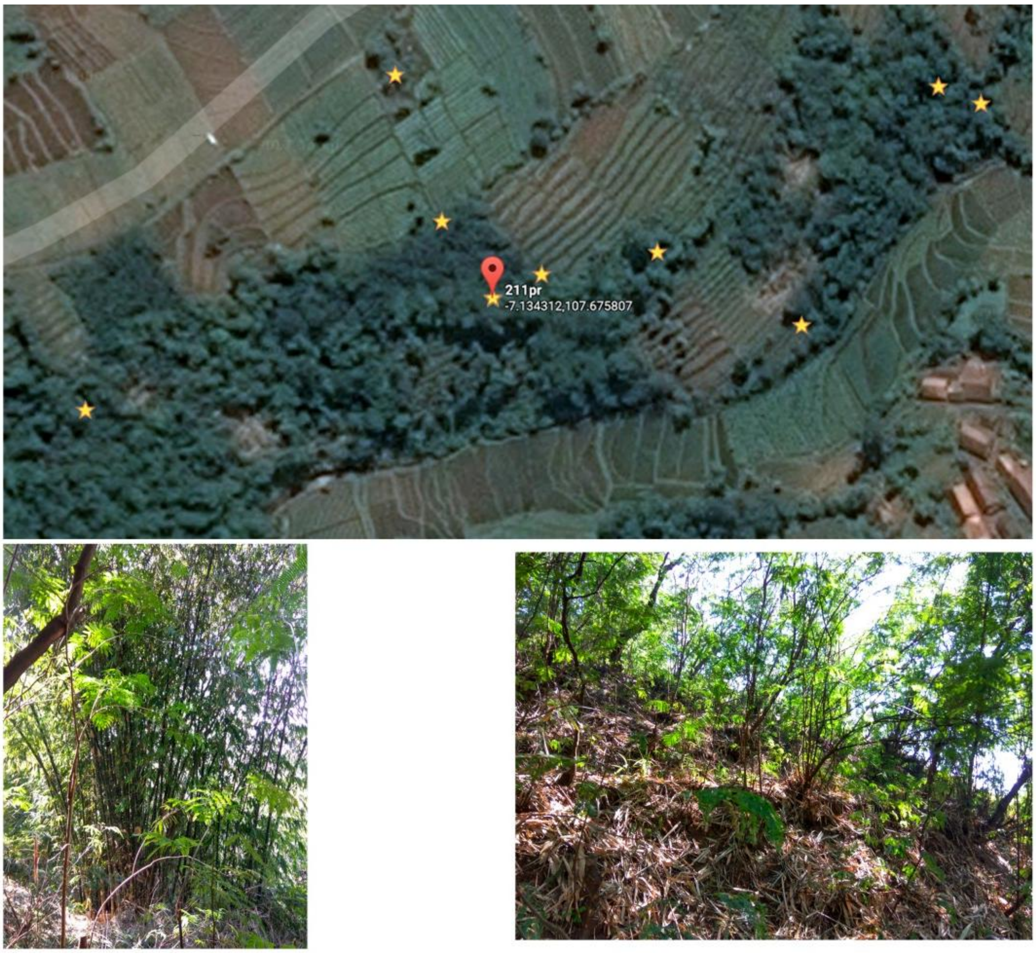
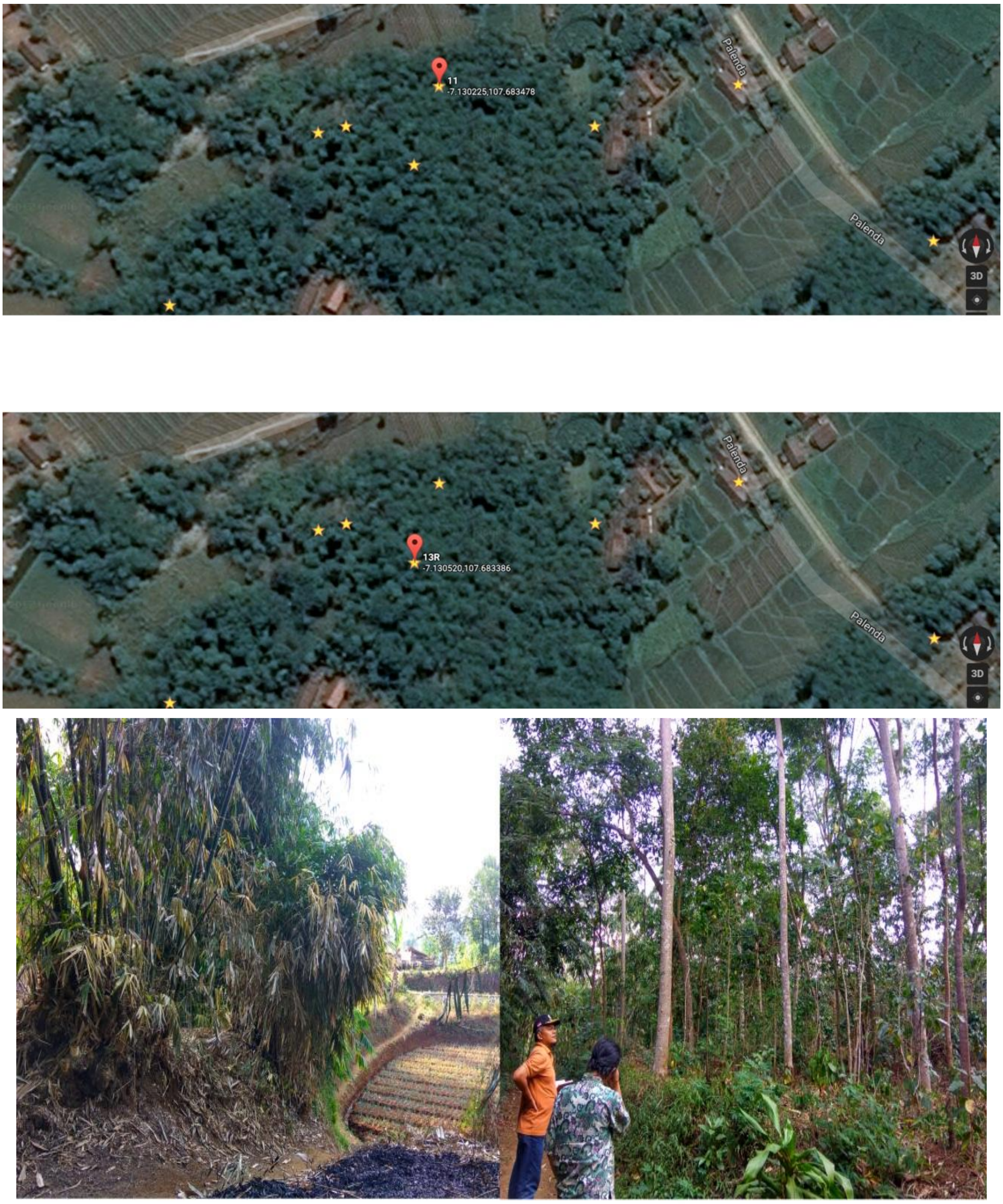


Figure 9: Location at Point 211pr

Figure 9 shows the location at Point 211pr with land use of Bamboo Plants and Kaliandra Plants on the north side. Visible Kaliandra plants are represented by a finer texture than Bamboo Plants. That is because the Kaliandra Plant is a shrub with a lower height compared to Bamboo Plants. Even so, bamboo plants have a finer texture than Wood Plants. Figure 10, the texture of land cover at point 11 (top) in the form of bamboo and has a green color with a more diffuse smooth texture, while Timber Plants at point 13R (bottom) has a centralized green color because Wood Plants have a single stand type and do not gather.



11 13R

Figure 10. (Top) Bamboo Land Cover, (Bottom) Wood Land Cover

The making of interpretation keys is based on the description of each element of interpretation which becomes the determining parameter. Characteristics of interpretation elements for key interpretation are presented in Table 4.

Table 4 Determination of Types of Land Use as Key Interpretation Based on Interpretation Elements

NO	Elements of Interpretation	Object 1	Object 2	Object 3	Object 4
1	Hue/ color	Light green	Green	Green	Green-brown
2	Texture	Smooth	Smooth-Robust	Rugged	Rugged
3	Form	Irregular	Regular	Vary (rounded)	Irregular
4	Size	Vary	Similar-varies		Small
5	Site	Settlement boundary or on vegetation land	Located on flat or sloping land with terracing adaptations	On the slopes of tasa/ sloping land	Flat slope
6	Association	Mixed garden		River	Street
7	Conclusion	Bamboo garden/ bamboo dominated garden/ bamboo talon	Rice fields	Mixed garden with perennials/ the trees/ *bamboo mix tree garden*/ bamboo talon	Settlement

D. Identification of Land Use

Land use identification is done by visual interpretation, meaning that land use identification uses direct eye observation of the appearance in high-resolution imagery to infer the type of land use that is recognized. The introduction of types of use is based on the elements of interpretation and key interpretations that have been made. Distribution of land use is done by limiting or delineating the types of land use that can be identified using elements of interpretation and key interpretations. Delineation of land use distribution is done by screen-dig or digitization on screen. Zoning of the type of use is carried out directly on the monitor screen in line with the interpretation process.

The results of visual identification through delineation in full or overall produce temporary land use data. Temporary land use means that the identified land use has not been validated and verified in the field and also old land use maps. Verification and validation are carried out at several points as a test sample for interpretation results. Verification results are carried out to improve land use maps, if there are differences in interpretation between types of land use on the map and in the field or previous land use data if the type of land use does not change.

The results of verification and validation in the form of land use data that shows the latest land use distribution is expected to reflect the distribution of the use of the study site so that it can be used as input data for further spatial analysis.

3.2.4 Air Quality, Noise, and Vibration

Baseline data Condition of air quality, noise and vibration in the UCPS area were retrieved using periodic direct measurement data conducted by PT.PLN (Persero) in the RKL-RPL document. Data from measurements of air quality, noise, and stores from RKL-RPL documents in each location are then tabulated into trend data for each semester within a certain period of time. The results of monitoring ground air quality are then compared with the quality standards in the legislation in force in Indonesia.

3.2.5 River Usability

Baseline data on river use or utilization is compiled from a study report conducted by PT. PLN (Persero) from 2009-2019. Then do the verification related changes that occur by direct observation in the field. River users are information regarding the overall utilization of the river as part of the resource element.

3.2.6 Terestrial Habitat and Biodiversity

The terrestrial and biodiversity habitat baseline data are divided into two parts, namely terrestrial habitat and biodiversity and aquatic biodiversity and habitat. Terrestrial habitat data were obtained from various study data conducted by PT. PLN, LIPI and Padjadjaran University during 2009-2019. This data includes updating terrestrial fauna which refers to the biodiversity management plan report for 2014 and 2017, which is also confirmed by the publication of Husodo, et al., 2019. While for habitat and aquatic biodiversity data obtained from the 2009 biodiversity survey data, LIPI 2011 data, and the 2019 RPL/RKL report. Data were elaborated to see the latest situation, namely in 2019, mainly related to terrestrial fauna that was threatened or registered on the IUCN red list. Whereas the presence of aquatic biota is analyzed yearly for fish species, and for plankton and benthos abundance, diversity (*Shannon-wiener index*) and dominance (*Simpson Index*) are analyzed as indicators of water quality.

3.3 Baseline Socio-Economic Assessment

Baseline data preparation for this segment is mainly carried out through an assessment of the results of existing socio-economic studies which are then updated with the latest conditions. The ESIA socio-economic team extracts data and information obtained from various documents that contain secondary data that has been validated. The main baseline database is the social and economic parameters that have been presented in the EIA (environmental impact assessment) document compiled by UCPS in 2011, then the LARAP (land acquisition and resettlement action plan) document, which is also in 2011. The update to the main database is first obtained in the Mid Term Review document, which is a progress report on the implementation of the action plan commitments from LARAP from 2011 to 2016. In addition, other updates are taken from the monitoring document of the RKL/RPL which is a follow up from AMDAL. For the record, AMDAL and EIA are relatively similar assessments. The difference is that EIA (like LARAP) is based on IFC Performance Standards criteria, and environmental (and social) impact analysis standard developed by the World Bank group, the International Finance Corporation (IFC). Whereas AMDAL is an environmental impact analysis (including a limited number of social impacts) determined by the Government of the Republic of Indonesia through the Ministry of Environment. This RKL/RPL monitoring document was obtained from PLN UCPS and is semi-annual from 2012 to the first semester of 2019.

The first thing to emphasize in the socio-economic baseline is that in the presentation of EIA and LARAP which are prerequisites of the UCPS development plan in 2011, there is no analysis of social and economic impacts in a fairly large portion and guided by the IFC Performance Standards. This is because EIA focuses more on environmental impact analysis and LARAP focuses on aspects of land acquisition for UCPS development as well as plans for resettlement and restoration of the livelihoods of residents who become PAP (*Project Affected People*). As for the ESIA baseline for social and economy, the portion of social and economic impacts is greater than before, which is listed in a number of ESS (environmental and social standards) derived from the World Bank ESF guidelines (environmental and social framework). The details are as follows:

1. ESS 1, is partial;
2. ESS 2, is partial;
3. ESS 4, is partial;
4. ESS 5, is full. This ESS cannot be completely equated with LARAP because it contains an involuntary resettlement element;
5. ESS 7, is partial in particular related to complain handling mechanism and elements of gender-based violence
6. ESS 8, is full;
7. ESS 10, is full but it is possible there is a relationship with other parameters such as environmental aspects.

Based on the details above, each ESS element is then broken down into several parameters, as follows:

a) Location of settlements and housing

This baseline describes the current conditions of settlements and community housing around UCPS especially PAPs. This data is obtained from the secondary data sources mentioned above, in addition to additional data from the Social Mapping document that has been carried out by UCPS in 2019 for West Bandung District and Cianjur District especially in the districts where the PAPs are located (hereinafter referred to as social documents mapping). This aspect will assist in the analysis of managing social impacts on ESS 1.

b) Demographics

This baseline shows the population distribution in the area around UCPS as seen from the population value per village, density per km2, and the ratio between female and male residents. The data source for the presentation of this information comes from the social mapping document. This aspect will help with the analysis of managing social impacts and potential social risks in ESS 1.

c) Community structure and services

This baseline informs the characteristics and structure of the community around UCPS as seen from the level of education of the adult population, family subsistence patterns, access to education children and other related information. The data source for the presentation of this information is derived from social mapping documents as well as reliable external information sources. This aspect will help with the analysis of managing social impacts and potential social risks in ESS 1.

d) Community infrastructure

This baseline was reviewed from various aspects such as community drinking water sources, electricity service transmission, road infrastructure, and sanitation. The data source for the presentation of this information is derived from social mapping documents as well as reliable external information sources. This aspect will help with the analysis of managing social impacts and potential social risks in ESS 1.

e) Work

Community livelihoods, especially PAPs around the UCPS area are mapped and will provide input to the analysis of social impact management and potential economic development of the community as required in ESS 1. Sources of data on this aspect were obtained from UCPS RKL-RPL Semester 1, 2019, Mid Term Report, population data from BPS and Social Mapping. This baseline includes the elements: employment opportunities, income and poverty levels, and others.

f) Environmental services (ecosystem services)

This aspect explains the relationship between carrying capacity of the environment or environmental services to the livelihood of the community, both socially and economically as represented on information for food supply services, water supply services, prevention and protection against natural disasters, and regulation of water flow and flood management. External data sources derived from scientific publications were used for this analysis.

g) Health services

This aspect is related to the extent to which support for health facilities can be reached by the community around UCPS, especially those related to the protection of vulnerable people from a health perspective and support for recovery services for gender-based violence. Based on preliminary data from the 2011 EIA and LARAP documents which were supported by updates from the related BPS data, the information became an indication for analysis on ESS 7.

h) Public opinion

This aspect is mainly to answer ESS 10 related to managing the engagement between UCPS and relevant stakeholders. Based on social mapping as informed in the Social Mapping document, which is then traced to the timeline or history of community engagement (stakeholder engagement) and community feedback mechanisms, namely a review of RKL-RPL Semester 1 2019 monitoring documents. Feedback mechanism and type of complaints also examined in order to find out the structure and form of UCPS services both in the context of handling social impacts and resolving LARAP commitments. The strategy of consultation and discussion between UCPS and the community determines the information disclosure model between the two parties.

i) Vulnerable people or sensitive groups

In the initial stages of ESIA activities, researchers conducted surveys or primary data collection to gather more information about the baseline of vulnerable communities and sensitive groups around UCPS. Another analysis of secondary data was also carried out on Social Mapping documents. This analysis is relevant to ESS 7.

j) Traffic and road safety

Based on the RKL/RPL monitoring documents for 2018 and 2019 to find out the latest developments and changes in traffic and road safety aspects in the past year, this analysis was carried out in order to support the assessment of the social impacts of road construction and the resulting traffic impacts. This analysis is relevant to ESS 1.

k) Cultural heritage

Protection of wealth (assets) and cultural heritage related to ESS 8. Review of scientific publications and data sources from the government of West Bandung District and Cianjur District will complete this analysis to find out the extent of the impact of UCPS development on society.

Chapter IV. Environmental and Socio-Economic Baseline Information

4.1 Introduction

This chapter provides an overview of initial environmental baseline data "before hydropower construction" and discusses sensitive environmental factors, which may be needed by, or influence, the construction or operation of hydropower plants. There are several main data sources used in the baseline environment data:

1998	ANDAL Report UCPS Cisokan (PT.PLN, 1998)
2001	ANDAL Report UCPS Cisokan additional (PLN/Newjec Inc., 2001)
2006	ANDAL Report UCPS Cisokan (PLN/Newjec Inc., 2007b)
	ANDAL Report Transmission line UCPS Cisokan (PLN/Newjec Inc., 2007a)
2009	Previous EIA report with: ▪ Cultural Heritage Survey (Neneng, 2009) ▪ Biodiversity Survey (Rahmat, 2009)
2013	Watershed Management Study report (Watershed Management) to support Upstream Cisokan Upper Cisokan Pumped Storage (PT.Goetrav Bhuana Survey).
2019	Hydrology review report Updating Detailed Design and Preparing Construction Drawing of Upper Cisokan Pumped Storage Power Plant Project (PLN Enjiniring, Nippon Koei Co.Ltd., NEWJEC Inc., PT.Indokoei International, PT. Wiratman).
2009- 2019	PLN's environmental assessment report through a competent external consultan to obtain data series from 2009 to 2019.

Preliminary environmental baseline data from each of the previous studies are compiled into one data set and presented in an appendix.

4.2 Environmental Baseline

4.2.1 Physical Characteristics

A. Climate

Climate Characteristic of The Study Area

Regional climate characteristics determine the characteristics of land surface dynamics, soil development, hydrological characteristics, erosion of sedimentation and land use dynamics. Climate is one of the determinants of soil development. Soil development and soil type are determined by climate, geology, slope, organism and time factors. Climate parameters that determine the dynamics of the ground surface include, temperature, air humidity, wind direction, wind speed and rainfall.

Climate classification of the study area based on rainfall data according to Koppen is in the Af climate or tropical rain climate. This climate is characterized by high rainfall in the rainy season with a relatively long rainy season. Schmidth - Ferguson climate classification shows that the study location is in type A climate. This is the same as the classification according to Koppen (Arifah, A, 2016). The General description of climate conditions in the project area is shown in Table 5 below.

Table 5 Climate Condition in Study Area

Climate Parameter	**Value**	**Data Source**
Average monthly air temperature	23 - 26^{0}C	(Project site monitoring)
Average monthly wind velocities	2,3 – 6,85 m/s	(Saguling DAM)
Average monthly relative humidity	86 – 88%	(Saguling DAM)
Total monthly rainfall (dry season)	10 – 100 mm	(Project site monitoring)
Total monthly rainfall (rainy season)	50 – 30 mm	(Project site monitoring)
Average rain days (dry season)	2 – 15 days/month	(Saguling DAM)
Average rain days (wet season)	12 – 24 days/month	(Saguling DAM)
Average daily evaporation potential	4,5 mm	(Project site monitoring)
Wettest / most humid months	November - March	(Bandung Climate Station)
Driest months	July – August	(Bandung Climate Station)
Predominant winds	East; 1,425 km/hr	(Project site monitoring)

Characteristics of Air Temperature

Air temperature is an important parameter in environmental studies because air temperature determines environmental conditions and the condition of land resources. Biotic and abiotic processes are also largely determined by temperature. Areas with high average daily temperatures will determine the characteristics of vegetation and vegetation growth in certain areas.

The regional temperature distribution is usually used for water source analysis especially with regard to water balance calculations. Temperature is used to calculate the potential evapotranspiration of a region or loss of area water. The monthly evapotranspiration calculation is used to calculate the monthly water resources balance, so that the dynamics of monthly water loss can be identified. The distribution of average monthly temperatures in the study area is presented in Figure 11.

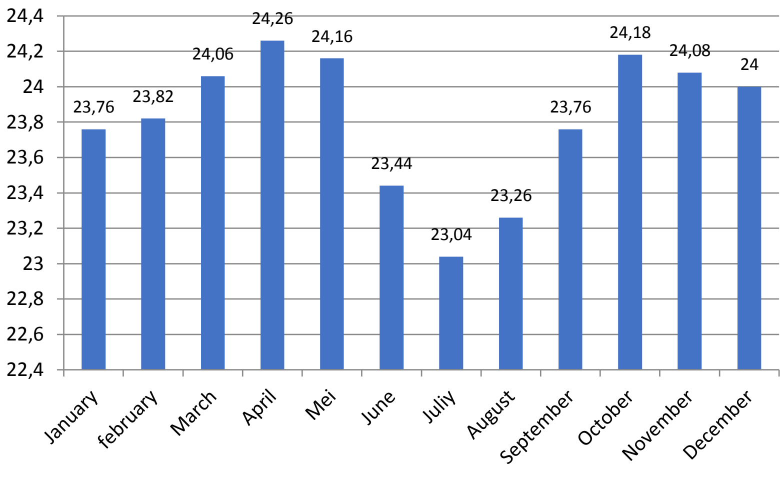


Figure 11. Average distribution of monthly temperatures in the study area
(data source: climate.data.org; accuweather.com)

Regional temperature data is obtained from temperature data of several location points and then averaged by arithmetic method to obtain the regional temperature. The average monthly temperature at the study site ranged from 23.4^{0}C - 24.6^{0}C. The results of the regional air temperature data collection show that the lowest monthly temperature in the study area occurred in July, while the highest average monthly temperature occurred in April. Generally in the dry months (dry season) the monthly temperature is relatively lower compared to the wet months (wet season).

Regional Wind Direction and Wind Speed Characteristics

The Wind is a result of pressure differences between places as a result of differences in temperature and humidity. The difference in pressure causes air movement. The movement of the wind is also determined by the difference in pressure in the northern hemispheres and southern hemispheres and the movement of air at the equator. Wind movement also occurs in the local area due to differences in pressure at the local level. Local wind movements include valley wind, mountain wind, land wind, and sea wind.

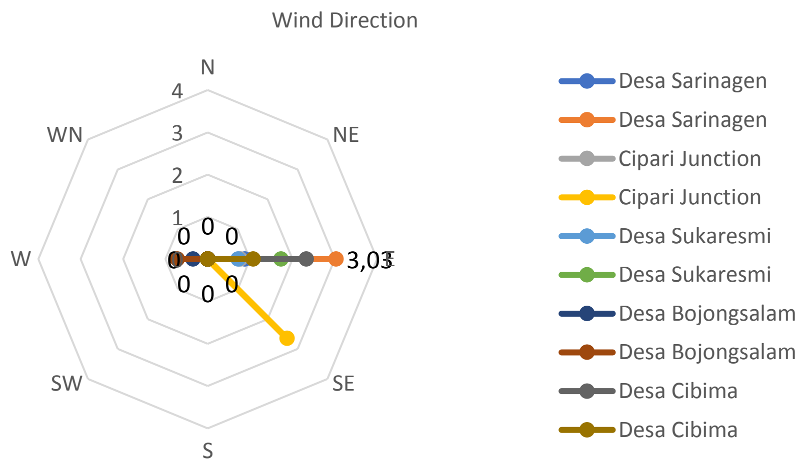


Figure 12 Wind Direction and Wind Speed Monitoring Results in the Study Area

The Wind movement locally is determined by the characteristics of surface roughness or topography of the region. Data on wind speed and wind direction at locations around UCPS are shown in Table 6.

Table 6. Wind Speed and Wind Direction Data at the UCPS Location

Location	Semester I		Semester II		Measurement Year
	Wind Speed (km/hr)	Wind Direction	Wind Speed (km/hr)	Wind Direction	
Sarinagen Village (Near Quarry)	0,88	E	3,03	E	2019
Cipari Junction	0,77	E	2,65	SE	2019
Sukaresmi Village	0,72	E	1,73	E	2019
Bojongsalam Village	0,35	W	0,72	W	2016

Cibima Village (Upper dam)	2,33	E	1,07	E	2019

Regional rainfall characteristics

Rainfall is a major component in determining surface runoff, water resources, flow discharges, and erosion-sedimentation. Rainfall provides a supply of surface water and groundwater as a source of water for domestic needs, agricultural irrigation, water supply for plants, industry and, other activities. Rainfall also impacts erosion and sedimentation in the catchment area. Soil erosion occurs due to rainfall that falls on the surface of the earth about the surface of the land that is sensitive to rain energy called erodent. The process of peeling off the soil layer by rain energy, and then being transported downstream then settles is an erosion-sedimentation process.

Distribution of annual rainfall obtained from annual rainfall data at the rainfall gauge station then interpolated to obtain the characteristic spatial distribution pattern of rainfall using the isohyet method, then classification is performed to obtain the annual rainfall distribution class. Rainfall mapping results show that in general, the study location is an area with a fairly high rainfall ie more. In general, further south the annual rainfall in the study area is higher. The southern region is the upstream part or catchment area of the Cisokan watershed, so with sufficiently high rainfall, it will provide a sufficiently high water supply for surface and groundwater. The detailed distribution of annual rainfall in the study area is presented in Figure 13 below. (map details are shown in Appendix 6).

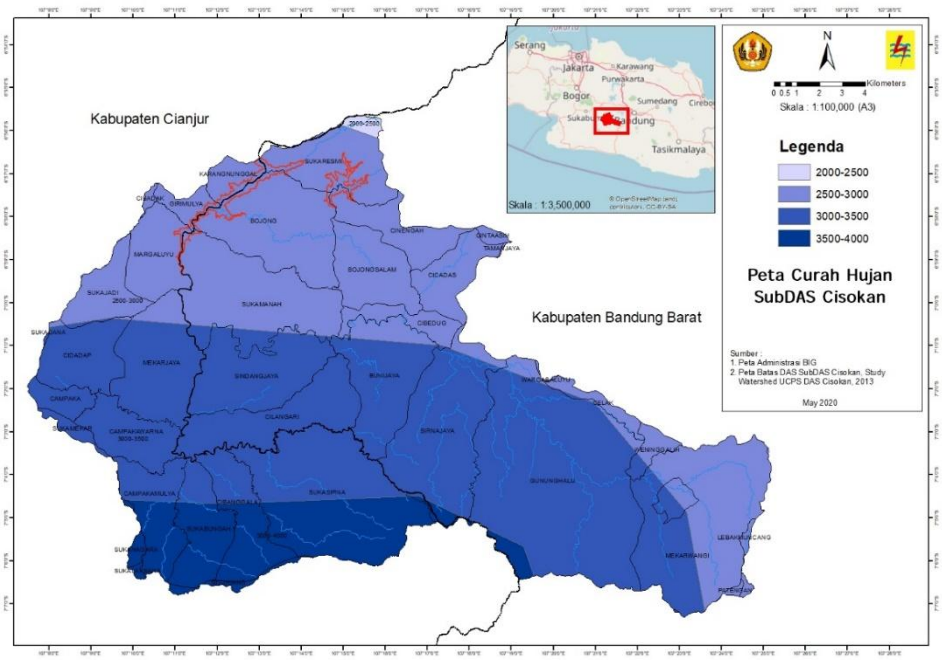


Figure 13. Distribution of annual rainfall in the study area

Ten years of rainfall data at the UCPS location taken from CHIRPS imagery over the past 10 years (2009-2019) is shown in Figure 14 and Figure 15.

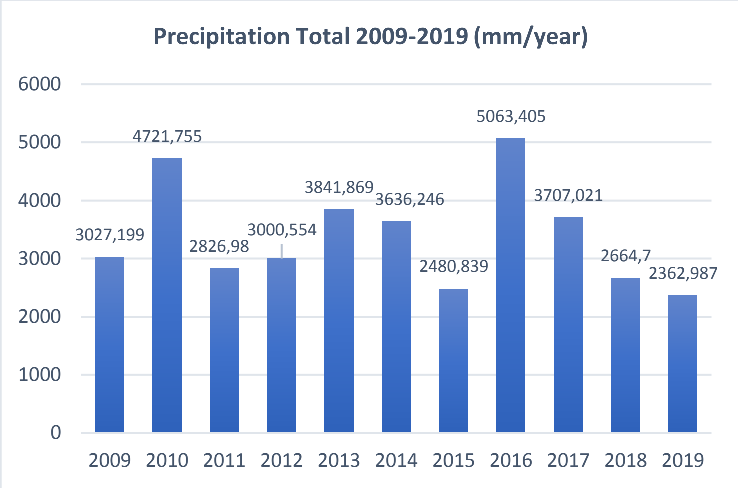
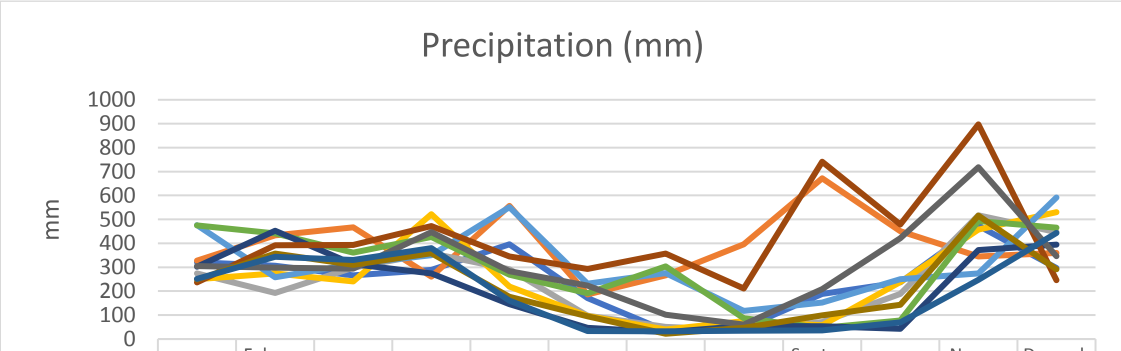


Figure 14. Precipitation 2009-2019 at UCPS



	January	February	March	April	May	June	july	August	September	October	November	December
2009	321,683	305,739	266,211	289,335	396,118	170,737	34,793	47,442	188,837	236,603	473,348	296,353
2010	328,314	434,004	466,381	261,341	556,025	186,516	266,688	395,782	671,857	450,521	345,077	359,249
2011	274,619	192,988	297,903	358,374	292,14	98,144	51,12	38,045	71,003	188,496	517,147	447,001
2012	250,417	274,785	240,701	521,052	219,037	96,412	39,929	74,672	57,239	238,693	457,407	530,21
2013	475,644	258,113	313,004	350,957	551,097	231,964	275,311	117,579	152,196	249,749	274,796	591,459
2014	475,128	441,332	361,058	426,357	268,983	191,599	303,189	86,428	46,701	77,451	492,927	465,093
2015	302,836	452,538	313,115	274,779	146,025	46,506	28,429	54,187	53,844	42,527	371,76	394,293
2016	237,132	392,031	393,857	472,012	345,438	292,317	356,645	211,346	741,514	478,406	897,073	245,634
2017	305,46	297,674	294,566	446,776	283,121	223,611	102,233	60,547	208,523	420,753	717,937	345,82
2018	248,576	357,737	310,055	359,027	176,424	94,324	22,172	46,389	98,8	143,268	515,838	292,09
2019	251,435	343,444	329,9	380,369	160,247	33,546	32,326	35,016	35,707	69,767	247,86	443,37

Figure 15. Monthly Precipitation Data 20019-2019 UCPS

B. Topography

Topography

The topography is the formation of extrogen origin which is a process of land degradation by exogenous forces forming a distinctive relief on the surface of the earth. The topographic shape is the result of exogenous processes and rock characteristics that form specific topographic patterns. The topography is generally divided into plain, bumpy, hilly and mountainous.

Based on the Cisokan watershed topographic map, the location of this project is located in the Bandung Zone. Located in a vulnerable part of the hilly mountainous region in the southern part of

West Java. Based on image interpretation, it is known that the height of the topography ranges between 270.41 m - 2,075 m above sea level. The northern part of the region is an alluvial plain and the Indian Ocean in the South. In a broader landscape, there are sporadic volcanoes and alluvial plains, including Mount Pangrango in the Northeast of the project area.

Among the cisokan watershed, topography can be seen the Cisokan River flowing from South to North. Cisokan River is one of the tributaries of the Citarum. Citarum River flows into the Java Sea in the north and is one of the largest rivers in Java. The Cisokan River flows over a steep V-shaped valley before it flows to the plains, until it then joins the Cirata Dam.

The topography of the Cisokan UCPS project site consists of sloping hills to steep hills with an altitude of between 400 m - 1000 m above sea level. Located in the northern part of the Cisokan watershed. Topographical conditions in the Cisokan watershed are displayed spatially in Figure 16. (map details are shown in Appendix 7).

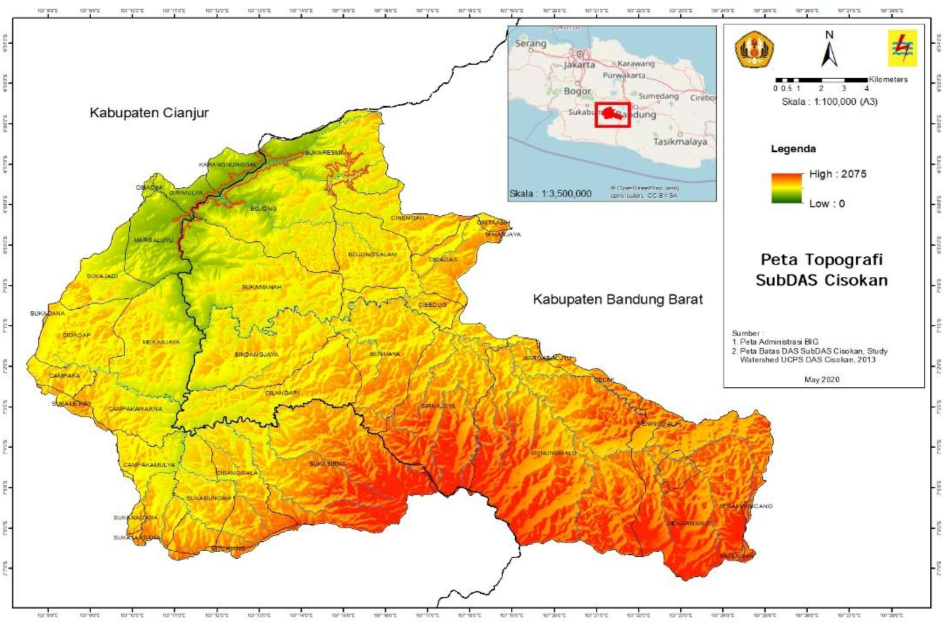


Figure 16. Cisokan Watershed Topographic Map

Landscape

In general, the study area is an area formed by a structural process forming a structural rock that undergoes a process of degradation to form denudational mountains. The landscape of the project area consists of tertiary volcanic and sedimentary rocks, with geological structures of folds and faults that generally point northeast - southwest. The geological situation in the hilly landscape is dominated by sandstone, shale, breccia, and there is a little andesite lava. General stratigraphy (from young to old) are:

- Alluvial sandstone, breccia and limestone, mixed with clay and sand along the Cisokan and Cilengkong river valleys and their main branches. Represents the Holocene period.

- Volcanic breccia sandstone and andesite lava from the Pliocene period. Surface rocks are found throughout the area, and some have weathered due to weather.
- Breccia and sandstone units. Grayish black sandstone above the breccia layer with fragments of volcanic rock, sandstone, limestone and clay.
- Sandstone and clay rock. The lower part consists of volcanic breccia stones and andesite and basal fragments. The upper layer consists of chunks of brownish yellow sandstone between clay rock and clay stone.
- Yellowish-brown limestone, weathered where rock layers are exposed.

C. Slope

The data on the slope is very useful in the introduction of terrain relief and is an input in the preparation of land units as a basis for determining the ability of the land to determine the potential carrying capacity of the land. The Slope is also an input data in determining the erosion potential of the study area because the slope is one of the determinants of land erosion. The slope also influences the formation of land and the potential for landslides (Asdak, 2002).

Slope maps can be identified by visual observation of height information that is reflected in the form of land contours on the earth's map. The slope can also be done by digital modeling through the processing of height data into three-dimensional information, then filtering is carried out to reduce the slope information. The identification of slope using visual analysis of contour maps has the advantage because the pattern of delineation results more closely resembles land surface conditions, but requires a longer time and stage. Making slope maps with digital modeling of digital spatial data is easier with fairly good accuracy, therefore in this study slope information is created using digital modeling.

Based on the classification that has been done, the Cisokan watershed is divided into 5 slope classifications: Flat (<8%), Sloping (8% - 15%), very sloping/Hilly (16% - 25%), Moderately steep (25% - 40%), and Steep (> 40%). The slope at the study site varies greatly from flat to steep slope. Flat slopes are in the area below or at the bottom of the basin. The slope of the flat and hilly land occupies a fairly wide area, in addition to the slope grade of 16-25% (hilly) also has a large enough area. Steep slopes occupy narrow areas that are areas of river banks or hillsides. The slope distribution of the study area is presented in Figure 17. (detailed maps are shown in Appendix 8).

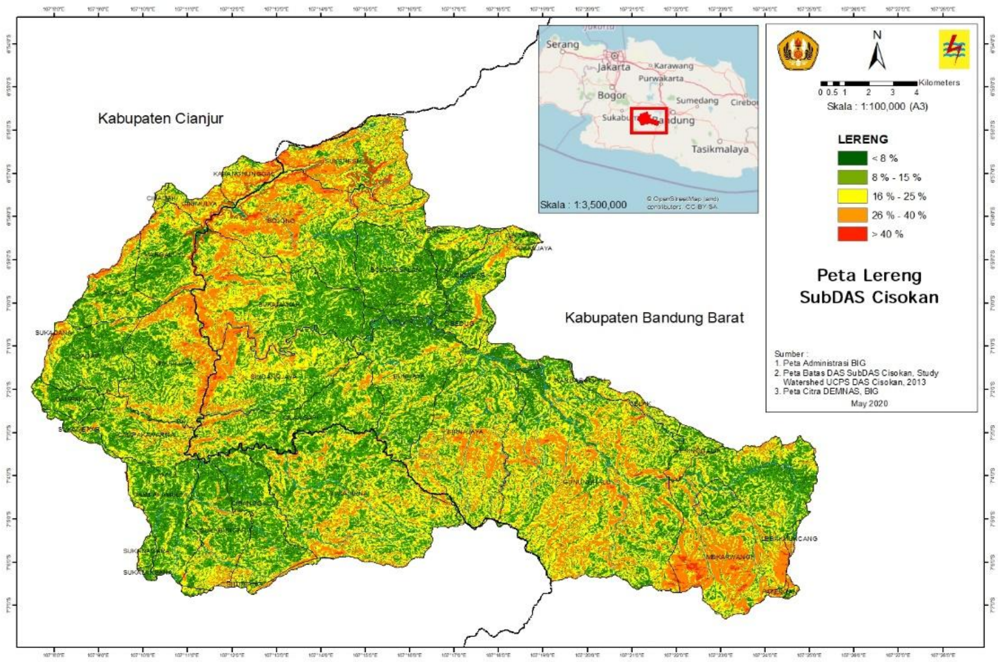


Figure 17. Slope Classification Map

Based on the classification that has been done, it is known that the area in the Cisokan watershed that has a slope of <8 (flat) is 4,768.78 Ha, the area with a slope of 8% - 15% (sloping) is 10,365.57 ha, the total area with a slope of 16% - 25% (hilly) of 14,751.55 ha, area of a slope with 26% - 40% (moderately steep) of 7,264.07 ha, and area of the slope of> 40% (steep) is of 291.68 ha.

Spatial distribution of slope digital modeling results show that the location with high slope is in the north and south. The northern region is a downstream friend which is the planned lower cisokan and upper cisokan weir area. The position of the dam is very suitable because it is on a steep slope so that the weir's body is relatively short. The upstream area in the southern part is a protected forest area so it is very suitable with the capability of the land. Areas with high land slopes usually have low soil solum depth due to high erosion, but with the use of forest land, it is possible to reduce erosion.

D. Geology and Hydrogeology

Geology/Lithology

Geology is the nature of the constituents that interacting with environmental parameters determine shaping of the land, relief and the ability of land in the supply of resources. Geology is one of the determinants of soil development, soil type, and soil properties. Geology also determines potential disaster information regarding the process of its formation. Therefore, geology is a component of the mapping unit formation in the ecoregion, because geological characteristics will determine the physical and environmental characteristics of the region.

Based on the regional geological map of the geological formations in the Upper Cisokan Watershed, rock formations consisting of Andesite horenblende, Andesite Piroksen, Andesite, Limestone Members, Sandstone Members, Sandstone-Batulanau Members, Breccia & Sandstone Members, Clay

Members, Napal, Sandstone, Sindangkerta Members, Sandstone Members, Sandstone Members, Sandstone-Batulanau Members, Breccia & Sandstone Members, Clay Members, Sandstone Members, Sindangkerta Members, Sindangkerta Members, Reef Limestone, Tuffaan Breccia. Pyroclastic Deposits, Bentang Formation, Beser Formation, Bojonglopang Formation, Cimandiri Formation, Nyalindung Formation, Andesite Lava. The distribution of rock formations is shown in Figure 18.

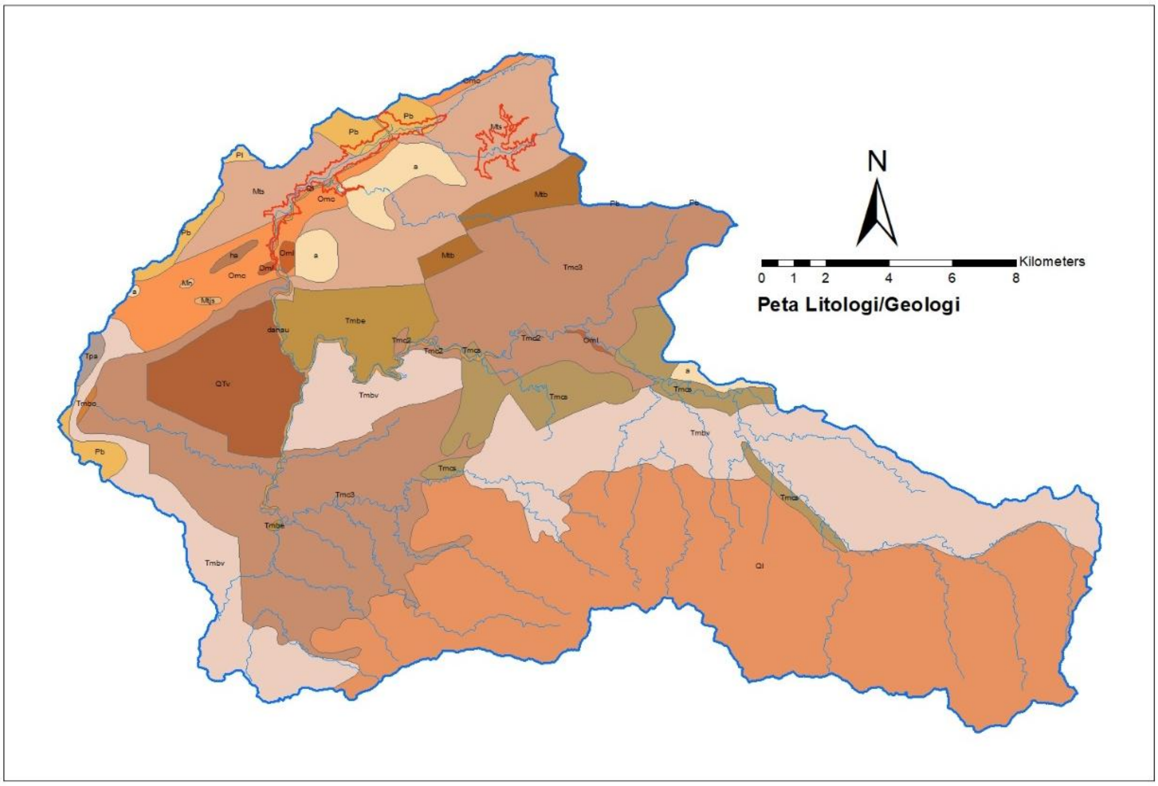


Figure 18. Lithology Map in DAS Cisokan

The location of the work was carried out in West Bandung Regency, Java Island, Indonesia. Regional geology covered physiography, geological structure, and regional stratigraphy. West Java Physiography according to van Bemmelen (1949) modified by Martodjojo (1984), based on physiographic the area of West Java is divided into four zones (Figure 19), namely: 1) the Jakarta Coastal Zone Zone; 2). Bogor zone; 3) Bandung Zone; 4) South West Java Mountain Zone; 5) Bayah Mountain Zone.

Job sites include the Bandung Zone (see Figure 19). The Bandung Zone is a volcanic area that has a relatively depressed form compared to the Bogor Zone and the Southern Mountain Zone. This zone forms a depression, but the altitude reaches 700-750 masl. This depression zone is shaped like a basin because the zone is between two flanking heights. This zone is formed from the results of Tertiary rock weathering and Quaternary volcanic precipitates so that most of them are filled with Quaternary alluvial and volcanic deposits.

Figure 19 Physiography Zone Map of West Java and Banten

Regional Stratigraphy

Based on Stratigraphical, the regional distribution of formations contained in the study area consists of (Sudarminto, 2015) :

1. Rajamandala formation which is Oligocene age (Omc & Oml), Citarum formation which is Miocene age (Mtb & Mts), and Pliocene age formation (Pb) and Quaternary deposition (Qa). The formation (Pb) is out of alignment above the Mts and Omc formations with andesite lava flow inserts. The main tectonic features are folding structures, thrust faults, strike-slip faults and Cimandiri faults which are 2 km northeast of the downstream DAM. The rocks that dominate the project area mainly consist of the Mts and Pb formations and in civil buildings occupy the Mts Citarum formation.

2. The Rajamandala (Tom) Formation consists of polymytos conglomerates, graywackes, quartz sandstones, limestone clay, dolomitan limestone inserts, mudstone, shale, tuffs, coal chips & lenses, containing quartz crystals, polished rocks, limestone clay, dolomitan limestone inserts. Some of the limestone is aligned. The age of this formation is Oligocene.

3. Lengkong Formation (Tml) consists of napal, partly containing globigerina, tuff, claystone, mudstone, limestone sandstone, partially rocky tuff, 30 is andesite & dacite, partial limestone is breccia. This formation thickness reaches 300 m with a shallow marine depositional environment and is thought to be of Early Miocene age.

4. The Span Formation (Tmbe) consists of tuff and sandstone, lignite, tuff tormane, tuff shale & breccias, tycoon conglomerates, local glauconite, limestone, tuffaceous breccias, and tuff. The depositional environment of this formation is neritic - shallow seas with estimated age of Late Miocene.

5. Beser Formation (Tmbv) in the form of volcanic breccias, lahari breccias, tuff breccias, tuffs, rocky tuffs; tuffaceous sandstone inserts, tuffaceous clay & conglomerates, andesitan. The beser

formation also contains plant residues & hardened wood. Local claystone is intertwined with coal. Sedimentary terrestrial - beach environment. Beser Formation in Upper Miocene age.

6. The Cibodas Formation (Tmci) consists of limestone, tuffaceous limestone, sandstone limestone; limestone sandstone inserts & tuff sandstones. Maximum thickness reaches 250 m. Upper Miocene Cibodas Formation.
7. The Bojonglopang Formation consists of reef limestone and tuff lane at the bottom. Reef limestone in the form of repetitive layers of solid limestone which is rich in mollusks and algae with layered limestone which is composed of the results of solid cement corals. Tufaan Napal contains fossils of small foraminifera, large foraminifera and mollusks.
8. Cimandiri Formation consists of interlocking claystone and light gray to medium siltstone, yellowish brown sandstone, local limestone. In some places they are lava deposits composed of tuffs, andesite breccias and tuff breccias. In siltstone or sandstone inserts containing glauconite in the Cibodas Valley can be found globigerina, resin granules and rarely plant remnants.
9. Andesite rocks found in the Quarry Mount Karang location are rock materials that produce flat rock material in crumbled conditions; it can be noted in rocks from blasting results that become small (2-3cm), this is possible in the freezing process of andesite igneous rocks experiencing interruption or mixing with other coponents (for example water) so that the freezing is not massive, then formed splinters.

Geology of Project Area

The geological location of Cisokan UCPS was taken from the Cianjur Sheet Geology Map (Sudjatmiko, 2013) on a scale of 1: 100,000. Based on this map, there are 3 rock formations that support the project location, namely the Rajamandala Formation (Omc), Citarum Formation (Mts), and Pb Formation (Pb).

Table 7. Geological Formation in Project Area

Ages	Abbreviation	Formation	Apperance
Neogene Pliocene	Pb	Pb Formation	Tuff Breccia, Shale/Sandstone alternation, Andesite
Neofene Miocene	Mts	Citarum Formation	Sandstone/siltstone alternation, Sandstone, Tuff Breccia, Andesite, Breccia Sandstone, Shale/Sandstone alternation
Paleogene Oligocene to Neogene Miocene	Omc	Rajamandala Formation	Marl/Sandstone alternation

Three (3) supporting geological formations at the Cisokan UCPS project site are as follow:

- **Rajamandala Formation (Omc)**

  The Rajamandala (Omc) Formation generally consists of Marl / Sandstone (Ml / Ss). Distributed in a narrow area between 0.5 km width and Length = 40 km from the North-East to South-West direction. The location of the Cisokan UCPS project is located in the southern area of its distribution. The Rajamandala Formation (Omc) is thought to have formed at the end of the Oligocene mass to the Early Miocene of the Tertiary Period.

- **Citarum Formation (Mts)**

  The Citarum Formation (Mts) rests on the Rajamandala Formation (Omc). The Citarum Formation (Mts) is mostly distributed in the southern and northern regions of the Rajamandala Formation (Oms) distribution. The Citarum Formation consists of Sandstone and Siltstone alternation (Ss / Silt), Sandstone (Ss), Tuff Breccia (Br), Andesite (An), Breccia Sandstone (BrSs), and Shale and Sandstone Alternation (Sh / Ss). The Citarum Formation is thought to form during the early Miocene tertiary periods.

  The Citarum Formation is the formation with the most extensive distribution of rocks at the Cisokan UCPS project site. Some of the buildings that will be built on this formation are Upper dam, waterway, and powerhouse.

  In some places, drag faults (drag faults) were observed that characterize this area as being intensively affected by tectonics.

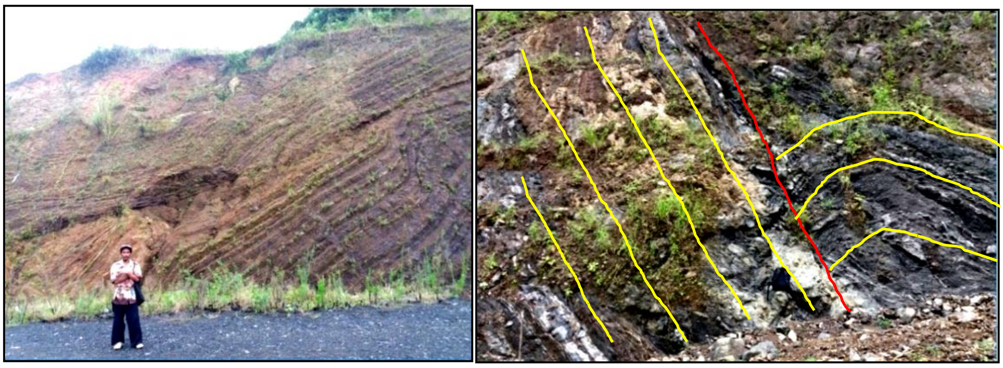


Figure 20 Citarum Formation Sandstone on Access Road to Lower DAM (Upright Sloping Sandstone and in Some Places Experiencing Drag Fault

  There are several types of sandstones observed in the study area, namely bluish-dark sandstones and brown sandstones. Bluish-colored sandstones are generally harder, while weathered brown sandstones are more intensive (Figure 20). The result is that dark-colored sandstones usually have thin soil, while brown-colored sandstones tend to be thicker.

- **Pb Formation (Pb)**

The Pb Formation (Pb) rests on the stoning formation (Omc) and the Citarum (Mts) formation with nonconformities. The Pb (Pb) Formation is largely distributed in the northern and southern regions of the Omc and Mts distribution. The Pb Formation (Pb) consists of Bruffcia Tuff (Br), Shale / Sandstone (Sh / Ss), and Andesite (An). Pb Formation is estimated to be formed in the Tertiary Period Pliocene. The building that will be built above the Pb formation is the Lower Dam. The detailed geological distribution of the location of the Cisokan UCPS region is presented in Figure 21.

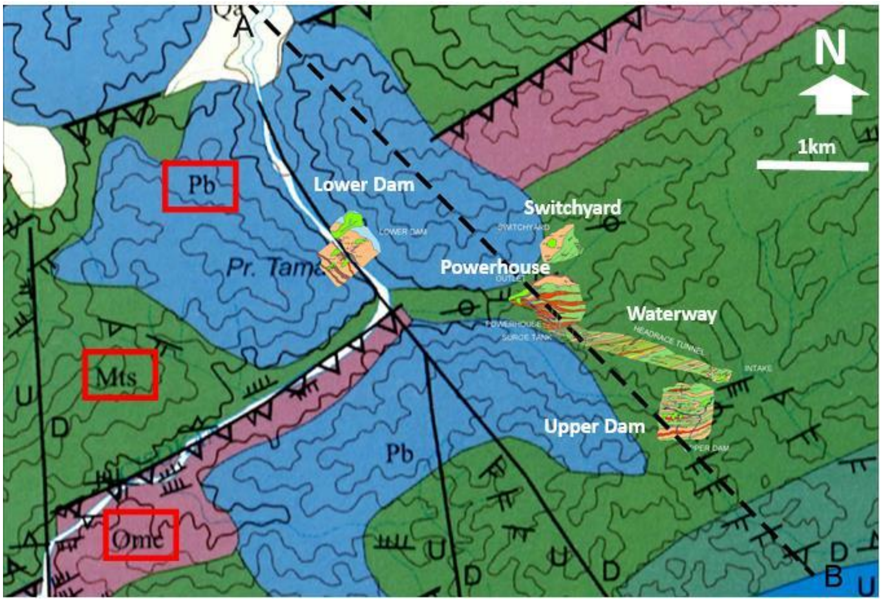


Figure 21. Geological Map of the UPCS Cisokan Area, enlarged from the Cianjur Quadrangle

A geotechnical/geoengineering study was carried out to identify in detail the local geology that compiled the location of the planned building and UP Upper Cisokan facilities. The results of the geoengineering study to identify the local geology of the building plan and the Cisokan UPL facility are as follows (PLN, 2014):

1. The upper dam is located in the middle of the Cirumamis River. The height for river sediment on the dam shaft is +730 m where the width of river sediment is approximately 12 m. The topographical appearance around the upstream dam includes a waterfall with a height of 50 meters located approximately 150 m downstream from the location of the dam shaft and a steep valley located 200 m on the left side of the upstream dam. The rock that forms the foundation for the upstream dam consists of tuffs breccias, sandstones, sandstones and andesite lava. Tuffs and sandstone / shale breccias are the dominant rocks in the upstream dam location.
2. The Lower dam is located on the Cisokan River which has a flow direction from southeast to northwest. River bed elevation around EL. 421 m on the axis of the dam with a width of 35 m. The river channel is on the left and right cliffs upstream of the dam, with land contours that are almost parallel to the river on the dam foundation. Avalanche is on the right bank, about 200 m downstream from the axis of the dam that occurred in 1994. The right and left bank has steep slopes with a slope of about 35° to 40°. Dam rock bed consists of tuff breccias, sandstone / shale, andesite and sandstone / marlite. Tuffa breccia rocks, sandstone / shale, and andesite have contact that is not in harmony with sandstone / napal. Tuffic breccia is the dominant rock in the Lower Dam that will be the bedrock of the foundation. Andesite with a pattern almost parallel to the river is located at the bottom of the left cliff on lower dam.
3. Powerhouse Building Ground level above the Generating Building ranges from EL. 600 m and EL. 750 m. Crown Generating Building around EL. 480 m, therefore the overburden thickness ranges from 120 to 270 m. While the ground surface has a slope of 30° -40°. The geology

of the building area consists of andesite and sandstone / siltstone with sandstone insertions and tuff breccias.

4. Waterway; (1) Intake The Intake Building will be located on the right bank of the Cipateungteung River, a small river with a width of about 2 m and the river bed at EL. 650 m at the Intake location. Weak slope 20-25 ° in the Retrieval Building. Geology in the intake area consists of tuff breccias and sandstone / siltstone. Talus deposits cover the bedrock at the foot of the Intake site. (2) Headrace Tunnel The rocks covering the Headrace Tunnel range from 20 m to 130 m. Geology along the No. Headrace Tunnel line 1 and No. 2 consists of sandstone / siltstone, sandstone, tuffa breccia and andesite. (3) Surge tank The Surge Tank location is at the end of the Headrace Tunnel which is on a small ridge with a Northeast to Southwest direction with EL. 820. Rocks around the location appear to be covered by thick soil. The bedrock consists of sandstone / siltstone and tuff breccias which are spread along the Headrace Tunnel. Surge Tank No. 1 is dominated by sandstone / siltstone and Surge Tank No.2 by tuff breccias. (4) Penstock The upper part of the Penstock consists of alternating layers of sandstone / siltstone and tuff breccias, while the lower part consists of andesite and sandstone / siltstone intersections. (5) Tailrace Tunnel Geology along the Tailrace Tunnel consists of andesite and sandstone / siltstone and sometimes with tuff breccias. The upstream part of the Tailrace Tunnel is dominated by andesite, and the downstream part is sandstone / siltstone. (6) Outlets Outlet buildings are located on steep slopes with a slope of about 50o on the left bank of the Cilengkong River. The geology of the Outlet Building consists of andesite and sandstone / siltstone sometimes with tuff breccias. Sandstone / siltstone.
5. Quarry Investigation has been carried out outside the project site to obtain a source of RCC material and concrete in general. The results of investigations only andesite rocks from the existing Mount Karang Quarry showed sufficient for the needs of the Project.
6. Access Road The Cisokan Hydroelectric Power Plant Project is located in a mountainous area with altitudes ranging from 700m to 1,000m. From the Cijambu River, the Access Road passes through Kamiran Village with an estimated altitude of 700 m and a slope of 20o to 30o. Henceforth Access Road to Cihanjawar with a height of 750 m and steep slopes. Rocks along Access Road consist of tuff breccias, alternating layers of sandstone / siltstone, tuff breccias and massive sandstones. Fresh rocks are exposed along the riverbed or river channel and excavated slopes for existing houses and roads.
7. 500 kV Transmission Line The transmission line will pass through mountainous terrain with an altitude of between 600 m and 1,100 m and a flat area of paddy fields at the height of 300 m. The mountains traversed are composed of Tertiary volcanic deposits and sedimentary rocks, which are partially covered by young volcanic deposits in flat areas. The geology of the hilly regions consists of tuff breccias, alternating layers of sandstone/siltstone, tuff breccias, and massive sandstones.

Hydrogeology

Hydrogeology in the West Java region is influenced by tectonic processes that have taken place since the beginning of the Tertiary sub-era geology time relating to the formation of geological structures and the existence of various types of rocks. Submerging the Indian Ocean Plate under the Eurasian Plate with a subduction zone stretching east-west in the southern part of West Java has resulted in folds/fractures, sedimentation basins, areas of height, and the emergence of volcanic activities marked by volcanic ranks of east-west trending in the central part of West Java. Hydrogeological conditions in the Cisokan River Basin are shown in Figure 22.

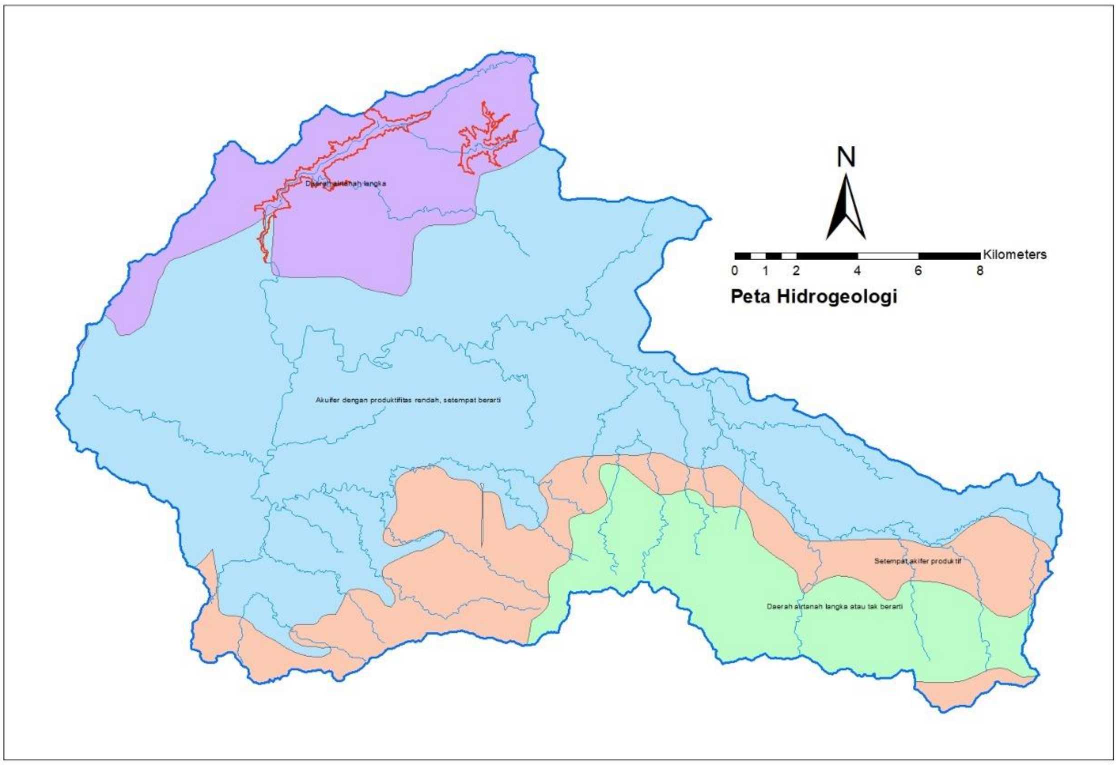


Figure 22. Maps of Hydrogeology Cisokan Watershed

Based on the Hydrogeological Map it is known that the Cisokan watershed has 4 formations: local productive aquifer formation, rare or meaningless groundwater area formation, rare earth ground area formation, and aquifer with low local productivity means. The largest formation is the type of aquifer formation with local productivity means that the area reaches 21,551.75 ha. These formations generally have a very low continuity rate; limited amounts of shallow groundwater can be obtained in valleys or weathering zones. While the area of the local productive aquifer in the Cisokan watershed area is 6,395.19 ha. The formation is an aquifer with a very diverse continuity; groundwater is generally not used because of the deep groundwater level; local springs can be used, while the area of water formation or meaningless water sources and the extent of scarce groundwater in the Cisokan watershed are 5,043.68 ha and 5,232.50 ha, respectively.

D. Soil

Type of Soil

The aspects of soil type seen in this study are soil sensitive to water erosion, soil fertility, sufficient soil depth. Based on secondary data obtained, data on soil types in the Cisokan watershed area consist of 3 (three) classes of soil types, namely Insensitive, Somewhat Sensitive, and Sensitive Soil. Insensitive soil types include Alluvial, Glei soil, Planosol, Gray Hydromerf, Water Latics. Sensitive soil types include Andisol, Laterite, Grumusol, Podsol, Podsolic, whereas the nature of Soil that is somewhat sensitive is Latosol.

Table 8. Soil Types and Sensitivity un the cisokan watershed

NO	Type of Soil	Information	Area (ha)	Percentage
1	Alluvial, Glei soil, Planosol, Hydromorph Gray, Water laterite	Not sensitive	15,532	38.82%
2	Latosol	Somewhat sensitive	9,569	23.92%
3	Andisol, Laterit, Grumusol, Podsol, Podsolic	Sensitive	14,911	37.27%

Based on the analysis, it is known that the area of soil types in the Cisokan watershed is not sensitive at 15,532 ha (38.82%), the type of soil with a rather sensitive category has an area of 9,569 ha (23%), and the type of soil in the sensitive category has an area of 14,911 (37, 27%). Distribution of soil types based on the sensitivity (red), green (slightly sensitive), cream (not sensitive) is shown in Figure 23.

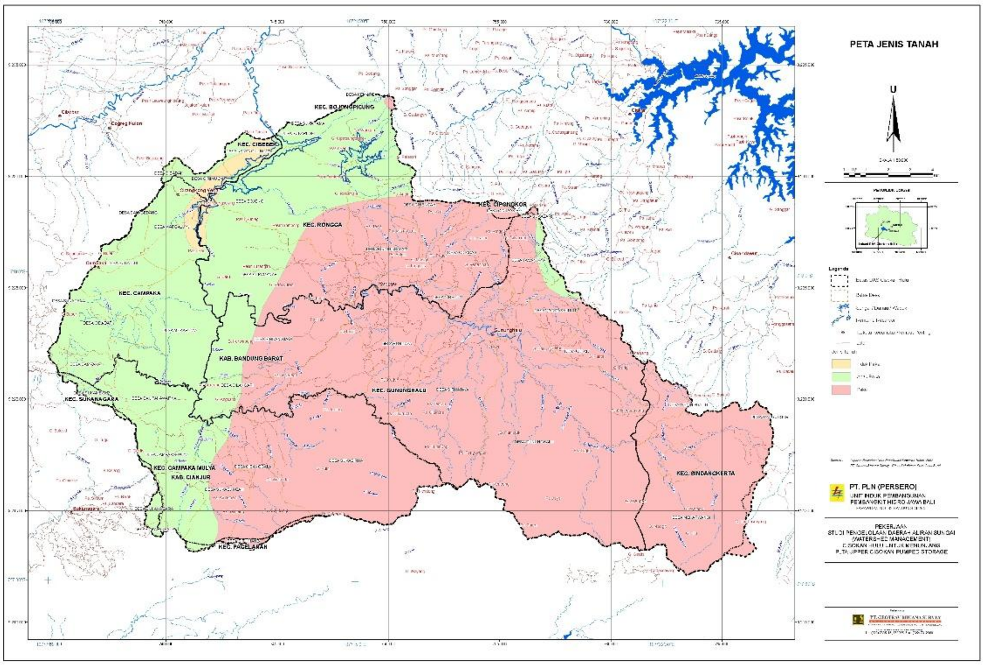


Figure 23. Map of Distribution of Soil Types based on their level of sensitivity in the Cisokan River Basin

Soil Solum

Soil solum in the Cisokan watershed according to data of the solum (effective depth) scale of 1: 250,000 from BPN-RI ranges from 75 cm to 150 cm. A list of the areas of each solution in the Cisokan watershed is shown in Table 9.

Table 9. Soil Solum in Cioskan Watershed

No.	Solum	Area (Ha)	Persentage
1	75 – 90 cm	7,581	20.25%
2	> 90 cm	12,521	33.4%
3	90 – 150 cm	17,194	45.92%
4	Waterbody/river	146	0.39%
	Jumlah	37,441	100.00%

Based on the analysis results it is known that 45.92% (17,194 ha) of the Cisokan watershed area has a soil solum of 90-150 cm, 33.44% (12,521 ha) has a soil solum> 90 cm, 20.25% (7,581 ha) has a soil solum 75 - 90 cm. And 0.39% (146 ha) is water / river. Any soil solum in the Cisokan watershed is shown in Figure 24.

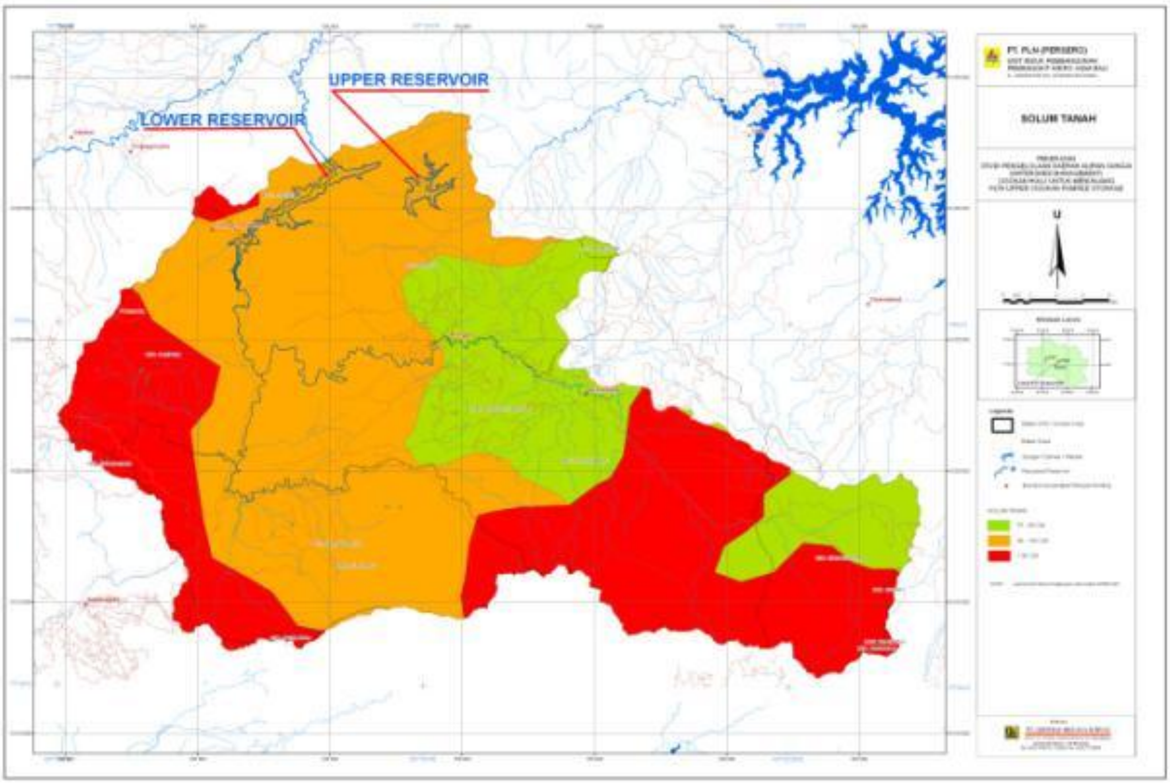


Figure 24. Distribution of Solum Land in the Cisokan River

4.2.2 Hydrology

A. Catchment Area

The Upper Cisokan Pumped Storage Power Plant (UCPS) has two dams namely a lower dam and an upper dam. The lower dam is on the Cisokan River, while the upper dam is on the Cirumamis River which is a tributary of the Cisokan River.

The lower dam UCPS Cisokan Catchment area is 374 km^2 with an actual area of 355 km^2. This catchment area has several tributaries that flow into the Cisokan River as the main river. The flow from the upper Dam also flows into the Cisokan River which originates from the Cirumamis River and the Citapos then joins the Cisokan River.

Catchment area for the upper dam is 10.5 km^2. Cirumamis River is the main river in the upper dam area paint cement. And there are several streams from other rivers such as Cilawang, Cipateunteung, Cibima, and Cidongke rivers. Eventually, the Cirumamis River will flow and join the Cisokan River.

Watershed boundary identification using a topographic map (Map of Indonesian Earth) Scale 1: 25,000 relief approach as a basis for determining the watershed area, obtained an overview of the situation of the catchment area (catchment area) for the Upper Cisokan Pumped Storage Power Plant (UCPS) both upper and lower dam. The UCPS Cisokan hydropower situation map is presented in Figure 25.

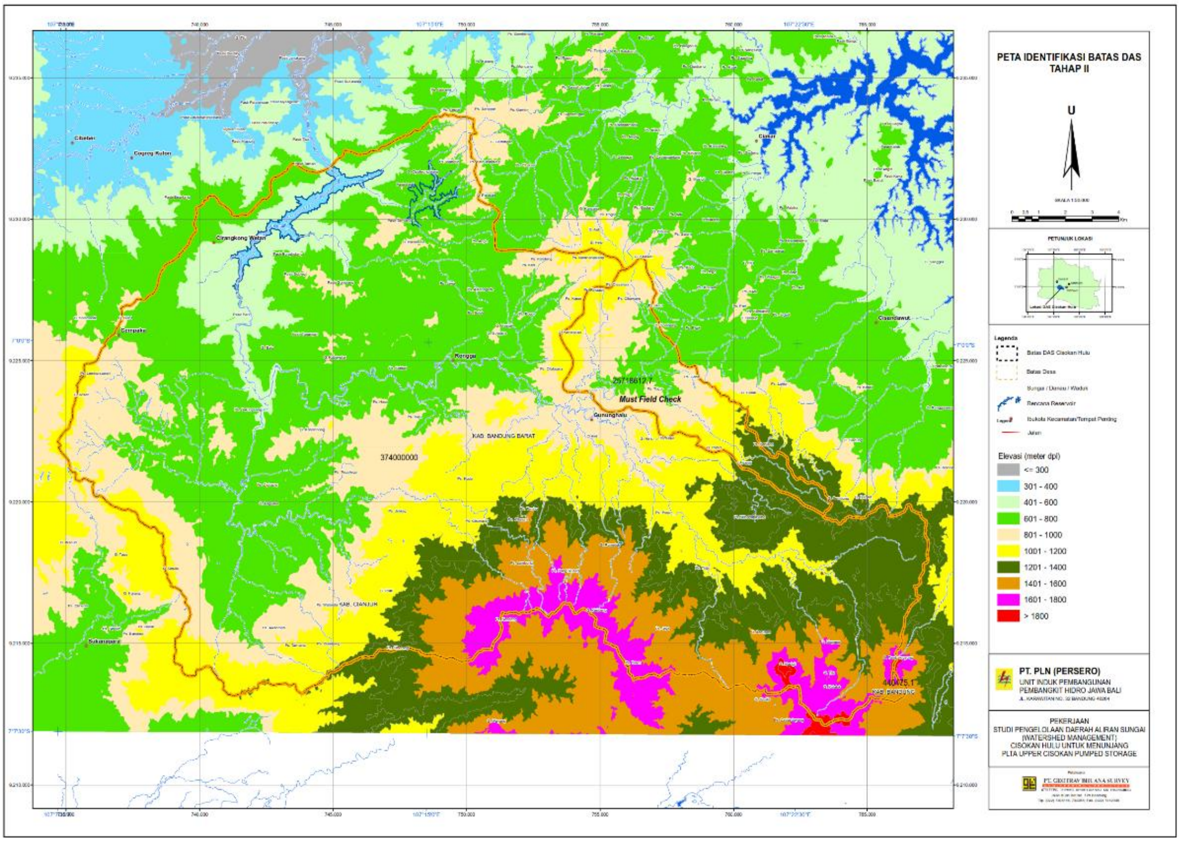


Figure 25. Catchment Area Cisokan Watershed

The hydrology of the Cisokan River Basin is affected by rainfall and is seen to have low flow season conditions and high flow seasons, consistent with the rainy season. Upper tributaries of the region may experience a long period of low discharge but do not look dry during the dry season, and maybe filled with water from volcanic rocks and coral rocks. There is gravity taken from rivers and tributaries for irrigated rice fields, fisheries and the use of water not to drink. The most significant water withdrawal is 6 m^3/s, from the Cihea Irrigation system downstream of the project area.

The Cisokan watershed is the Cisokan river catchment that flows into the Upper Cisokan and Lower Cisokan weir plans. The Cisokan watershed consists of many watersheds that flow through rivers that are spread throughout the watershed. One of the catchment areas of the Cisokan watershed which is the upper Cisokan before entering the lower Cisokan weir is the Cirumamis River. Upper Cisokan Dam is part of the Cisokan tributary that flows into the lower Cisokan dam. The catchment area for the Upper Cisokan Dam runs through the Cisokan tributary, the Cirumamis River.

Drainage density varies in the Cisokan watershed reflecting the relief conditions and lithology of the constituent rocks. Drainage density indicates that the Cisokan watershed has several levels of drainage rate based on the physical characteristics of the land. The difference in drainage density shows the difference in the lithology of rock and landscape. The eastern region shows a lower drainage density, this indicates that the level of infiltration of rainwater into the soil in the soil is higher, or the rock lithology is more compact or porous so that water flows into the relief layer or can also occur because the rocks do not experience erosion.

The drainage patterns that are formed are mostly semi-parallel, semi-dendritic, dendritic, and trellis. The semi-parallel pattern is dominant inland with a steep slope, upstream. Dendritic and semi-dendritic occur in the Das basin area leading downstream. Trellis flow patterns occur in several places locally mainly due to structural processes that shape the landscape of the region such as the Cijambu river along the access road which tends to form trellis flow patterns. The detailed spatial distribution of drainage in the Cisokan UCPS region is presented in Figure 26.

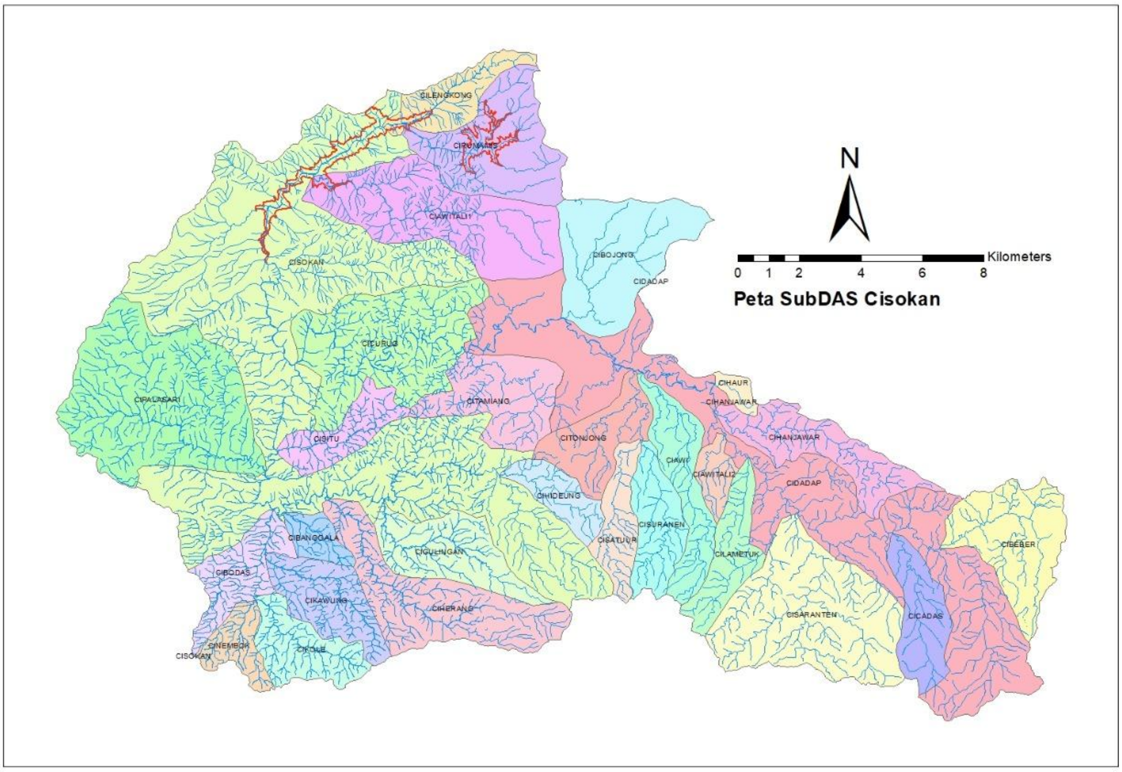


Figure 26. Cisokan Watershed Drainage Pattern

The area of the Cisokan River Basin is 355 km^2. which have tributaries include the Cirumamis River and the Cilengkong River. Cilengkong River is a river that flows into the main channel, the Cisokan River has a higher river gradient with river bed characteristics in the form of andesite rocks from freezing rocks from volcanoes. The area of the watershed which is the catchment area of the Cisokan Upper Dam plan is the Cirumamis River Basin with 10.5 km^2, covering the Citapos, Cipateungteung, Cilawang, Cidongke, and Cimarel Rivers. Cirumamis River. Cirumamis watershed drainage is not too tight because of the high slope, formation of hilly slopes with compact rock lithology so that the erosion of the channel is not too strong. The spatial distribution of Cijambu Sub-watershed is presented in Figure 27.

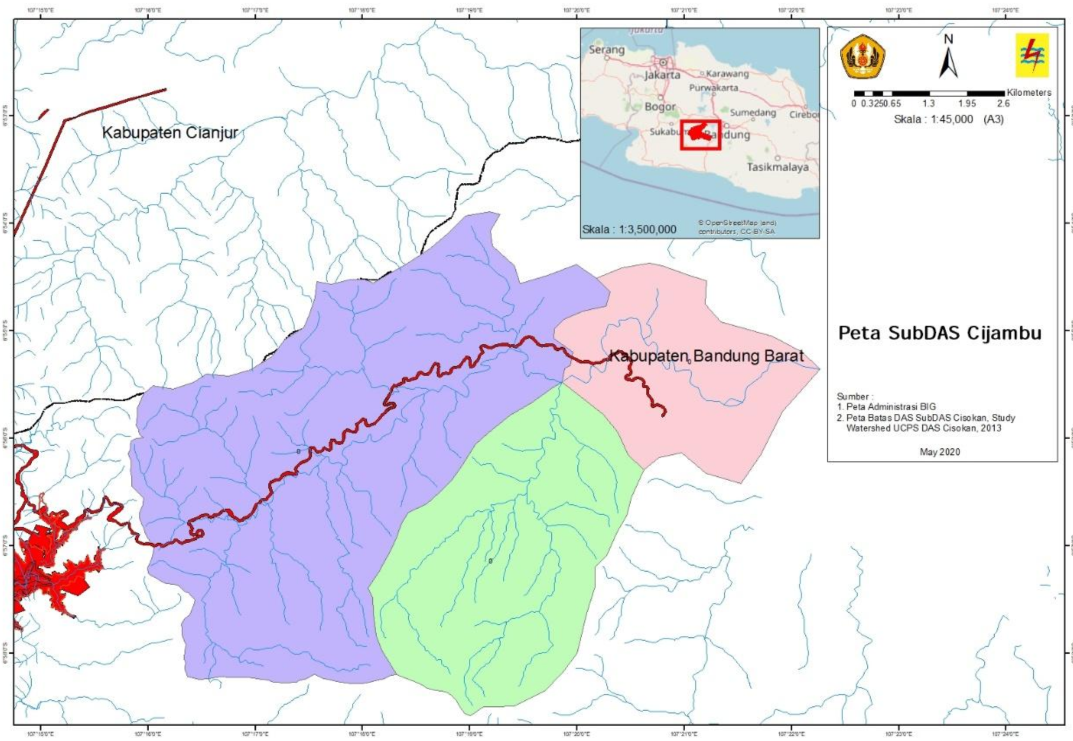


Figure 27 Cijambu Sub-watershed

The Cijambu River is located within the project area along the planned access road, but is not part of the Cisokan River Basin so that the ecology of the Cijambu River is closely related to the dynamics of the access road, not the Cisokan River Basin. The Cijambu watershed is along an access road which morphologically forms like a bird's feather, this is because the catchment area is controlled by the geological structure of the location. Cijambu River is a river that has the river valley intensively so that it forms cliffs on either side of the river but the river gradient is not too sharp. The river order assessment shows that the value of the Cijambu river order is only to second-order (Determination of the river order according to Horton).

Based on the drainage pattern shows that the drainage pattern of the Cijambu River is included in the trellis pattern. The location of the access road is in the Cijambu watershed which has an area of around 65.78 km^2. The Cijambu River is a river that is affected by the construction of an access road and can be used as a control point for observation of erosion and sedimentation from changes in land use on the Access Road.

B. River Characteristic

UCPS is crossed by several rivers including the Cisokan River, Cirumamis River, Cijambu River, River, Cilengkong, and other small rivers. An explanation of the characteristics of each river is as follows:

Cisokan River

The Cisokan River is part of the central Citarum River Basin, which flows into the Cirata reservoir as an estuary. The Citarum River drains water from much of West Java, including the city of Bandung, and includes three hydropower plants (including Cirata and Saguling).

The upstream of the Cisokan River is in a forest and agricultural area with a relatively low density of settlements so that there are dams or other obstacles in the natural river flow upstream of the project site. All tributaries flow throughout the year, but sometimes they experience a long period of low discharge during the dry season because the nature of lithology, relief and land use on the ability to store water greatly determines the fluctuation of the discharge. The characteristics of the Cisokan river body in the dam plan area are presented in Figure 28.

Figure 28. Cisokan River (Left: Low flow; Right: Condition: Flood)

Cijambu River

The Cijambu River is a tributary of the Saguling reservoir, flowing water through a steep incised hill with a steep river bank cliff before it flows into the Saguling dam body of water (Saguling Reservoir). The river flow gradient is relatively flat with characteristics of rocky water bodies with a narrow terraced river shaped river. Water quality monitoring is carried out to determine the dynamics of erosion that occur along the access road, runoff that occurs along the access road, as well as the quality of waste due to erosion and contamination of domestic activities and other activities that occur along the Cijambu River watershed when the PLTU development activities and when the PLTU operates. The characteristics of the Cijambu River water body are presented in Figure 29.

Figure 29. Cijambu River (Left: Low flow; Right: Condition: Flood)

Cilengkong River

The Cilengkong River flows from the Cilengkong Sub-watershed which empties into the Cirumamis River before entering the Cisokan River. Access roads that are close to the upper and lower DAM areas are included in the Cilengkong Sub-watershed so that the river can be used as a location for monitoring water quality due to sedimentation and erosion from the access road. Cilengkong River is relatively small in size, which is located on a sloped area that has a swift and clear flow. The upstream part of the Cilengkong River is used by people in the Cilengkong village. The downstream part of the Cilengkong River is used by people in Lembur Sawah village. The characteristics of the Cilengkong river water body are presented in Figure 30.

Figure 30 Cilengkong River

Cirumamis River

Cirumamis River is the main river in the upper dam Cisokan. The Cirumamis River in the upstream is relatively small and getting bigger towards the downstream because it receives an estuary from the Cilengkong River before entering the Cisokan River. Cirumamis river flow in the upstream towards the downstream is very heavy. This is influenced by the condition of the slopes around the river that is steep and narrow, so as to form a waterfall called Curug Walet. Characteristics of water bodies and conditions of rivers in the Cirumamis river are presented in Figure 31.

Figure 31 Cirumamis Upstream (Left) and Downstream (Right)

Characteristics of water bodies are information about the relief of water bodies, the basic conditions of water bodies, water body profiles and flow characteristics. The characteristics of water bodies in the rivers are shown in Table 10.

Table 10 River Characteristic in the Study Area

River	Dimension*		River Condition	Cliff Material and Riverbed
	depth	width		
Cijambu	10 -30 cm	15 – 18 m	stream , calm	large rocks, gravel, sediments, sand,
Cirumamis	20 – 50 cm	7 – 10 m	swift, calm, flowing	large rocks, gravel, sediments, sand
Cilengkong	10 – 30 cm	6 – 10 m	swift, calm, flowing	weathered rocks, sediments, sand
Cisokan	30 – 150 cm	20 – 30 m	swift, calm, flowing	River rock cliffs, large gravel, small gravel, sand

C. Groundwater

Groundwater Level

Groundwater level measurement is one of the environmental parameters to determine the condition of the groundwater quantity. Measurement of groundwater level is done by measuring the depth of the ground surface to the ground water level. Groundwater level measurements were carried out in 3 locations around the UCPS Cisokan project, in Kp. Bojongpari Karangsari Village, Kp. Cibima Sukaresmi Village, and Kp. Cibule Karangnunggal Village.

Measurement of groundwater level in Kp. Bojongpari Karangsari Village is conducted periodically every semester from 2014 to 2018 semester I. The measurement results show that the groundwater level ranges from 1.53 m - 3.1 meters. Changes in groundwater levels that occur tend to increase every year. in 2018 the first semester the groundwater level reached 2.6 meters. Changes in groundwater excise rates in Kp. Bojongpari Karangsari Village is shown a graph of changes in groundwater level presented in Figure 32.

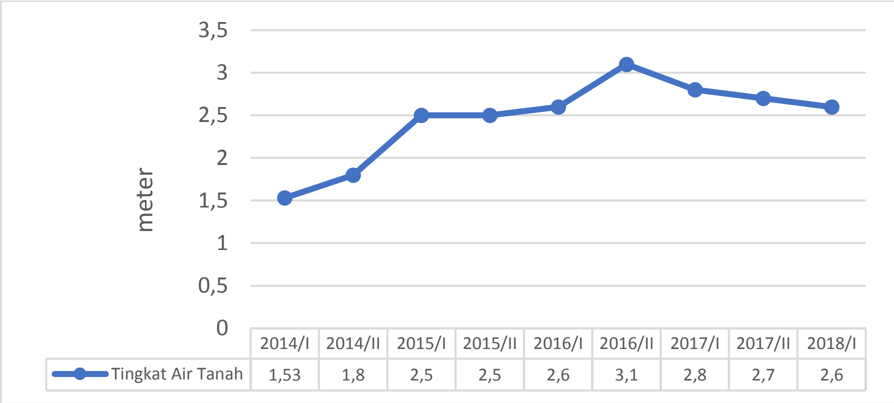


Figure 32. Groundwater level at Kp. Bojongpari Karangsari village

Measurement results in kp. Cibima Sukaresmi Village shows groundwater levels ranging from 1.12 m - 6 meters. Changes in groundwater levels that occur tend to increase every year. in 2018 the first semester the groundwater level reached 3.1 meters. Changes in groundwater excise rates in kp. Cibima Sukaresmi village is displayed on the graph presented in Figure 33.

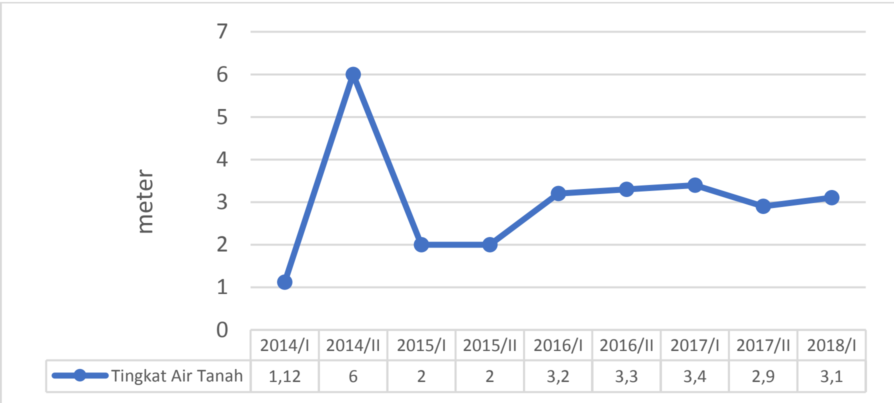


Figure 33. Groundwater level at kp. Cibima Sukaresmi Village

Measurement results in Kp. Cibule Karangnunggal Village shows groundwater levels ranging from 0.8 m - 4.1 m. Changes in groundwater levels that occur are very volatile. In the 2018 semester I the groundwater level will reach 2.1 meters. Changes in groundwater excise rates in Kp. Cibule Desa Karangnunggal is shown in the graph presented in Figure 34.

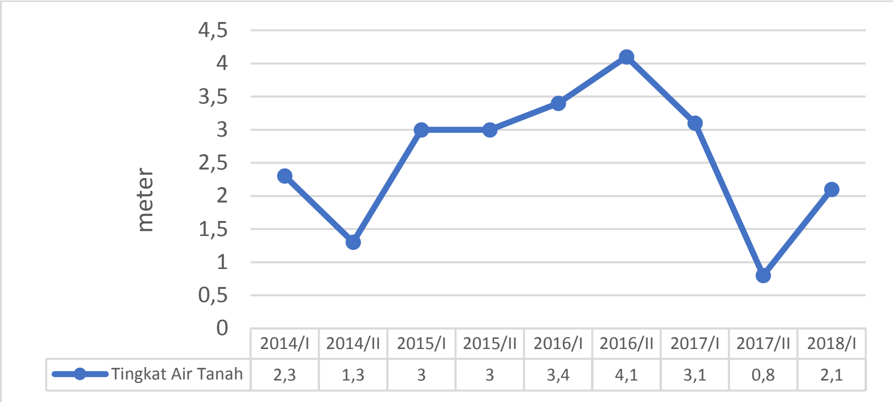


Figure 34. Groundwater level at Kp. Cibule Karangnunggal Village

Groundwater Quality

The quality of groundwater as clean water around the Cisokan UCPS project area is still very good. This is shown from waterquality measurements conducted at several locations around the project area. Monitoring groundwater quality is based on clean water quality standards in the Regulation of the Minister of Health Number: 416/MenKes/PER/IX/1990 regarding Requirements and Supervision of Water Quality. The measurement results at each sampling location are shown in Table 11.

Table 11. Resume Groundwater Quality Conditions at Sampling Locations

Location	Coordinat	Years	Water Quality Condition
UPP Office	S 06 55' 52,50'' E 107 21' 25,32''	2019/I	All parameters are still below the Clean Water quality standard required in Indonesia
Mr. Amin House Kp. Cimega	S 06 56' 42,4'' E 107 21' 40,4''	2019/I	There are several parameters above the quality standard, such as Turbidity (64.50 NTU), Nitrate as N (12.1123 mg / L), and Permanganate Value of KMNO4 (16.40)
Mr Cahyo house Kp. Cimega	S 06 56' 42,4'' E 107 21' 41,9''	2019/I	All parameters are still below the Clean Water quality standard required in Indonesia
Engineering Service office	S 06° 55' 54,0" E 107° 21' 23,8"	2018/II	All parameters are still below the Clean Water quality standard required in Indonesia
Water Tank A Sarinagen Village	S : 06° 55' 51,72" E : 107° 20' 16,07"	2017/II	All parameters are still below the Clean Water quality standard required in Indonesia
Water Tank B Sarinagen Village	S: 06˚ 55' 50,13" E: 107˚ 21' 34,33"	2016/II	All parameters are still below the Clean Water quality standard required in Indonesia
Rumah Contoh Sarinagen Village	S: 06˚ 55' 53,40" E: 107˚ 21' 28,28"	2016/II	All parameters are still below the Clean Water quality standard required in Indonesia

Based on the results of measurements at each location it is known that the temperature is the parameter that most often does not comply with quality standards. This is because at the time the measurement of water temperature is the same as the ambient air temperature. Even so, the temperature of clean water is still safe as clean water. The measurement of groundwater quality carried out at the location of the house of Mr. Amin Kp. Cimega in 2019 found that there are several parameters that exceed the required clean water quality standards. The cause of the condition is indicated due to seepage/weathering from Saguling reservoirs.

D. Surface Water

Low Flow

The low flow rate at UCPS is influenced by the water demand in the Cisokan Dam which is located downstream of the Cisokan River. Water flow from UCPS must meet the needs of the Cisokan Dam as the main beneficiary of the Cisokan River flow with the main designation, namely agriculture. Observations made at the Manglid and Cisokan Weir discharge stations throughout 2015-2018 show that when the discharge at the Manglid station was zero (ie 23 - 29 October 2015), irrigation in the Cihea channel was recorded at a minimum value of 0.22 m^3/s. Cisokan Dam takes up about 80% of the flow rate when the discharge at the Manglid station is less than 1 m3/s. Water retrieval at Cisokan Dam is at 50% condition when the discharge value at the Manglid station is worth 1-5 m^3/s.

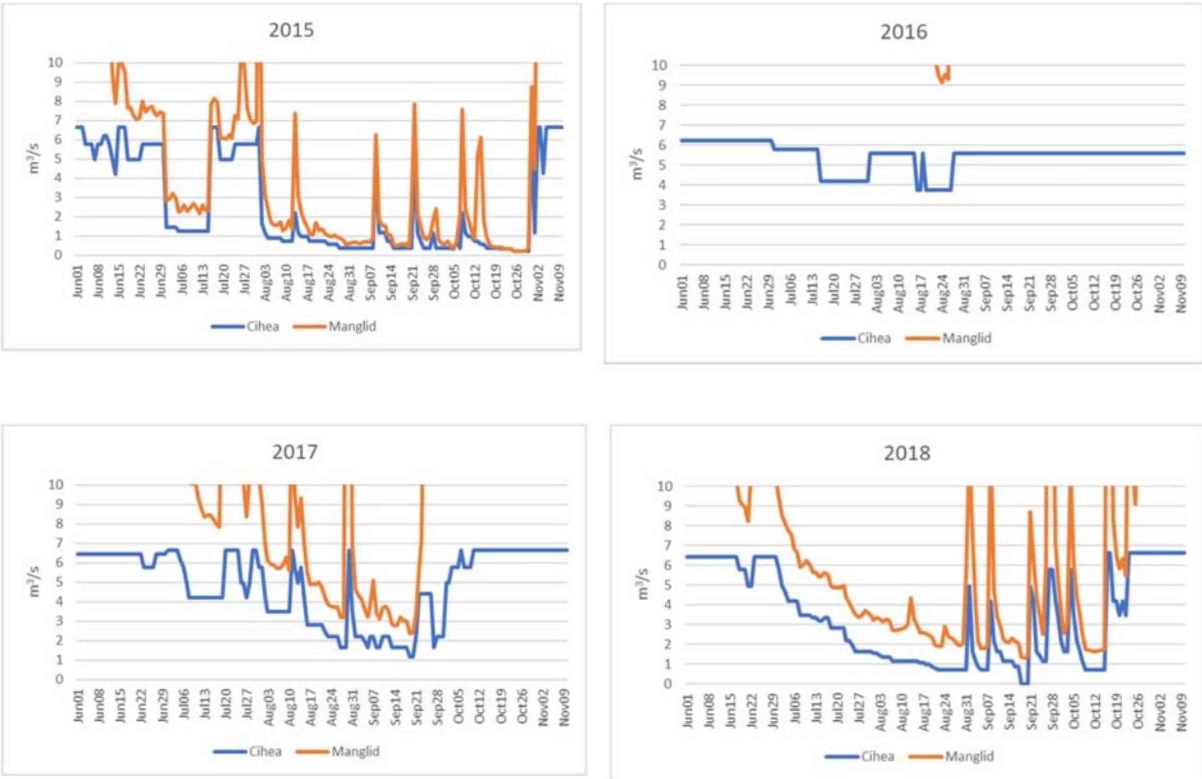
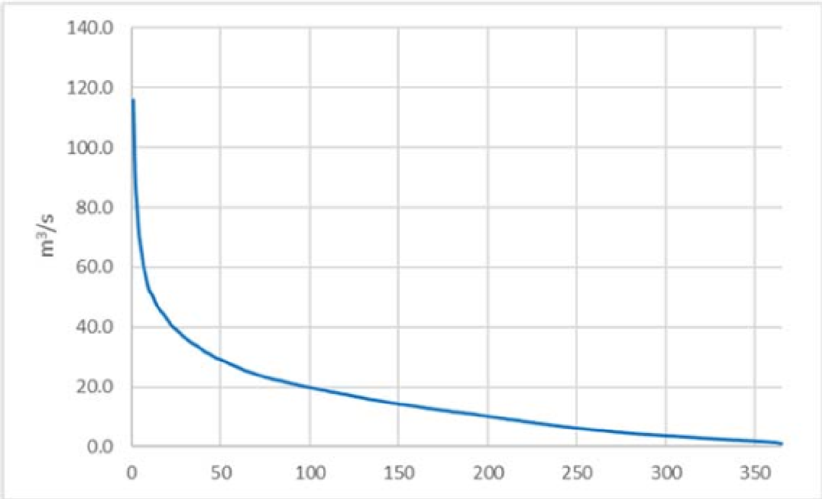


Figure 35 Comparison of Manglid Station Discharge and Cisokan Dam during the Dry Season

Figure 35 shows the pattern of water uptake in the Cihea irrigation channel during the dry season. Based on that, it can be assumed that the minimum current irrigation water requirement in Cisokan Dam is 0.22 m^3/s and 6 m^3/s at maximum conditions. The flow duration curve formed in the Cisokan River is shown in Figure 36.



Days	95	185	275	355
Q (m^3/s)	20.4	11.4	4.76	1.7

Figure 36 Cisokan River Flow Duration Curve

High Flow

High flow at the lower DAM UCPS is approximated by the flood discharge probability of the Cirata Dam design. Analysis on the upper DAM is not possible to calculate using design flood discharge modeling because the area is relatively small, so the flood discharge approach is carried out by means of a daily maximum discharge analysis from the discharge measuring station. The results of the modeling analysis are then compared with the flood discharge method based on the Indonesian National Standard (SNI) No. 2415: 2016 (Figure 37).

Dam Site	Catchment Area (km^2)	Item	PMF	Return Period (Year)						
				10000	1000	100	20	10	5	2
Upper Dam	10.5	$Q_m(m^3/s)$	333	230	185	133	98.0	86.0	74.0	42.7
		$W_{24h}(10^6m^3)$	4.24	2.47	2.06	1.61	1.25	1.10	0.94	0.69
Lower Dam	374	$Q_m(m^3/s)$	2430	1430	1160	891	460	370	284	173
		$W_{24h}(10^6m^3)$	104.8	60.3	48.4	37.0	29.0	16.8	13.8	9.01

Figure 37 Modeling of Design Flood Discharge at UCPS Upper and Lower DAM

There are several evaluation methods in determining repeat periods that can be used in SNI, including; Gumbel, Normal Log, Pearson Log, Hydrograph Unit, Nakayasu, Gamma I, ITB I, ITB II Melchior, Werduwen, etc. Flood discharge analysis is performed on the Manglid station discharge data from 2002 to 2018 using the Gumbel probability method. The data used is the annual average discharge data for 16 years. The results of calculations using the Gumbel flood discharge analysis at 10,000 years return period of 1,069 m^3/s, while using modeling flood discharge modeling at 10,000 years return period of 1,430 m^3/s.

Water Quality

Water quality observations are carried out every semester from 2012 to 2019. Water quality observations are carried out on the Cirumamis River, Cilengkong River, and Cisokan River which are the main rivers at UCPS. Other observations were made on the Cijambu River along the access road and several other rivers with the aim of obtaining more complete information related to the flow in each river catchment area.

The parameters monitored refer to the West Java Regional Regulation No. 39 of 2000 concerning water allotment standards and water quality standards for the Citarum River and its tributaries in West Java. Graphs of BOD and COD contamination values in water bodies in several river basins in the UCPS region are presented in Figure 38 and Figure 39.

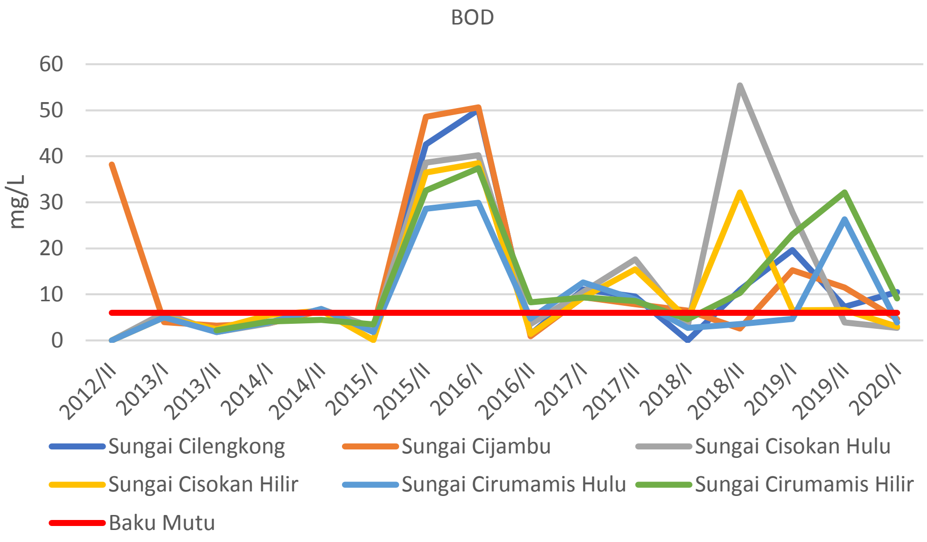


Figure 38 BOD levels in rivers in the Study Area

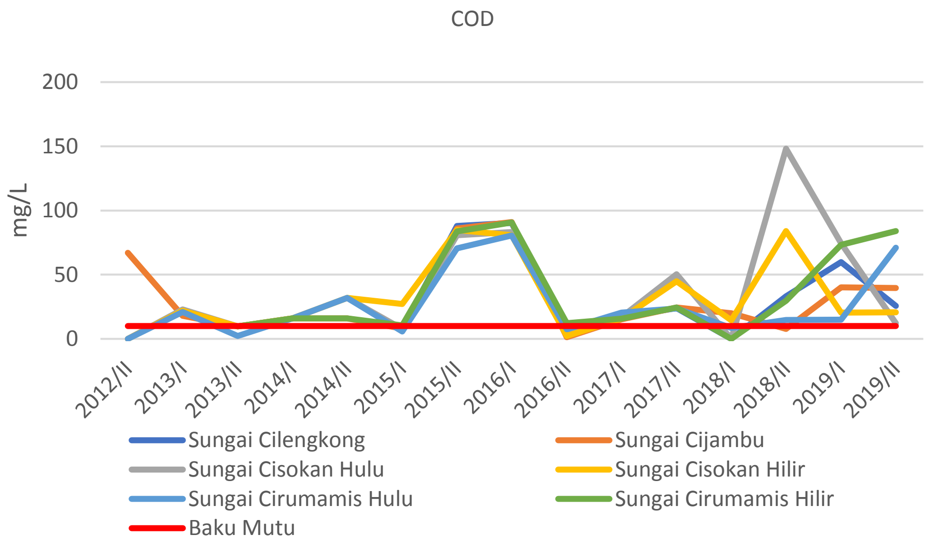


Figure 39 COD levels in rivers in the Study Area

BOD and COD parameters during 2012-2019 showed fluctuations in all rivers in the study area. From 2015 to 2016, BOD and COD levels in all rivers have increased to exceed the specified quality standards. That value goes down again then fluctuates again. 2019 as a year of observation shows a downward trend below the quality standard.

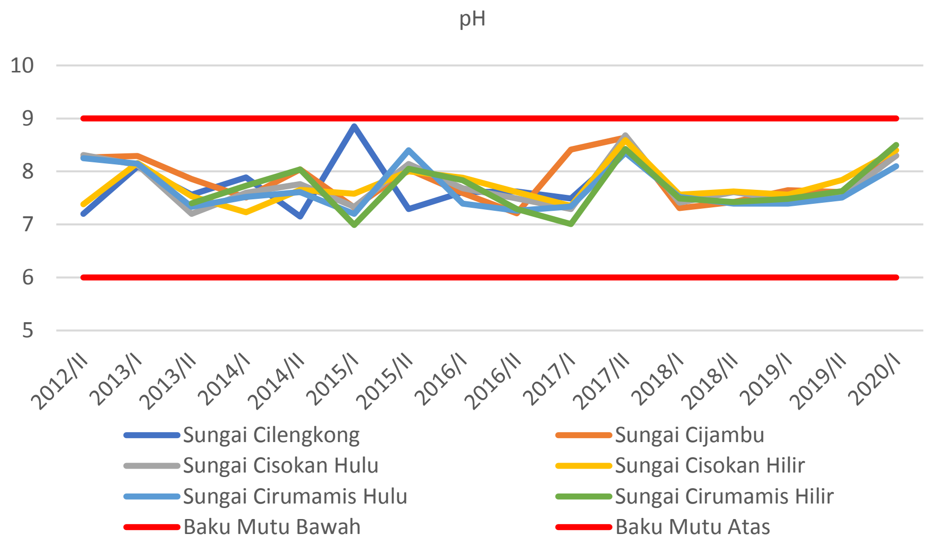


Figure 40 PH levels in rivers in the Study Area

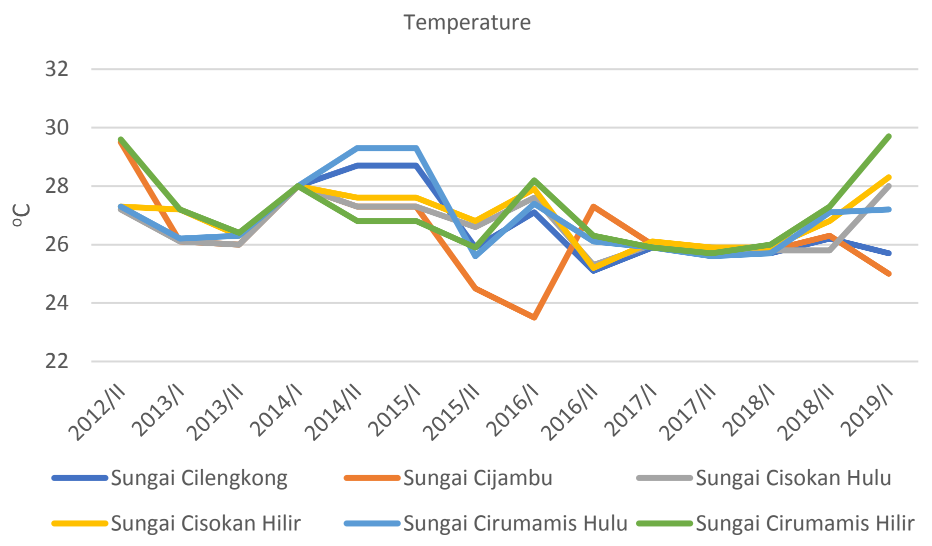


Figure 41 Temperature levels in rivers in the Study Area

PH levels in all rivers in the study area show fluctuations every year. This value is still within the established quality threshold, which is between 6-9. The temperature on the surface of the river in the study area also shows fluctuations that range between 2-3oC at each observation.

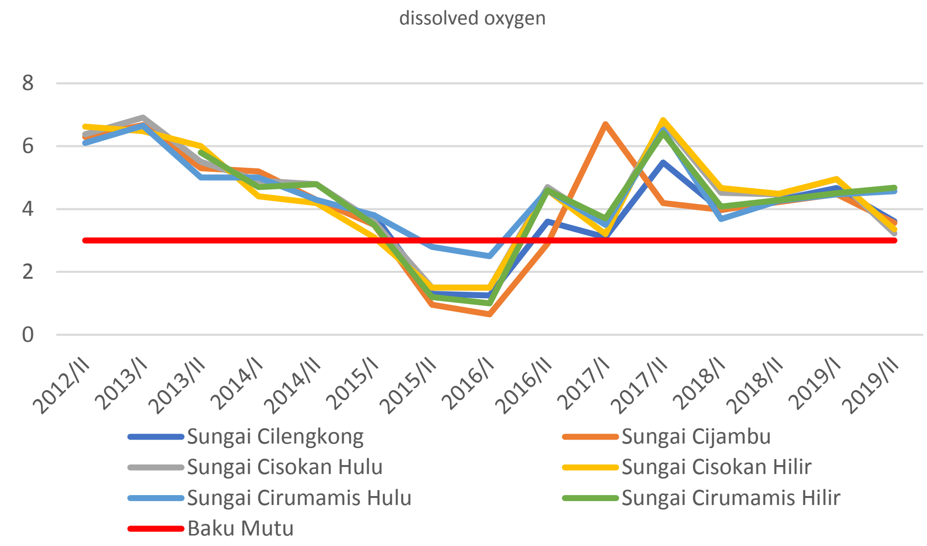


Figure 42 Dissolved Oxygen levels in the Study Area

Dissolved oxygen content (DO) in several rivers in the study area is in good condition, indicated by values that are above the quality standard. The higher the DO value compared to its quality standard indicates the better the water conditions in the region. Guidelines belonging to the Government of West Java Province states that the value of dissolved oxygen is required to be more than 3.

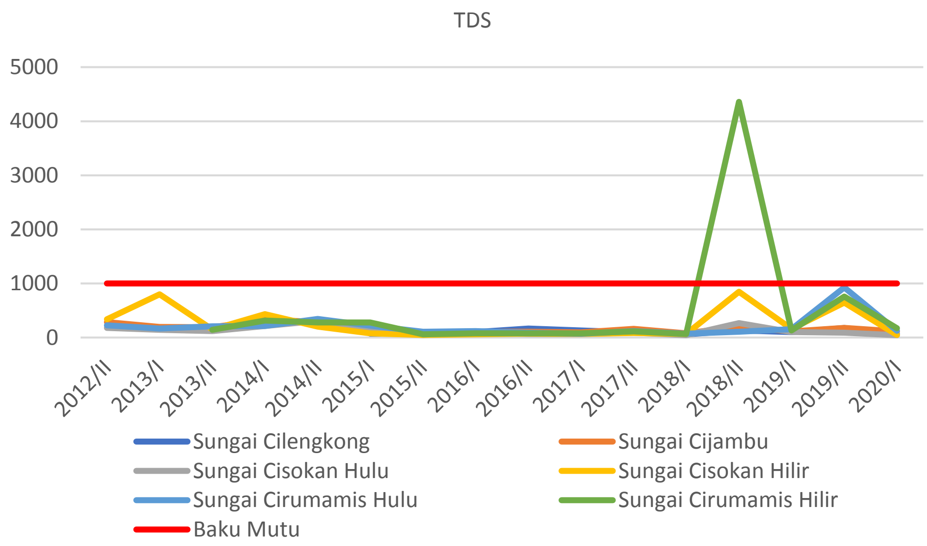


Figure 43 TDS Level in the Study Area

The results of environmental monitoring show that the amount of dissolved solids in several rivers in the study area is below the quality standard set by the West Java Provincial Government from 2012 to 2017. One value crosses the quality standard threshold occurs in the Cirumamis Hilir River in 2018 and then returns again under the established quality standard, this shows that in 2018 there has been a large erosion of land or can also be in the form of landslides.

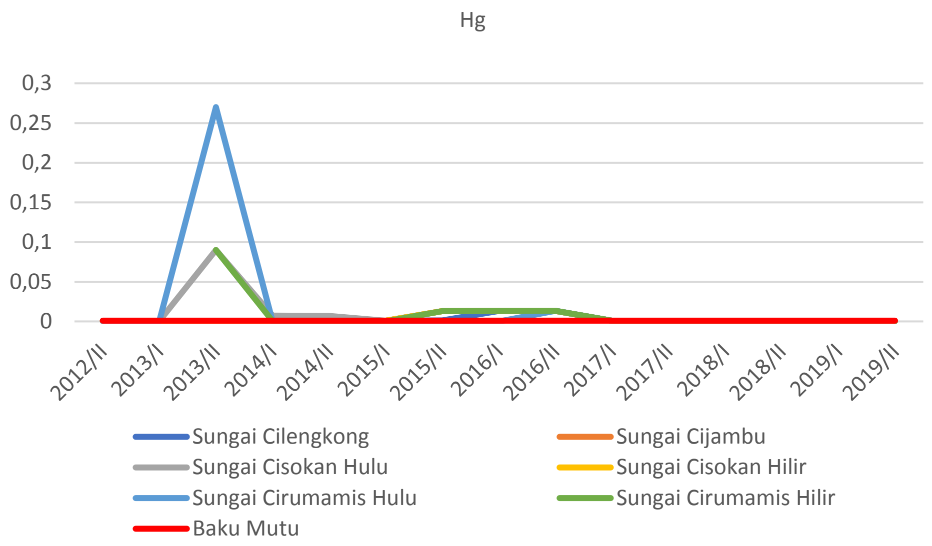


Figure 44 Hg levels in rivers in the Study Area

The 2011 EIA report stated that there was an illegal gold mining activity near the study area. The results of the monitoring of mercury content in several rivers around the UCPS area show that the mercury content in the Cirumamis and Cisokan Rivers exceeded the quality standard set in 2013. The mercury content in the river gradually decreased in 2015-2017, up to the results of monitoring in 2018- 2019 shows that the mercury content in rivers in the study area has not been recovered (Figure 44).

Erosion and Sedimentation

Erosion on the Cisokan Sub-watershed was measured in 1991-1992, then continued in 2000-2001 at the Manglid observation station and observation point in Kampung Cibule, Karangnunggal Village.

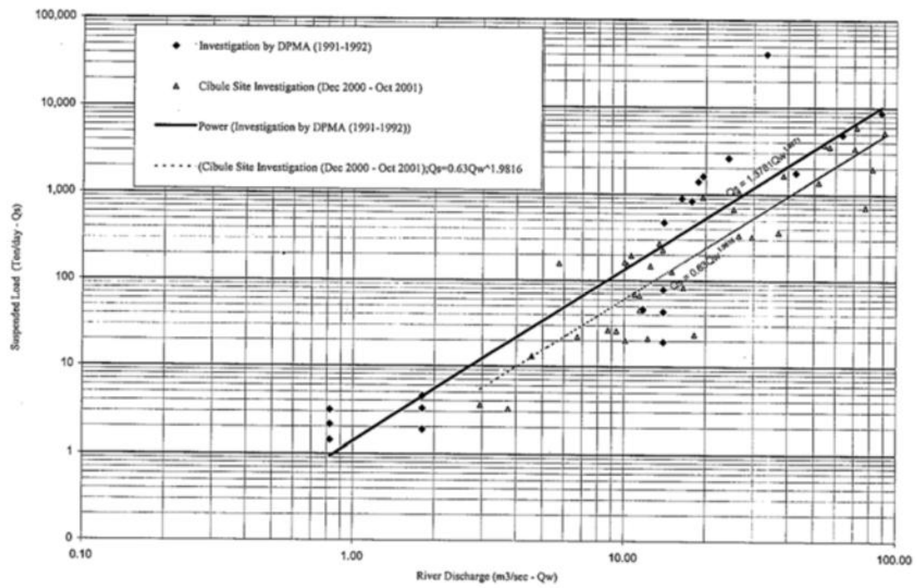


Figure 45 Relationship Between Sedimentation and River Discharge

The most recent sedimentation and erosion data was approached using bathymetry measurements at the Saguling DAM. Bathymetry measurements in 2004 and 2016 were used assuming that the Cisokan Sub-watershed is an upstream part of the Saguling DAM, so that the Cisokan Sub-watershed contributes to sedimentation in the Saguling DAM.

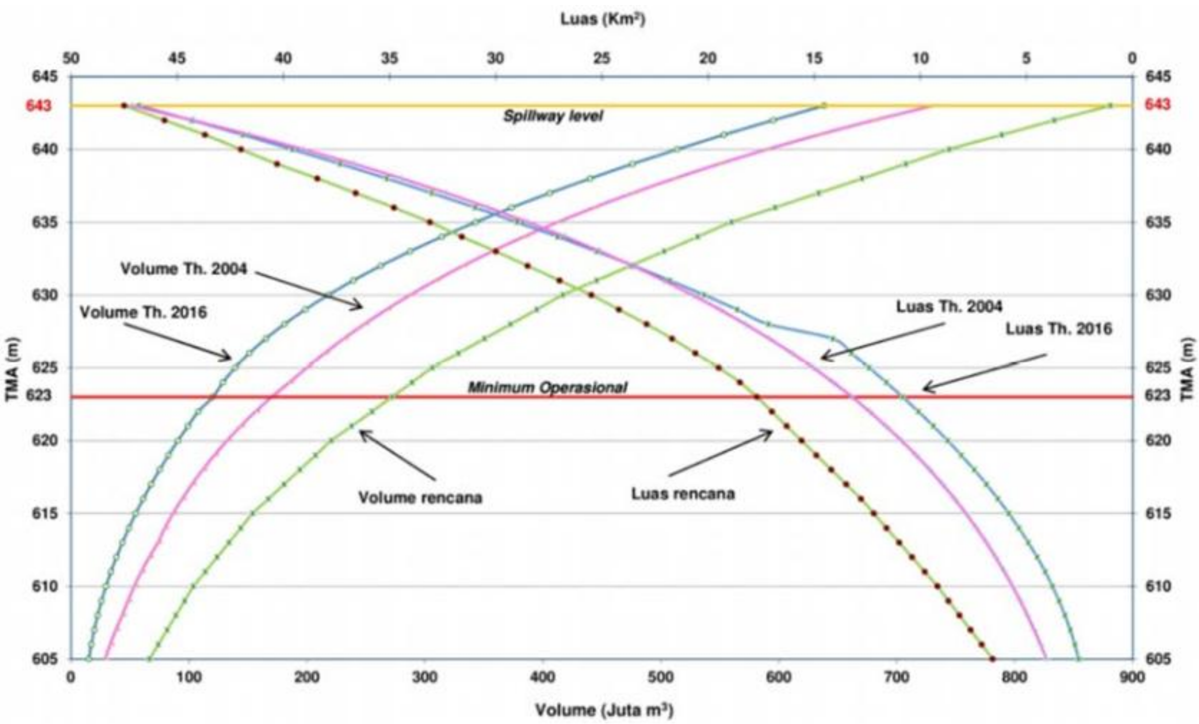


Figure 46 Bathymetry Survey at Saguling DAM

Bathymetry survey results show that erosion occurred at 7.89 million m^3/year or 3.456 m^3/km/year. The results of the 2019 UCPS Hydrology study compared the seven results of erosion rate measurements in the Cisokan watershed. The erosion rate used as the basis for the design of the UCPS design was 1.86 mm/year, assuming the erosion that occurred in the Cisokan watershed would be smaller than the erosion in the Saguling Dam, and taking into account the geological conditions and land cover in the Cisokan watershed.

4.2.3 Land Use, Settlement, and Infrastructure

The smallest administrative regions in Indonesia are marked by formal boundaries of village areas. Within the boundaries of this village there is a settlement pattern in the form of a combination of several hamlets, farmhouses and development along the road. The pattern of settlements in the project area is spread (radial). This is because the location of settlements is in a fairly high plateau area and mountainous relief.

The land uses in this study are grouped into two, which is a land use in the Cisokan watershed and specific land uses at the project implementation location.

Most of the road infrastructure in the project area can already be traversed by small and medium-sized vehicles, especially roads in sub-district centers and large village centers. The condition of the main road and the road that goes through the centers of sub-districts and large villages are in the form of asphalt. Whereas for remote villages road conditions are still in the form of stone roads and dirt roads. Access to villages and hamlets located at the center of sub-districts and villages can be accessed using two-wheeled and four-wheeled vehicles. Meanwhile, access to remote hamlets and farmhouses located in hilly areas can only be accessed by foot and two-wheeled vehicles

Most of the main roads (asphalt) can already be passed by small vehicles and medium-heavy vehicles (small trucks or minibusses). The access road from Cipari T-junction to the upper and lower locations is 100% in the form of asphalt road and can be passed by heavy vehicles. Public transport facilities available around the project area are generally in the form of public transportation and two-wheeled vehicles ("ojek").

A. Cisokan Watershed Land Use

Land use in the Cisokan watershed area consists of forests, gardens, settlements, rice fields, shrubs, fields, and water reservoirs. The results of mapping land use as a data update activity using visual interpretation of 2020 data show that the area of forest is 14,918.34 ha, gardens 5,993.09 ha, settlements 1,283.48 ha, paddy fields 6,120.67 ha, shrubs 5,857.36 ha , 3033.84 ha of fields, and 222.65 ha of water bodies. The land use map is shown in Figure 47 (map details are shown in Appendix 9).

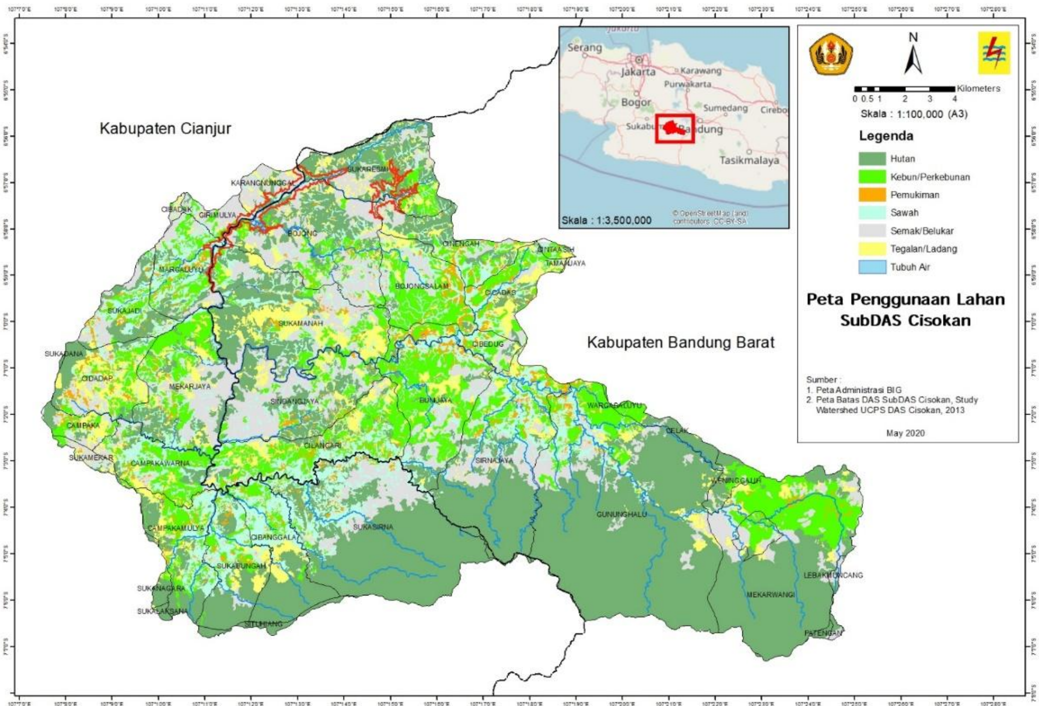


Figure 47 Map of Land Use in the Cisokan UCPS Watershed in 2020

Based on the analysis, forest land dominates land use in the Cisokan watershed with a percentage of 40% of the land area. while the garden, paddy fields, and shrubs have the same percentage, which is 16% of the total land area. percentage of other land use, settlement 3%, fields 8%, and the water reservoir 1%.

Table 12 Land Use in the Cisokan Watershed

No.	Land Use	Area (Ha)	Percentage (%)
1	Forest	14.918,34	40%
2	Farm	5.993,09	16%
3	Settlement	1.283,48	3%
4	Rice Field	6.120,67	16%
5	Shrub	5.857,36	16%
6	Field	3.033,84	8%
7	Waterbody	222,65	1%
	Total	**37.429,42**	**100%**

The land use of the location of the Cisokan Hydroelectric Power Plant project is specifically divided into land use / habitat types as follows: 1) rice fields and fish ponds 2) yards, 3) shrub land, 4) mixed farm, 5) Production forests, 6) secondary forest.

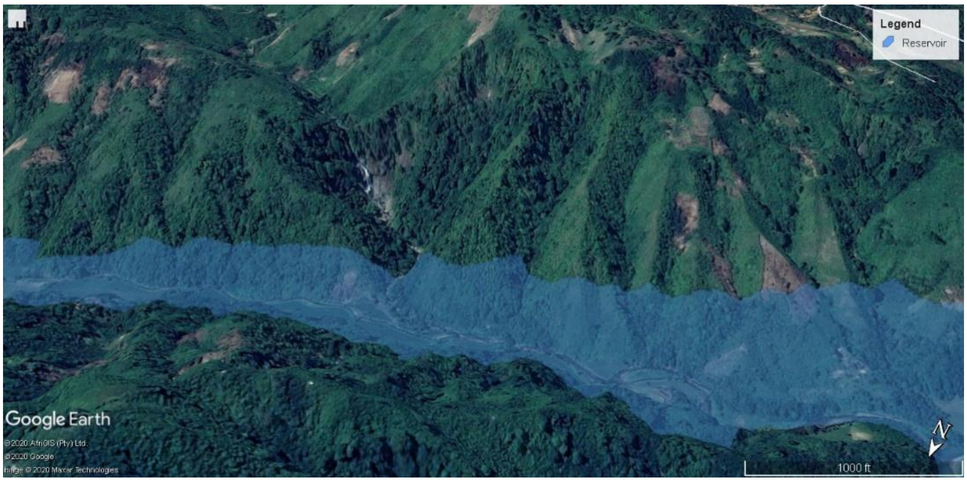


Figure 48 Changes in Land Use Around Curug Walet in 2013 - 2017 - 2020

The results of monitoring Google satellite imagery data from 2013 to 2020, there has been a change in landuse from secondary forests or shrubs to agricultural land. Land use changes also occur in land cover changes to access roads. Satellite imagery in 2020 shows an avalanche on the slope above Curug Walet (red circle in the picture). This was confirmed by observations in the field, that there was an avalanche of about 30 meters close to the location of the Walet Waterfall. The steep slope topography and agricultural activities have triggered landslides on the slopes around the study area.

Figure 49 Change in Land Use in the Study Area

The dominant land use location for the UCPS project is paddy fields, which supports the subsistence lifestyles of people living around the project area. No karst ecosystem was found at the time of habitat survey. More specifically, an explanation of each type of land use at the UCPS project implementation site is as follows:

Rice Field and Fish Pond

Rice fields are the dominant land use type in all project implementation locations. The types of rice fields at the project site are rainfed and irrigated fields. The cropping pattern mostly uses the inter-cropping pattern, such as the cropping pattern of palawija or vegetables between the rice harvest periods, there are intermittent harvest periods of other commodities, such as harvesting beans, corn, and onions.

Figure 50 Rice Fields and Fish ponds in the Study Area

The pattern of making fish ponds in the area around the project was built around the residence and rice fields. Fish species that are bred by the local community are tilapia *(Oreochromis mossambicus)* and carp *(Cyprinus carpio)*.

Yard

Most of the rural communities in the hilly areas around the project site do not have house yards because most of the residents grow crops directly in the rice fields and gardens. The utilization of the yard is mostly in quarry location. Utilization is used to grow ornamental plants, fruit trees, and vegetable gardens (such as tomatoes and chili), parks, and fish ponds.

Figure 51 Settlements at BIA Locations 2

Shrub

Another type of use in the area around the project is shrubs. scrubland is area that has been cleared by burning or cutting down trees. In some cases, the land is allowed to grow back, and in other cases, it is planted with fruit trees. Clearing trees and shrubs are usually done to provide new land. Some bushes tend to be open. Checkered soil habitats are suitable for a variety of bird species, but not for other animals.

Figure 52 Shrub in the Study Area

Mixed Farm

Mixed garden is an area uses for agriculture and plantations between forests. This type of land use serves to support food needs and provide additional income for local communities. The types of commodities planted include food crops, coffee, bananas, avocados, coconuts, bamboo, and palm sugar. A mixed garden in the area around the project cover large hilly areas.

Mixed gardens are still a good habitat for local fauna because of the structure of the forest canopy, the diversity of species from native species, and intentionally planted and the size of the vegetation cover.

Figure 53 Mixed farm in the study Area

Production Forest

Production forests in the area around the UCPS project are dominated by pine and mahogany trees, with land cover in the form of grass. Production forests in the area around the project become a habitat for much natural faunas. Local people use pine trees for their sap.

Figure 54 Production Forest

Secondary Forest

Secondary Forest is a combination of shrubs and trees that have grown back after land clearing. Throughout the survey area, this vegetation can be found in separate places, usually in more steep areas where agriculture or forest cannot grow. This area includes inaccessible cliffs and riverbanks in the gully and is found along the Cirumamis River between the upper and lower reservoir areas.

The natural forest is an area that is protected from new disturbances so that large tree specimens and a variety of mixed vegetation grow in this area. This habitat is the only natural habitat for a variety of rare and protected fauna in the survey area.

Figure 55 Secondary forest in Lower Dam UCPS

Secondary forests may be avoided from further land clearing processes due to steep, although logging and timber extraction are sometimes still do. Forest fires are a risk. Fauna is at risk of being isolated from its population and the carrying capacity of fragmented forests is limited. Most of the Cisokan Sub-watershed area is included in the production forest area as shown in Figure 56. (detailed map of the forest area is shown in Appendix 10.

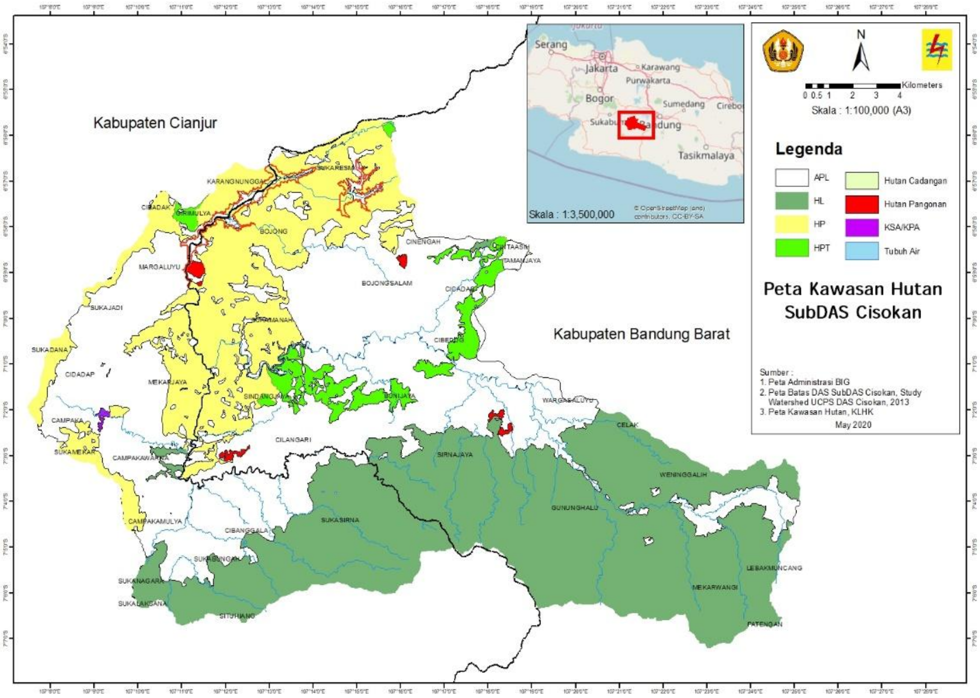


Figure 56 Forest Zone in the Cisokan Sub-watershed

B. Transmision Line

Settlement

Settlement areas are not the dominant type of land use along the transmission line. Some settlements in the transmission line location have a yard planted with several types of plants, including mango, coconut, banana, peanuts, as well as food plants and ornamental plants.

Figure 57 Settlement near Tower Point construction plan

Mixed Farm

Mixed gardens are the most common type of land use found at transmission line locations. Most of the mixed gardens are located on the Perum Perhutani land. Some of the mixed garden areas are leased to residents for agricultural activities.

Figure 58 Mixed Farm community in Suakratu Village

Rice Field

Most of the rice fields in the transmission line are located on the Cisokan River plain. The Largest rice fields in the location transmission lines are in the villages of Haurwangi and Mekarwangi, Bojongpicung District, Cianjur Regency.

Figure 59 Rice Fields on the Transmission Line Plan

Forest

The The most common forest types that are in the transmission line are production forests managed by Perum Perhutani. The types of trees that can be found in production forests include teak (Tectona grandis), Mahogany (Swietania mahagoni), and Dutch wood (Guazuma ulmifolia). The forests in the transmission line are mostly young forests.

Figure 60 Mixed Plantations and Forests on Transmission Line Plans

4.2.4 Air Quality, Noise, and Vibration

A. Air Quality

Air quality monitoring is carried out at several locations in the UCPS project area. Air quality monitoring is carried out twice a year, in semester 1 and semester 2. The main parameters of air quality that are monitored are Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2), Oxidant (O2), Dust (TSP), Carbon monoxide (Carbon monoxide) CO), and Lead (Pb). Measurements were made at several locations in the Cisokan UCPS area. The results of air quality measurements for each location are as follows.

- **Sarinagen Village (Near quarry)**

  The measurement of air quality in Sarinagen Village was conducted from 2014 - 2019 but without 2016 because the data was not available. Trend data for each air quality parameter is shown in the graph.

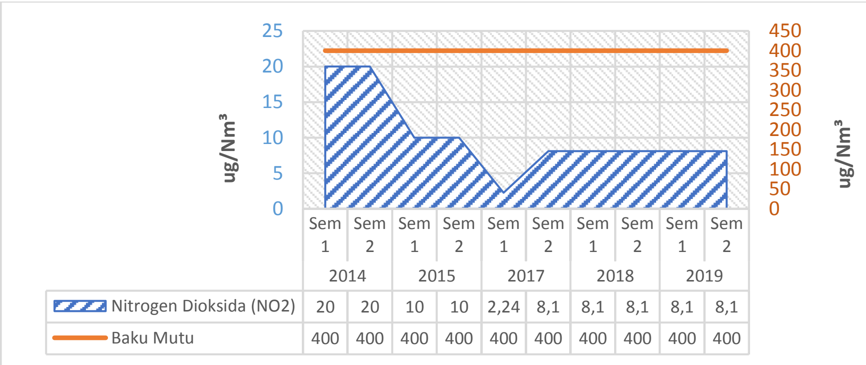


Figure 61. Nitrogen Dioxide Data Trend in Sarinagen Village

The trend of nitrogen dioxide (NO2) levels over the past 5 years has decreased, even in the last 2 years (2018-2019) NO2 levels <8.1 μg/Nm³. The average nitrogen dioxide (NO2) level in Sarinagen village around the Gunung Karang quarry in 5 years is <10.27 μg/Nm³. This value is still under the national ambient air quality standard (BMUA) for nitrogen dioxide (NO2) 400 μg/Nm³.

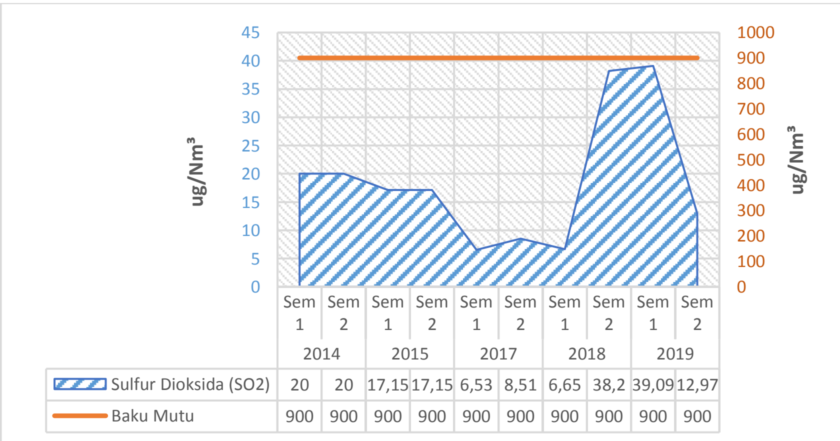


Figure 62. Sulfur Dioxide Data Trend in Sarinagenn Village

Based on the graph in Figure 62 it is known that the levels of Sulfur dioxide (SO_2) in Sarinagen Village in the last 5 years varied from the smallest <6.53 to the largest <39.09 μg/Nm³. these levels are still under the national ambient air quality standard (BMUA) for Sulfur dioxide (SO_2) which is set at 900 μg/Nm³. The average level of Sulfur dioxide (SO_2) in Sarinagen Village in a period of 5 years is 18,625 μg / Nm³.

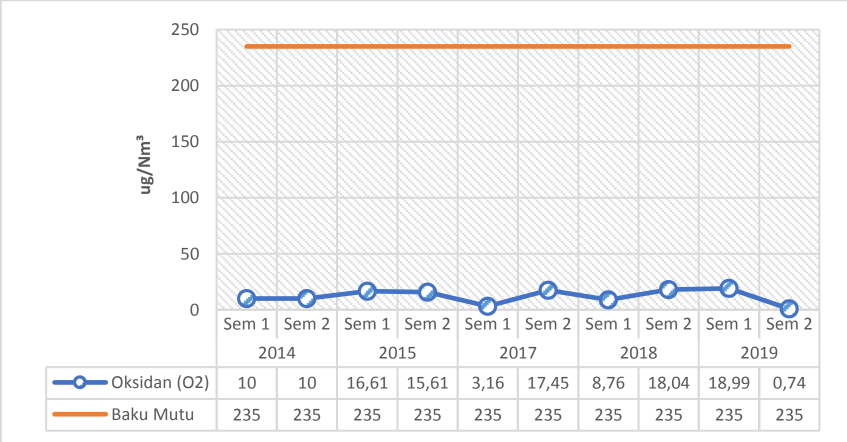


Figure 63. Oxidant (O2) data trend in sarinagen Village

Oxidant (O2) levels in Sarinagen village in the last 5 years ranged from 0.74 μg/Nm³ to 18.99 μg/Nm³. This value is under the national ambient air quality standard (BMUA) for Oxidant (O2) 235 μg/Nm³.

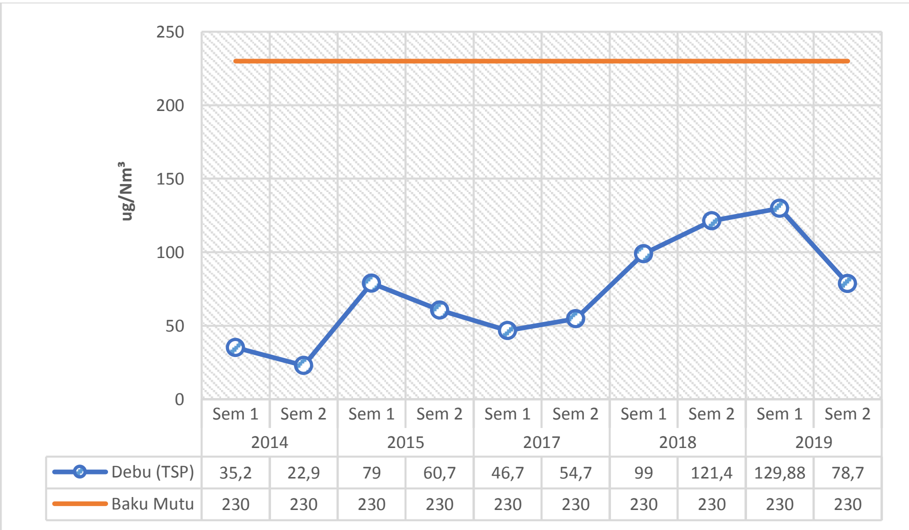


Figure 64. Dust (TSP) Data Trend (TSP) in Sarinagen Village

The level of dust (TSP) in Sarinagen Village in the last 5 years ranged from 22.9 μg/Nm³ to 129.88 μg/Nm³. The dust level (TSP) in Sarinagen village is still under the national ambient air quality standard (BMUA) for Dust (TSP) 230 μg/Nm³.

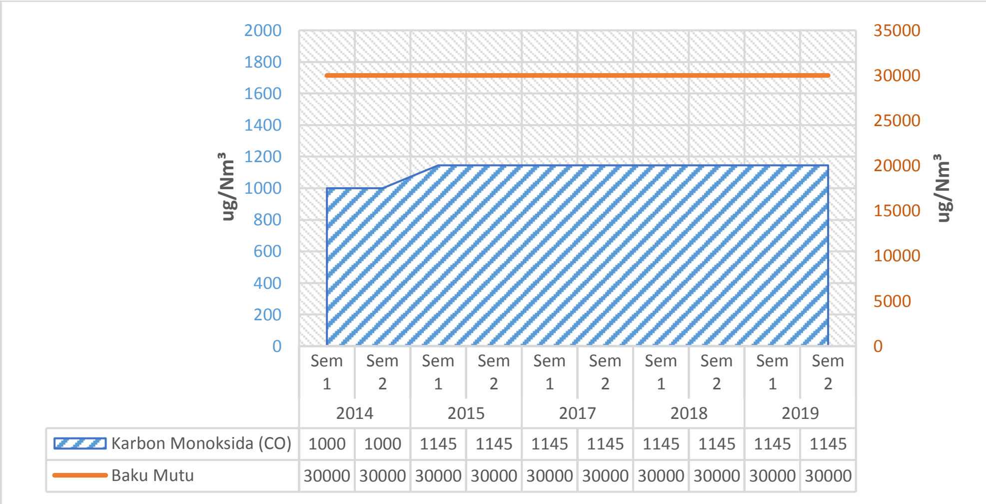


Figure 65. Cabon Monoxide (CO) Data Trend in Sarinagen Village

Based on the graph in Figure 65, it is known that carbon monoxide (CO) levels in Sarinagen Village range from <1000 to <1145 μg/Nm³. Carbon monoxide (CO2) levels in Sarinangen Village are still under the national ambient air quality standard for Carbon monoxide (CO) 30,000 μg/Nmug.

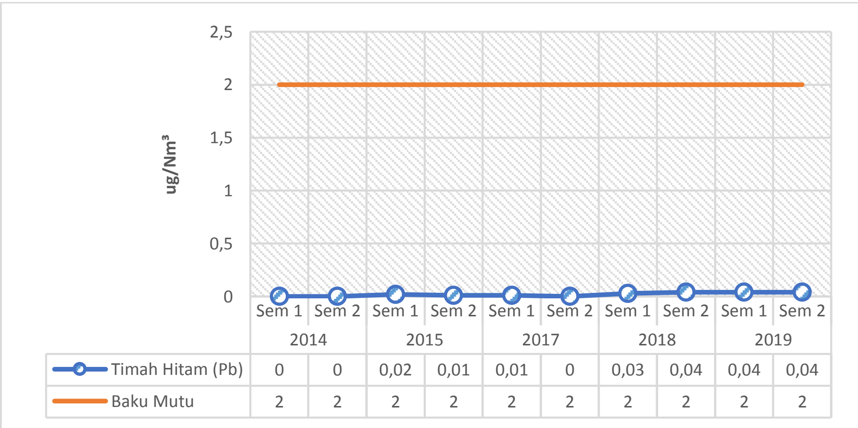


Figure 66. Pb Data Trend in Sarinagen Village

Based on the graph in Figure 66 it is known that lead levels (Pb) in Sarinagen Village range from 0 to 0.04 μg/Nm³. Lead levels (Pb) in Sarinangen Village are still under the national ambient air quality standard for Black Lead (Pb)) 2 μg/Nm³.

- **Cipari Junction (Cijambu Village)**

  The measurement of air quality in Cipari Junction (Cijambu Village) was carried out from 2015 - 2019. Trend data for each of the air quality parameters in this location are shown in the graph (figure 67).

  The levels of Nitrogen Dioxide (NO2) in Cipari Junction ranged from <2.24 to <12.29 μg/Nm³. Nitrogen Dioxide (NO2) levels in Cipari Junction are still under the national ambient air quality standard (BMUA) for Nitrogen Dioxide (NO2) which is set at 400 μg/Nm³. Trend data on nitrogen dioxide levels at the Cipari junction are shown in Figure 67

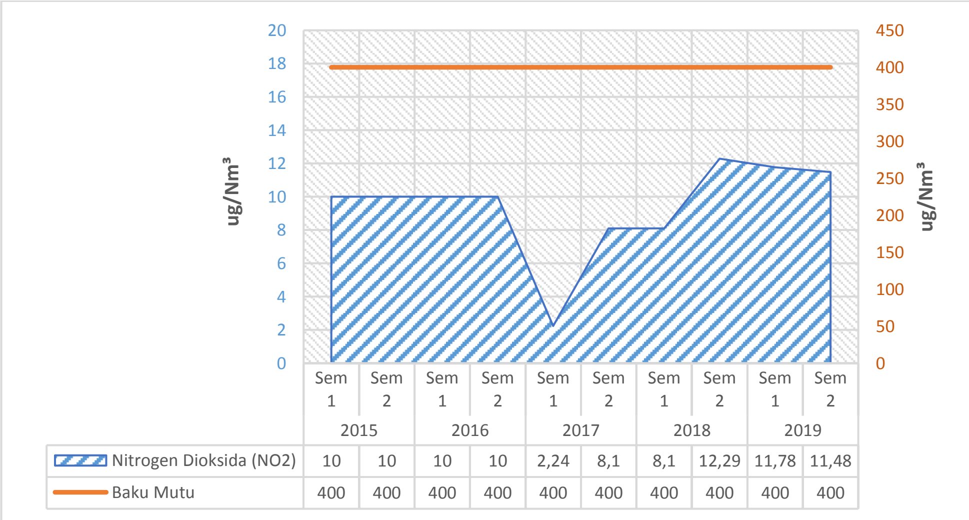


Figure 67. Nitrogen Diokxide Data Trend in Cipari Junction

Sulfur Dioxide (SO2) levels in Cipari Junction ranged from <2.24 to <41.37 μg/Nm³. Sulfur Dioxide (SO2) levels in Cipari Junction are still under the national ambient air quality standard for Sulfur Dioxide (SO2) which is set at 900 μg/Nm³. Trend data on sulfure dioxide levels at the Cipari junction are shown in Figure 68.

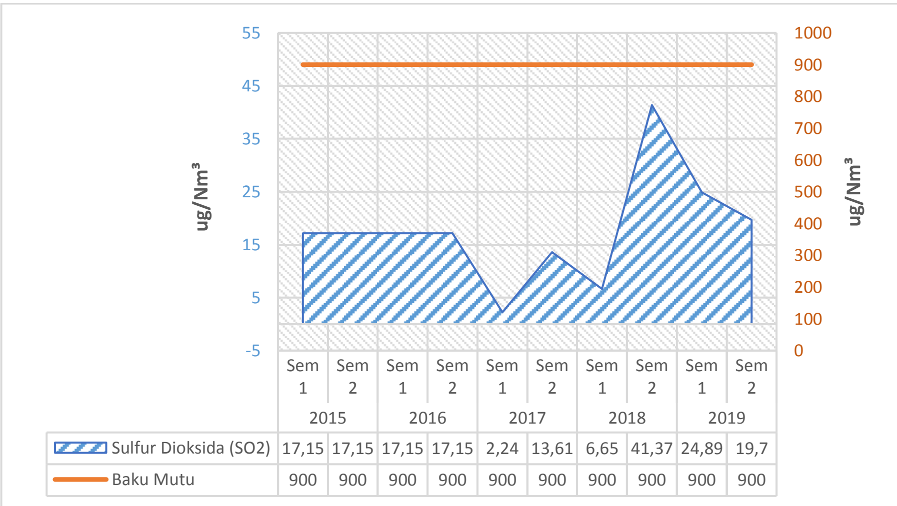


Figure 68. Sulfure Dioxide Data Trend in Cipari Junction

The level of Oxidant (O2) in Cipari Junction ranged from 9.95 to 37.29 μg/Nm³. The level of Oxidant (O2) in Cipari Junction is still below the national ambient air quality (BMUA) standard for Oxidant (O2) which is set at 235 μg/Nm³. Trend data on oxidant levels at the Cipari junction are shown in Figure 69.

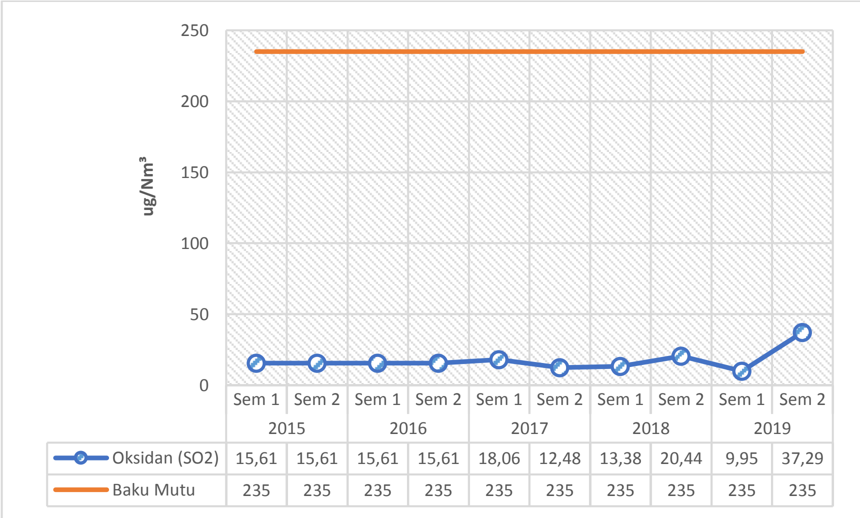


Figure 69. Oxidants (O2) Data trend at Cipari Junction

The level of dust (TSP) in Cipari Junction ranges from 25.6 to 205.8 µg/Nm³. The level of dust (TSP) at Cipari Junction is still below the national ambient air quality standard (BMUA) for dust (TSP) which is set at 230 µg/Nm³. The average TSP dust in Cipari Junction in the last 5 years is 93.14 ug/Nm³. Trend data on dust (TSP) levels at the Cipari junction are shown in Figure 70.

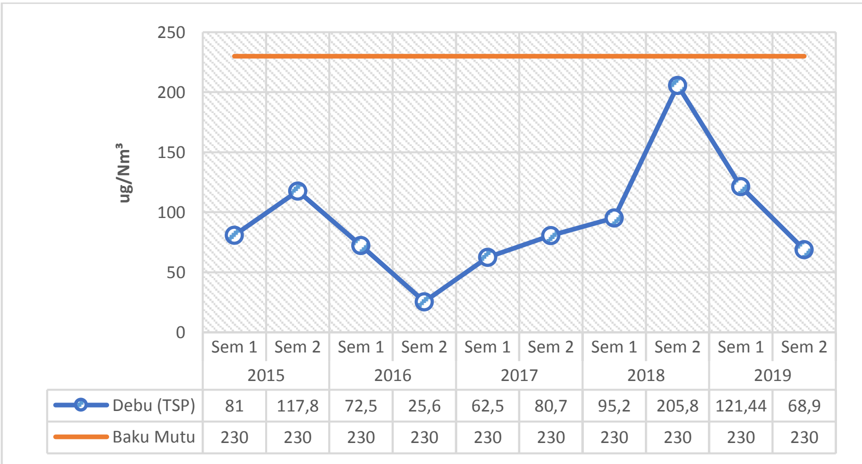
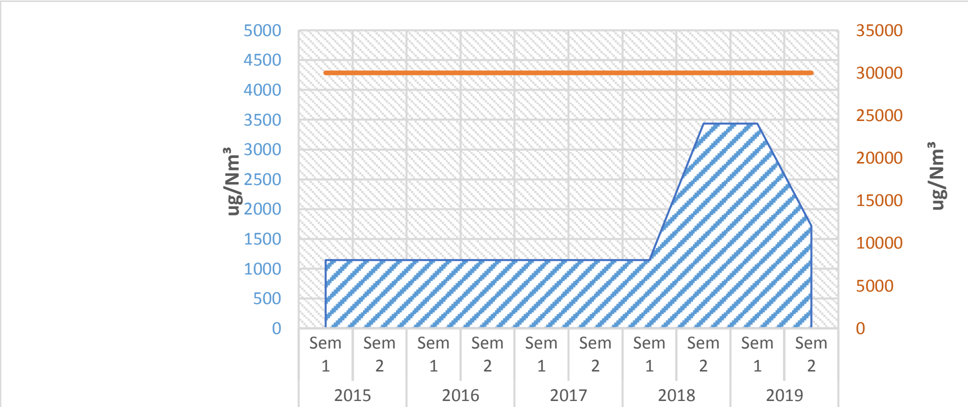


Figure 70. Dust (TSP) Data Trend at Cipari Junction

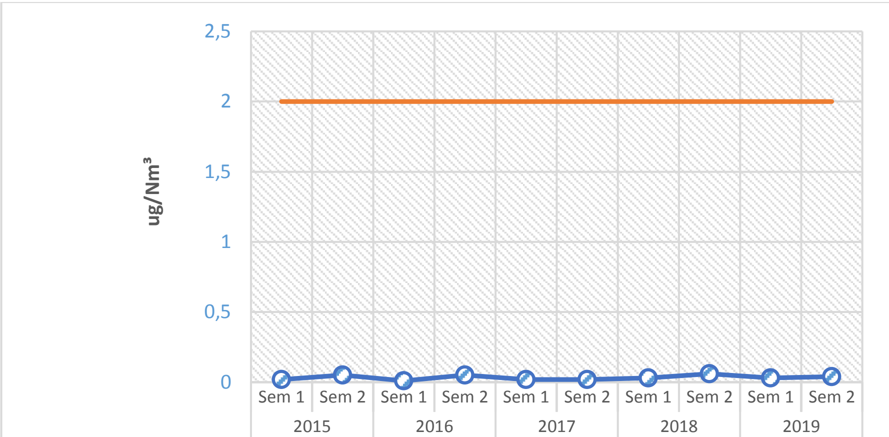
The level of Carbon Monoxide (CO) at Cipari Junction ranges from <1,145 to 3,435 µg/Nm³. Carbon Monoxide (CO) levels in Cipari Junction are far below the national ambient air quality standard for Carbon Monoxide (CO) 30,0000 µg/Nm³. Trend data on Carbon Monoxide (CO) levels at the Cipari junction are shown in Figure 71.



	Sem 1 2015	Sem 2 2015	Sem 1 2016	Sem 2 2016	Sem 1 2017	Sem 2 2017	Sem 1 2018	Sem 2 2018	Sem 1 2019	Sem 2 2019
Karbon Monoksida (CO)	1145	1145	1145	1145	1145	1145	1145	3435	3435	1718
Baku Mutu	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000

Figure 71. Carbon Monoxide (CO) Data Trend in Cipari Junction

The levels of Lead (Pb) in Cipari Junction ranged from 0.01 to 0.06 ug/Nm³. Lead (Pb) levels in Cipari Junction still under the national ambient air quality standard (BMUA) for Black Lead (Pb) of 2 ug/Nm³. Trend data on Lead (Pb) levels at the Cipari junction are shown in Figure 72.



	Sem 1 2015	Sem 2 2015	Sem 1 2016	Sem 2 2016	Sem 1 2017	Sem 2 2017	Sem 1 2018	Sem 2 2018	Sem 1 2019	Sem 2 2019
Timah Hitam (Pb)	0,02	0,05	0,01	0,05	0,02	0,02	0,03	0,06	0,03	0,04
Baku Mutu	2	2	2	2	2	2	2	2	2	2

Figure 72. Lead (Pb) Data Trend in Cipari Junction

- **Cibima Village (Upper Dam)**

  The measurement of air quality in Cipari Junction (Cijambu Village) was carried out from 2014 - 2019 without 2016. The trend data for each air quality parameter at this location is shown in the graph (Figure 73).

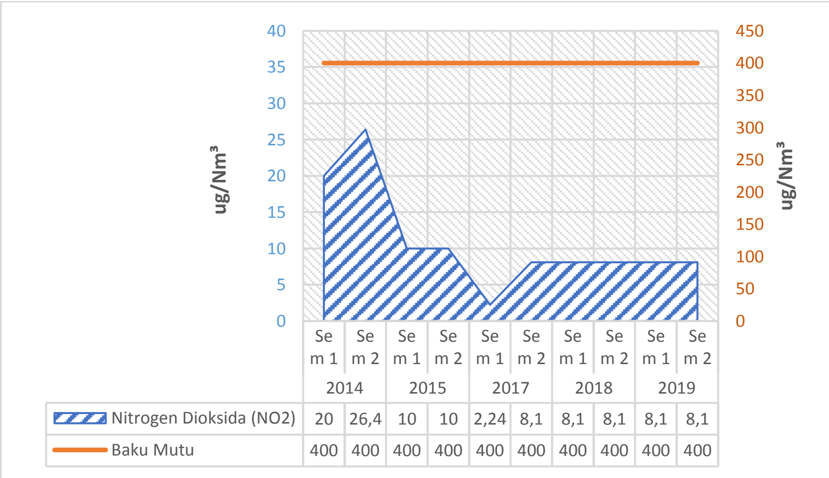


Figure 73. Nitrogen Dioxide (NO2) Trend Data in Cibima Village

Based on the graph in Figure 73 it is known that the levels of Nitrogen Dioxide (NO2) in Cibima Village ranged from <2.24 to <26.4 µg/Nm³. Nitrogen Dioxide (NO2) levels in Cibima Village are still under the national ambient air quality (BMUA) standard for Nitrogen Dioxide (NO2) 400 µg/Nm³.

In addition, the levels of Sulfur Dioxide (SO2) in Cibima Village are known in range between <5.43 to <34.78 µg/Nm³. Sulfur Dioxide (SO2) levels in Cibima Village are still under the national ambient air quality (BMUA) standard for Sulfur Dioxide (SO2) which is set at 900 µg/Nm³. Trend data on Sulfur Dioxide (SO2) levels at the cibima village are shown in Figure 74.

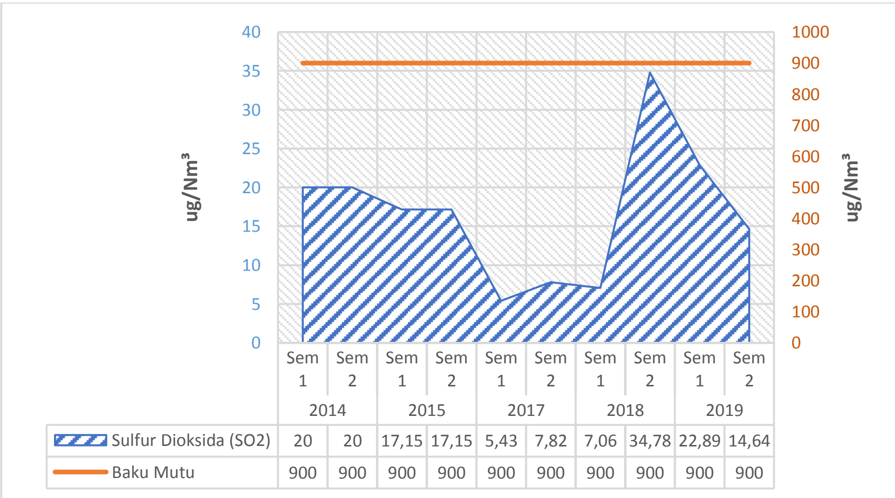


Figure 74. Sulfur Dioxide (SO2) Trend Data in Cibima Village

The levels of Oxidant (O2) in Cibima Village ranged from 0 to 21.89 µg/Nm³. The level of Oxidant (O2) in Cibima Village is still under the national ambient air quality standard (BMUA) for Oxidant (O2) of 235 µg/Nm³. Trend data on oxidant levels at the Cibima village are shown in Figure 75.

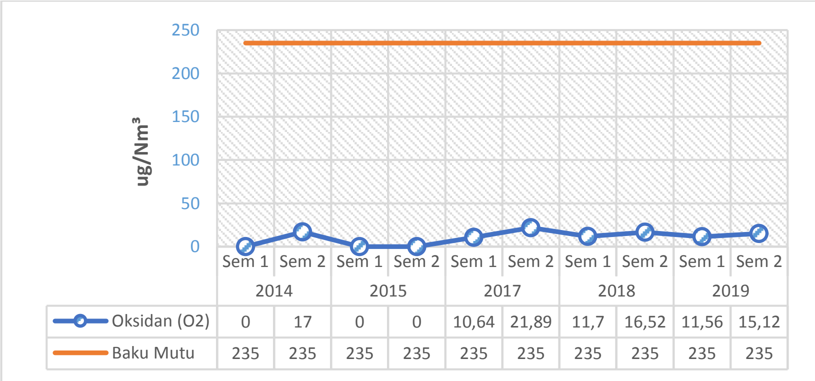


Figure 75. Oxidant (O2) Data Trend in Cibima Village

The level of dust (TSP) in Cibima Village ranged from 33.3 to 98.7 µg / Nm³. The level of dust (TSP) in Cibima Village is still bunder the national ambient air quality standard (BMUA) for Dust (TSP) 230 µg/Nm³. The average TSP dust in Cibima Village in the last 5 years is 69.17 µg/Nm³. Trend data on Dust (TSP) levels at the Cibima village are shown in Figure 76.

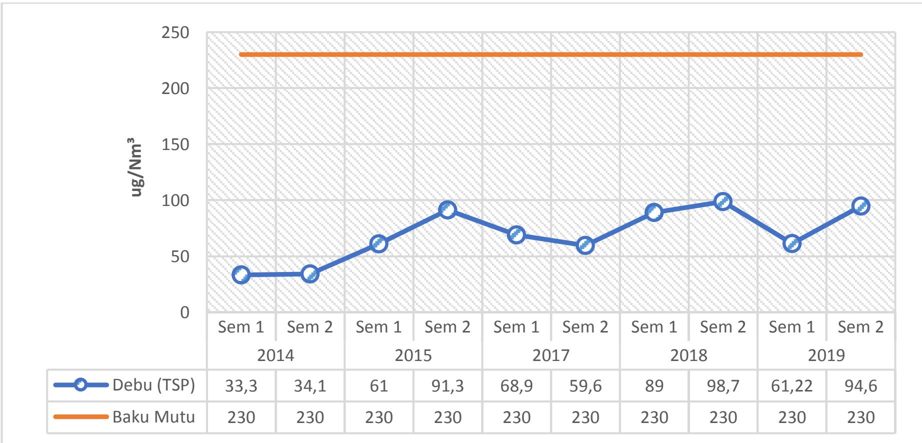


Figure 76. Dust (TSP) Data Trend in Cibima Village

Based on the graph in Figure 77 below, it is known that Carbon Monoxide (CO) levels in Cibima Village ranged from <1000 to 1,145 ug/Nm³. Carbon Monoxide (CO) levels in Cibima Village are far under the national ambient air quality standard for Carbon Monoxide (CO) which is set at 30,0000 ug/Nm³.

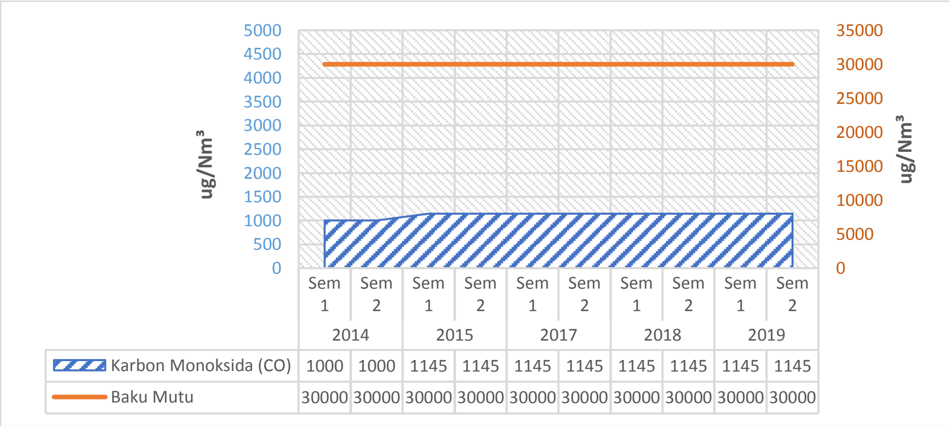


Figure 77. Carbon Monoxide (CO) Data Trend in Cibima Village

The levels of lead (Pb) in Cibima Village ranged from 0.02 to 0.5 µg/Nm³. Black Lead (Pb) levels in Cibima Village are still far below the national ambient air quality standard (BMUA) for Black Lead (Pb) which is set at 2 µg/Nm³. Trend data on Lead (Pb) levels at the Cibima village are shown in Figure 78.

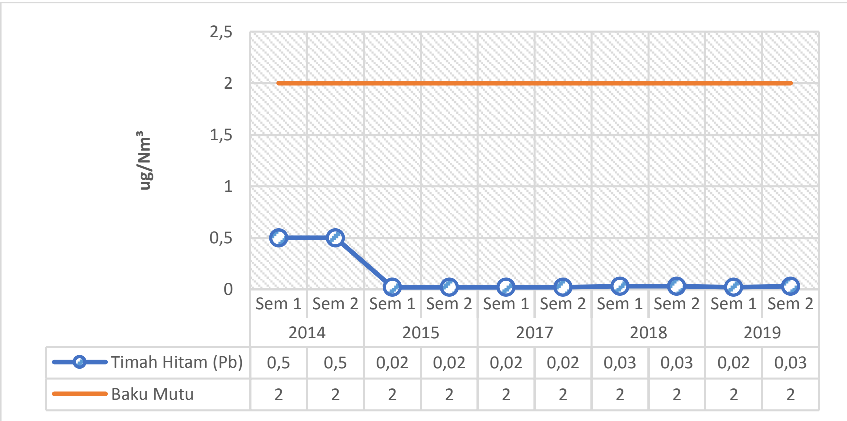


Figure 78. Lead (Pb) Data Trend at Cibima Village

- **Bojongsalam Village (Near Powerhouse)**

  The measurement of air quality in Bojongsalam Village was conducted from 2013 - 2016. Trend data for each air quality parameter at this location is shown in the graph (Figure 79).

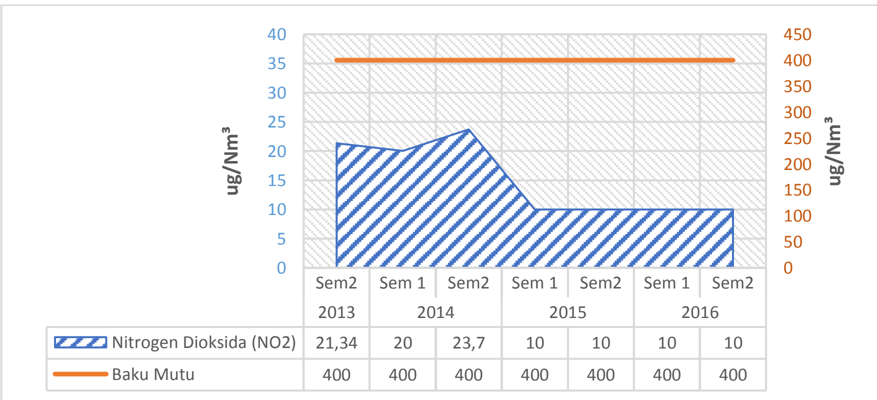


Figure 79. Nitrogen Dioxide (NO2) Data Trend in Bojongsalam Village

Based on the graph in Figure 79 it is known that the levels of Nitrogen Dioxide (NO2) in Bojongsalam Village ranged from <10 to <23.7 µg/Nm³. Nitrogen Dioxide (NO2) levels in Bojongsalam Village are still under the national ambient air quality (BMUA) standard for Nitrogen Dioxide (NO2) which is set at 400 µg/Nm³.

The Sulfur Dioxide (SO2) levels in Bojongsalam Village ranged from <13.69 to <20 µg/Nm³. Sulfur Dioxide (SO2) levels in Bojongsalam Village are still under the national ambient air quality (BMUA) standard for Sulfur Dioxide (SO2) which is set at 900 µg/Nm³. Trend data on Sulfur Dioxide (SO2) levels at the Bojongsalam village are shown in Figure 80.

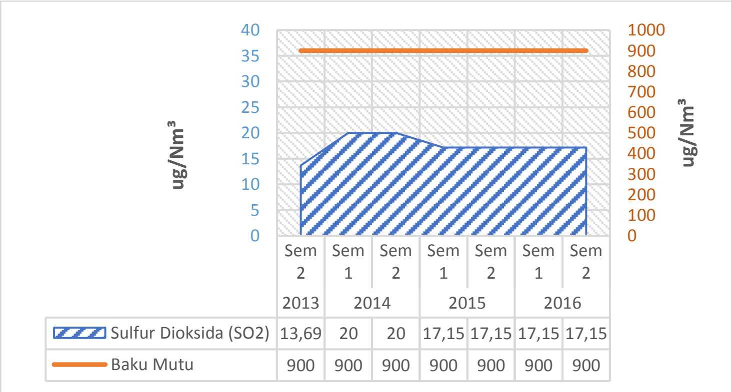


Figure 80. Sulfur Dioxide (SO2) Data Trend in Bojongsalam Village

The level of Oxidant (O2) in Bojongsalam Village ranges from 10 to 21.6 µg/Nm³. The level of Oxidant (O2) in Bojongsalam Village is still under the national ambient air quality standard (BMUA) for Oxidant (O2) which is set at 235 µg/Nm³. Trend data on Oxidant (O2) levels at the Bojongsalamvillage are shown in Figure 81.

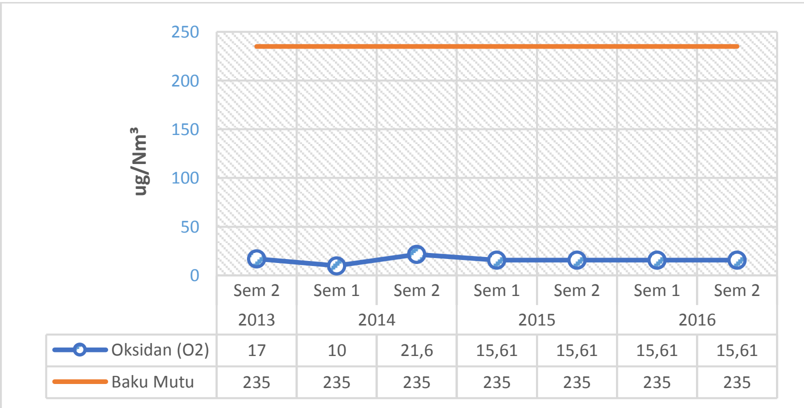


Figure 81. Oxidant (O2) Data Trend in Bojongsalam Village

The level of dust (TSP) in Bojongsalam Village ranged from 23.5 to 93.06 µg/Nm³. Dust content (TSP) in Bojongsalam Village is still under the national ambient air quality standard (BMUA) for Dust (TSP) which is set at 230 µg/Nm³. The average TSP dust in Bojongsalam Village in the last 5 years is 57.65 µg/Nm³. Trend data on Dust (TSP) levels at the Bojongsalamvillage are shown in Figure 82.

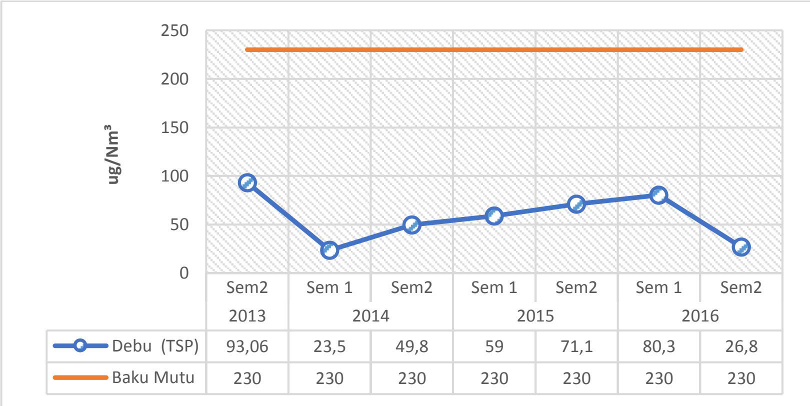


Figure 82. Dust (TSP) Data Trend in Bojongsalam Village

Based on the graph in Figure 83 below it is known that Carbon Monoxide (CO) levels in Bojongsalam Village ranged from <416.2 to 1,145 µg/Nm³. Carbon Monoxide (CO) levels in Bojongsalam Village under the national ambient air quality standard (BMUA) for Carbon Monoxide (CO) which is set at 30,000 µg/Nm³.

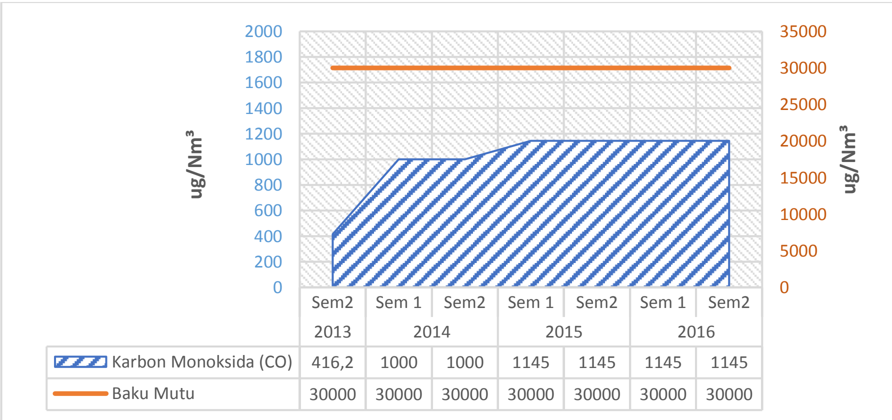


Figure 83. Carbon Monoxide (CO) Data Trend in Bojongsalam Village

The levels of Lead (Pb) in Bojongsalam Village ranged from 0.01 to 0.5 µg/Nm³. Lead (Pb) levels in Bojongsalam Village is under the national ambient air quality (BMUA) standard for Lead (Pb) 2 µg/Nm³. Trend data on Lead (Pb) levels at the Bojongsalam village are shown in Figure 84.

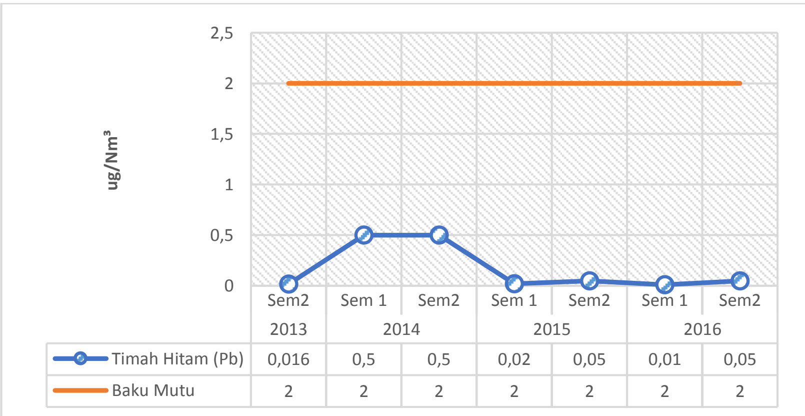


Figure 84. Pb Data Trend in Bojongsalam Village

- **Sukaresmi Village**

The measurement of air quality in Sukaresmi Village was carried out from 2014 - 2019. Trend data of each air quality parameter at this location is shown in the graph (Figure 85).

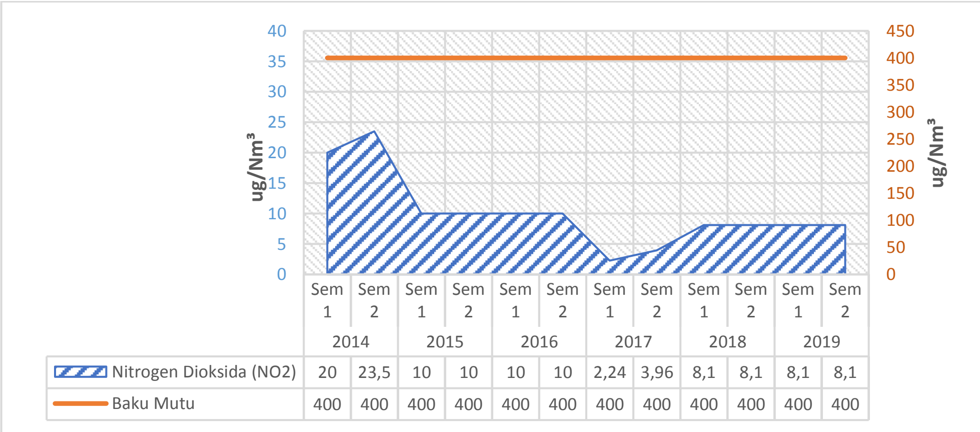


Figure 85. Nitrogen Dioxide (NO2) Trend Data in Sukaresmi Village

Based on the graph in Figure 85 it is known that the levels of Nitrogen Dioxide (NO2) in Sukaresmi Village ranged from <2.24 to <23.5 µg/Nm³. Nitrogen Dioxide (NO2) levels in Sukaresmi Village are still under the national ambient air quality (BMUA) standard for Nitrogen Dioxide (NO2) which is set at 400 µg/Nm³.

The levels of Sulfur Dioxide (SO2) in Sukaresmi Village ranged from <2.24 to <36.95 µg/Nm³. Sulfur Dioxide (SO2) levels in Sukaresmi Village are still under the national ambient air quality standard (BMUA) for Sulfur Dioxide (SO2) 900 µg/Nm³. Trend data on Sulfur Dioxide (SO2) levels at the sukaresmi village are shown in Figure 86.

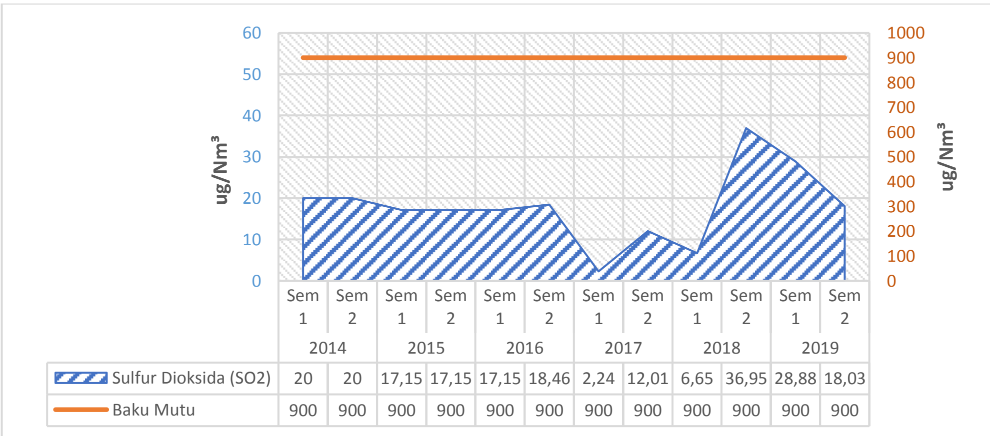


Figure 86. Sulfur Dioxide (SO2) Trend Data in Sukaresmi Village

Based on the graph in Figure 87 below, it is known that the levels of Oxidant (O2) in Sukaresmi Village ranged from 6.91 to 26.61 µg/Nm³. The level of Oxidant (O2) in Sukaresmi Village is still under the national ambient air quality standard (BMUA) for Oxidant (O2) 235 µg/Nm³.

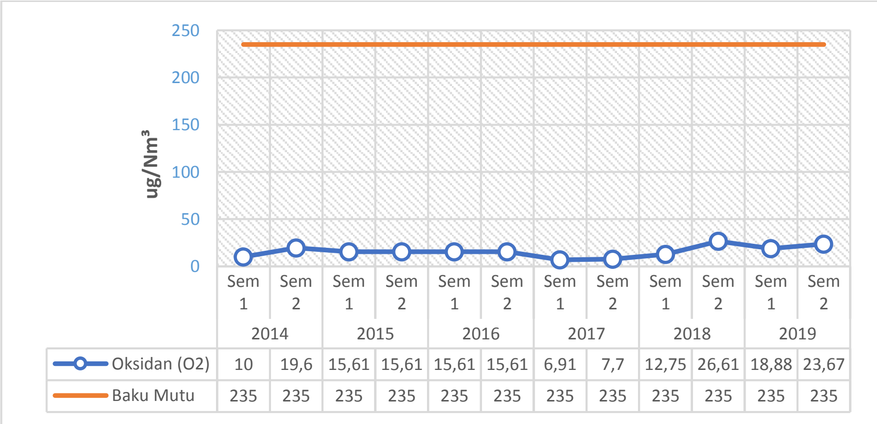


Figure 87. Oxidant (O2) Data Trends in Sukaresmi Village

The level of dust (TSP) in Sukaresmi Village ranged from 14.4 to 256.3 μg/Nm³. Dust levels (TSP) in Sukaresmi Village in general are still under the national ambient air quality standard (BMUA) for Dust (TSP) 230 ug/Nm³ each year. But in 2015 semester 2 and 2018 semester II Dust content (TSP) in Sukaresmi Village exceed ambient air quality standards with content values reaching 256.3 μg/Nm³ and 241.4 μg/Nm³. Trend data on Dust (TSP) levels at the sukaresmi village are shown in Figure 88.

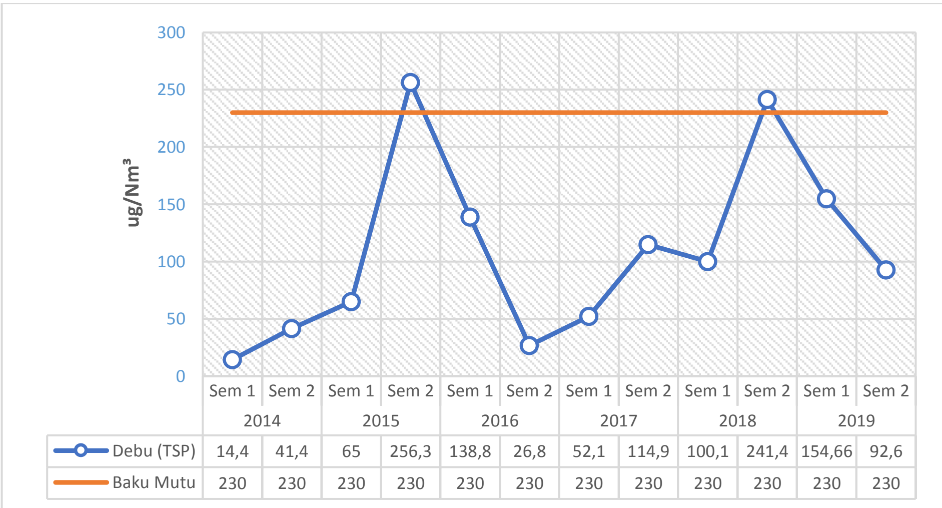
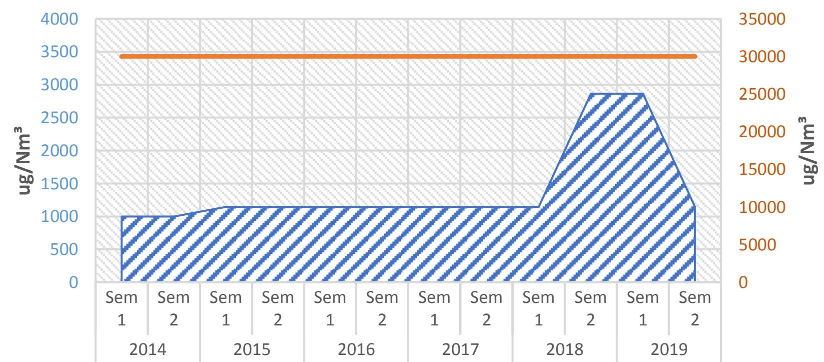


Figure 88. Dust (TSP) Data Trend In Sukaresmi Village

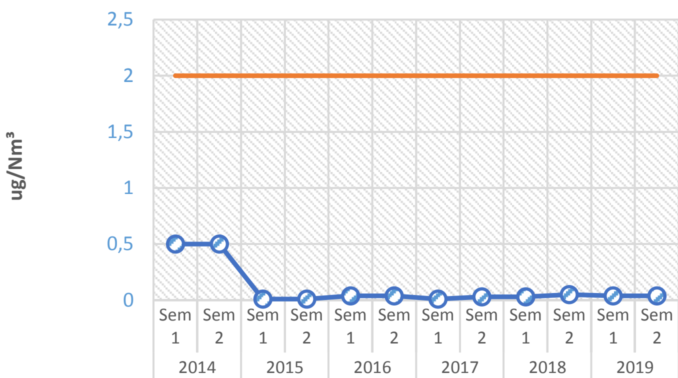
The levels of Carbon Monoxide (CO) in Sukaresmi Village ranged from <1,000 to 2,862 μg/Nm³. Carbon Monoxide (CO) levels in Sukaresmi Village are still under the national ambient air quality standard for Carbon Monoxide (CO) 30,0000 μg/Nm³. Trend data on carbon monoxide (CO) levels at the sukaresmi village are shown in Figure 89.



	2014 Sem 1	2014 Sem 2	2015 Sem 1	2015 Sem 2	2016 Sem 1	2016 Sem 2	2017 Sem 1	2017 Sem 2	2018 Sem 1	2018 Sem 2	2019 Sem 1	2019 Sem 2
Karbon Monoksida (CO)	1000	1000	1145	1145	1145	1145	1145	1145	1145	2862	2862	1145
Baku Mutu	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000

Figure 89. Carbon Monoxide (CO) Data Trend in Sukaresmi Village

Based on the graph in Figure 90 below, it is known the levels of lead (Pb) in Sukaresmi Village ranged from 0.01 to 0.5 µg/Nm³. Lead (Pb) levels in Sukaresmi Village are still under the national ambient air quality standard (BMUA) for Lead (Pb) 2 µg/Nm³.



	2014 Sem 1	2014 Sem 2	2015 Sem 1	2015 Sem 2	2016 Sem 1	2016 Sem 2	2017 Sem 1	2017 Sem 2	2018 Sem 1	2018 Sem 2	2019 Sem 1	2019 Sem 2
Timah Hitam (Pb)	0,5	0,5	0,01	0,01	0,04	0,04	0,01	0,03	0,03	0,05	0,04	0,04
Baku Mutu	2	2	2	2	2	2	2	2	2	2	2	2

Figure 90. Lead Data Trend (Pb) in Sukaresmi Village

Based on the observation of air quality data for the last 5-6 years in locations around the Cisokan UCPS project, there has not been any significant air pollution. This is known from all air quality parameters measured below the ambient air quality standard (BMUA) set by the government. Nevertheless, dust levels (TSP) were found to exceed ambient air quality standards in 2015 semester II and 2018 semester II.

B. Noise

Noise ambient has been monitored in several locations around the Cisokan UCPS project area. Among them in Sarinagen Village (around the quarry), Cipari junction, Cibima Village (upper dam), Bojongsalam Village (near the powerhouse), and Sukaresmi Village. The results of ambient noise monitoring at each location are shown in the graph (Figure 91).

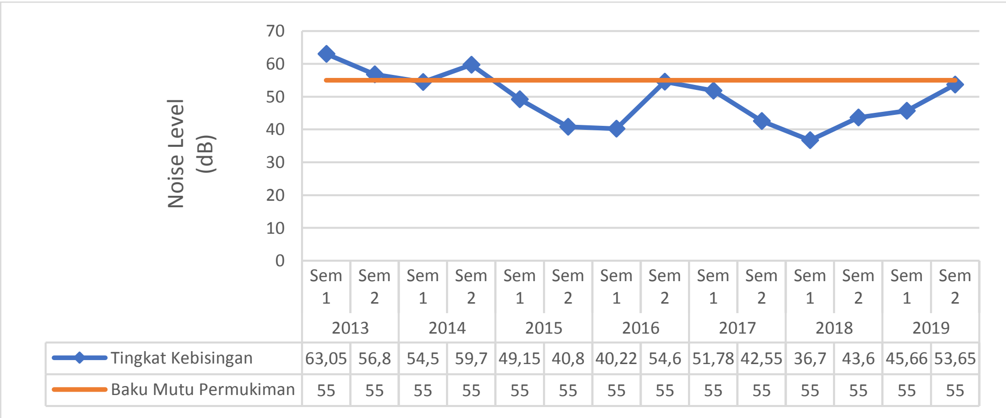


Figure 91. Noise Ambient Data Trend in Sarinagen Village

Noise Ambient Monitoring in Sarinagen Village was conducted from 2013 - 2019. Based on monitoring results it is known that the noise ambient in Sarinagen Village varies between 35.7 dB to the highest of 63.05 dB. In general ambient noise is under the noise ambient quality standard for settlements at 55 dB. Nevertheless, there are some results of monitoring noise ambient that exceeds quality standards, such as in 2013 semester 1 and semester 2, and 2014 semester 1.

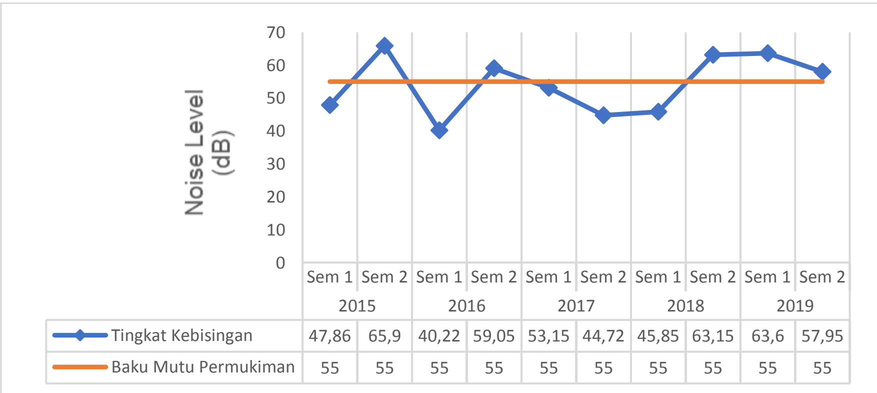


Figure 92. Noise Ambient Data Trend at Cipari Junction

Noise Ambient Monitoring in Cipari Junction was conducted from 2015 - 2019. Based on the results of monitoring it was found that noise ambient in Sarinagen Village varied between 40.22 dB to the highest of 65.9 dB. There are several monitoring results that exceed noise ambient quality standards for settlements (55 dB), such as in 2015 semester II, 2016 semester II, 2018 semester II, and 2019 semester I-II.

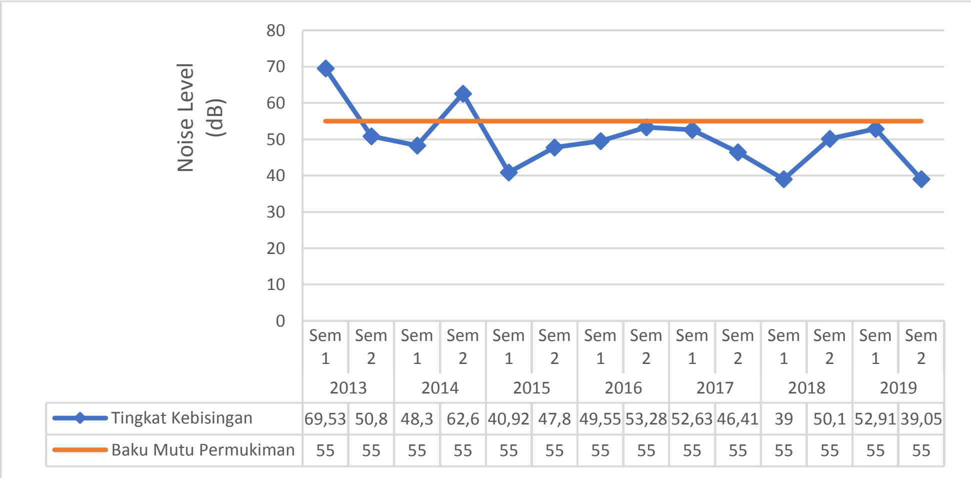


Figure 93. Noise Ambient Data Trend in Cibima Village

Noise Ambient Monitoring in Cibima Village (upper dam) was conducted from 2013 - 2019. Based on the monitoring results it was found that noise ambient in Cibima Village varied between 39 dB to the highest of 69.53 dB. In general noise ambient in Cibima Village is under the quality standard for settlements at 55 dB. Nevertheless, there are some results of noise ambient monitoring that exceed quality standards, such as in 2013 semester 1 and 2014 semester II.

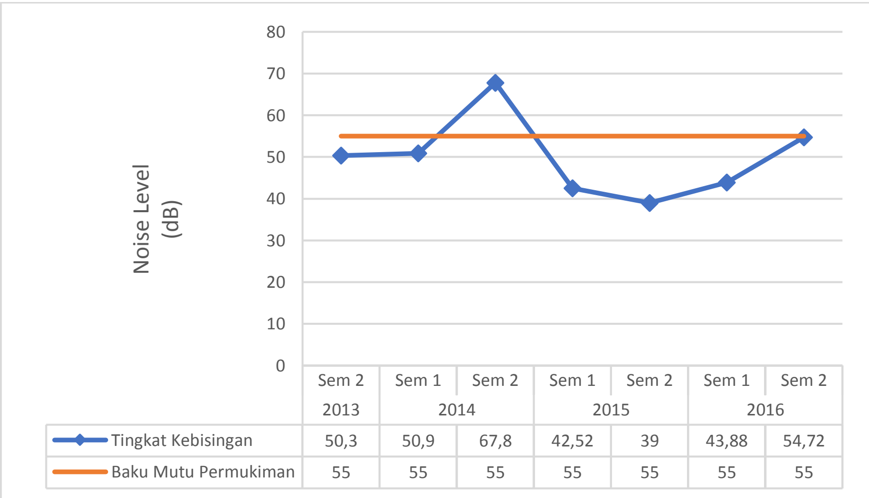


Figure 94. Noise Ambient Data Trend in Bojongsalam Village

Noise Ambient Monitoring in Bojongsalam Village was conducted from 2013 semester II - 2019 semester II. Based on monitoring results it is known that noise ambient in Bojongsalam Village varies between 39 dB to the highest of 67.8 dB. In general noise ambient in Bojongsalam Village is below the quality standard for settlements at 55 dB. Nevertheless, there are some results of noise ambient monitoring that exceed the quality standards, namely in 2014 semester II.

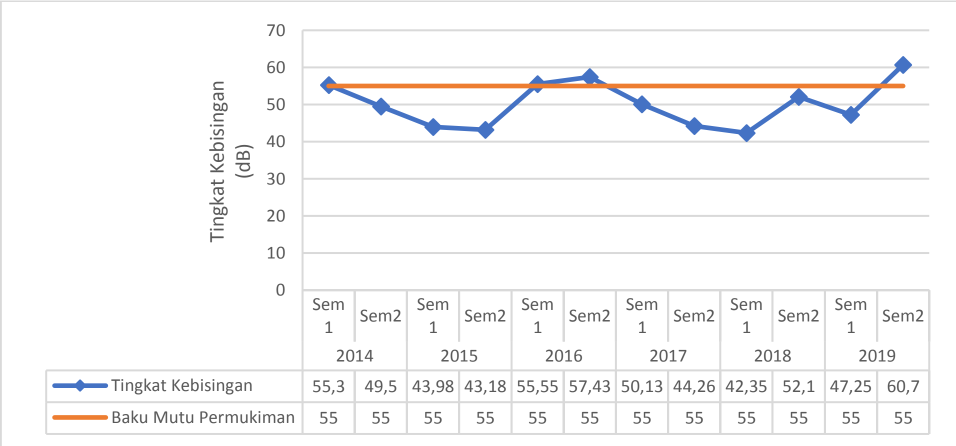


Figure 95. Noise Ambient Data Trend in Sukaresmi Village

Noise Ambient Monitoring in Sukaresmi Village was conducted from 2014 - 2019. Based on monitoring results it is known that noise ambient in Sukaresmi Village varies between 42.35 dB to the highest of 60.7 dB. In general noise ambient in Sukaresmi Village is under the quality standard for settlements at 55 dB. Nevertheless, there are some results of noise ambient monitoring that exceed quality standards, namely in 2016 the first semester and the second semester, and 2019 the second semester.

C. Vibration

Vibration levels have been monitored in several locations around the UCPS project area. Among them in Sarinagen Village (around the quarry), Cipari junction, Cibima Village (upper dam), and Sukaresmi Village. The results of monitoring the vibration level at each location are shown in the graph (Figure 96).

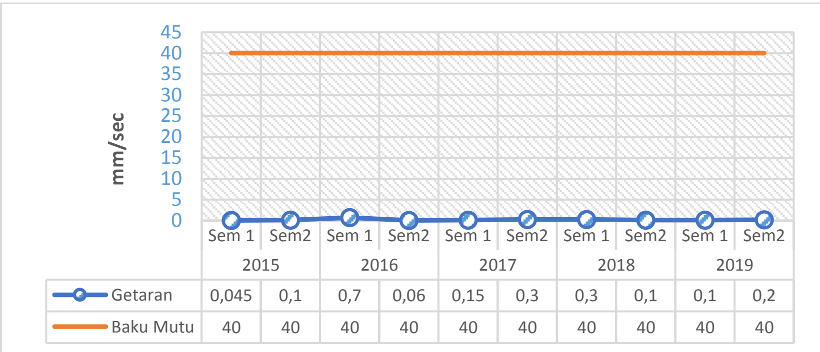


Figure 96. Vibration Level data trend in sarinangen village

Monitoring of vibration levels in Sarinagen Village was conducted from 2015 - 2019. Based on the results of monitoring it was known that vibration levels in Sarinagen Village varied between 0.045 mm / sec to the highest 0.7 mm / sec. Overall vibration levels in Sarinagen Village are under the vibration quality standard for settlements at 40 mm / sec.

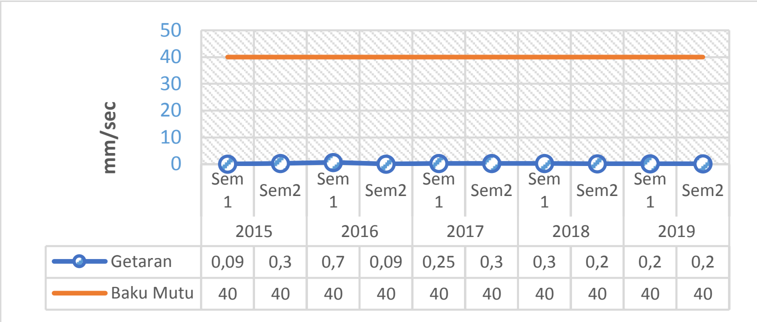


Figure 97. Vibration Level data trend in Cipari Junction

Vibration level monitoring at Cipari Junction is conducted from 2015-2019. Based on the monitoring results it is known that the vibration level at Cipari junction varies between 0.09 mm/sec to the highest 0.7 mm/sec. Overall vibration levels at Cipari junction are under the quality standard of vibration levels for settlements at 40 mm/sec.

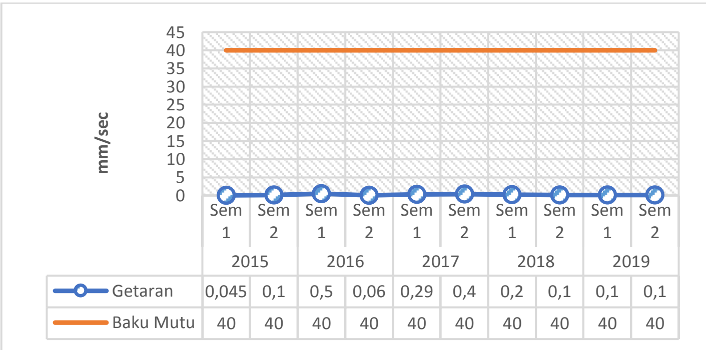


Figure 98. Vibration Level data trend in Cibima Village

Monitoring of vibration levels in Cibima Village was conducted from 2015-2019. Based on the results of monitoring it is known that the vibration levels in Cibima Village varied between 0.045 mm/sec to the highest of 0.29 mm/sec. Overall vibration levels in Cibima Village are under the vibration quality standard for settlements at 40 mm/sec.

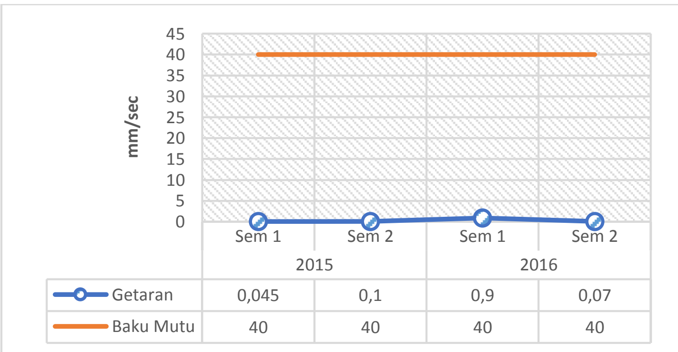


Figure 99. Vibration Level data trend in Sukaresmi Village

Monitoring of vibration levels in Sukaresmi Village was conducted from 2015 and 2016. Based on the results of monitoring it is known that the vibration level in Sukaresmi Village varies between 0.045 mm/ sec to the highest 0.9 mm/sec. Overall vibration levels in Sukaresmi Village are under the vibration quality standard for settlements at 40 mm/sec.

4.2.5 Terestrials Habitat and Biodiversities

A. Land Use and Habitat

1. **Land Allocation For The Infrastructure Development**

Area which allocated for UCPS hydropower development included 775.64 ha (PLN, 2009) and administratively located in two regencies, that is Bandung Barat and Cianjur (Table 13). Including: 1) major power plant development, surge tank, switchyard, upper and lower dam; 2) the access road; 3) upper and lower dam inundation area; 4) transmission line and quarry, and landslide potential area. For the detail of whereabout various development will happened, see the Figure 100.

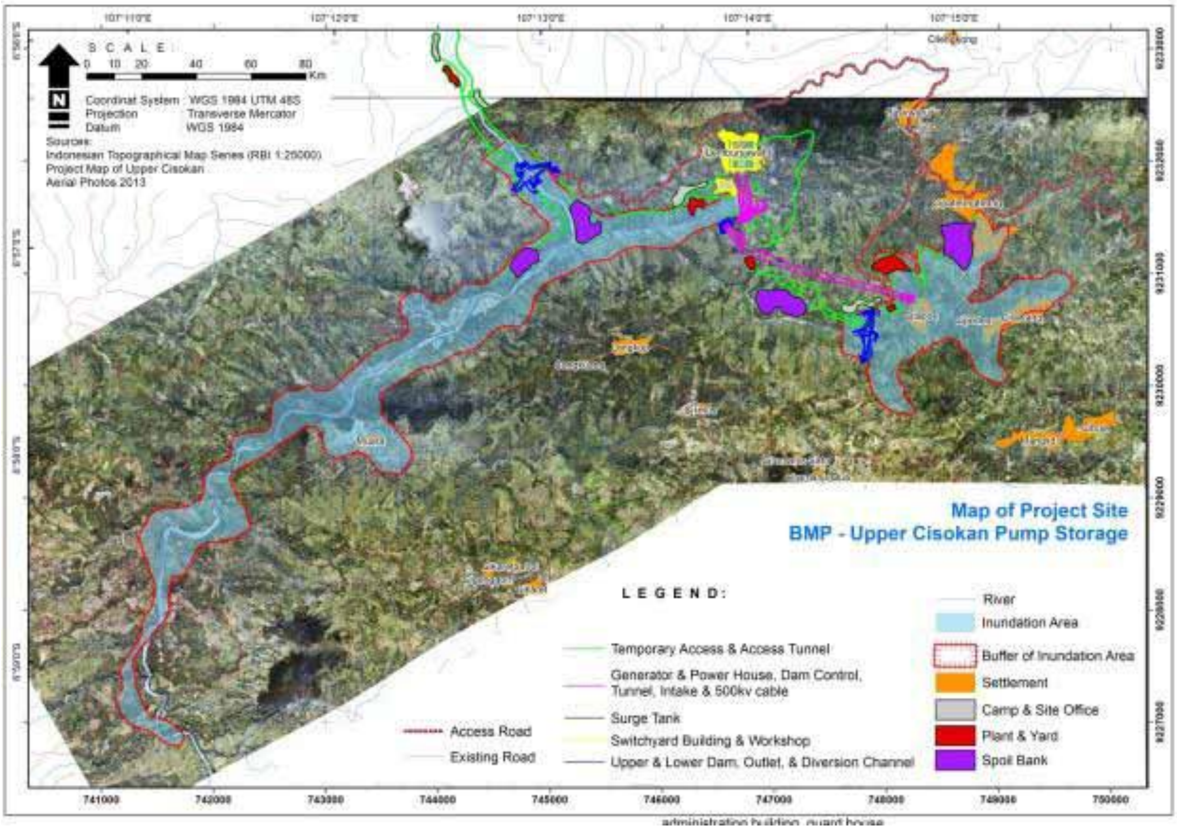


Figure 100. Map of Cisokan project location above describe where various development will take place . Scale 1: 25.000 (BMP, 2014; Husodo, et al., 2019)

Based on PT Perhutani III5 land ownership map, most of UCPS hydropower development reside in the production forest area where Perhutani (Forestry) managed, in KPH Cianjur and unit of KPH Bandung Selatan administration management. Forest type in this production area were overlap with the UCPS Hydropower infrastructure development, which mostly pine, and teak forest. Beside production forestland, the land which UCPS hydropower used also include area of community land for about 310-328 ha (LARAP, 2011).

Table 13. Land requirement for PLTA UCPS project and its relation with the administration boundary

Regency	Subdistrict	Village	Project Location						
			Major Construction	Upper dam	Lower dam	Access Road	Transmission Line	Quarry	Landslide Protection
West Bandung	Cipongkor	Cijambu				√			
West Bandung	Cipongkor	Karangsari				√			
West Bandung	Cipongkor	Sarinagen				√			
West Bandung	Cipongkor	Sirnagalih				√			
West Bandung	Rongga	Bojongsalam	√	√					
West Bandung	Rongga	Cibitung				√			
West Bandung	Rongga	Cicadas	√	√					
West Bandung	Rongga	Sukaresmi	√	√		√	√		
Cianjur	Bojongpicung	Cibarengkok					√		
Cianjur	Bojongpicung	Haurwangi					√		
Cianjur	Bojongpicung	Hegarmanah					√		
Cianjur	Bojongpicung	Jatisari					√		
Cianjur	Bojongpicung	Kemang					√		
Cianjur	Bojongpicung	Mekarwangi					√		
Cianjur	Bojongpicung	Neglasari					√		
Cianjur	Bojongpicung	Ramasari					√		
Cianjur	Bojongpicung	Sukajaya			√		√		
Cianjur	Bojongpicung	Sukarama	√	√	√		√		
Cianjur	Bojongpicung	Sukaratu					√		
Cianjur	Campaka	Margaluyu	√	√					
Cianjur	Campaka	Sukajadi	√	√					
Cianjur	Cibeber	Girimulya	√	√					
Cianjur	Cibeber	Karangnunggal	√	√	√				
Cianjur	Cibeber	Salamnunggal			√				
Land Requirement [Ha]			82.16	121.06	245.52	171.8	106.52	59.43	48.4
Total Land Requirement [Ha]			775. 64						

(ANDAL, 2007; EIA, 2011)

2. Production Forestland

Cisokan production forest is managed by forestry services regional Cianjur and West Bandung Regency. The management is divided into productive forest land, unproductive forest land, and protected areas. Perhutani has divided its region to be 72 block totally 1,770.78 ha wide, where 428 ha (37%) classified as protected forest and the rest as production forest. From 428 ha which classified as protected, about 227 ha nowadays owns the vegetation above it and classified as the rocky slope. Production forest (1,342.40 ha) divided to the production type depends on land type, inclination and other characteristic of individual management blocks. It mostly has been cultivated by the pine tree

(543.79 ha), and the rest grown by mahogany, pine, natural forest, *Altingia excelsa*, teak, Gmelina spp., *Melia azedarach*, or without cover.

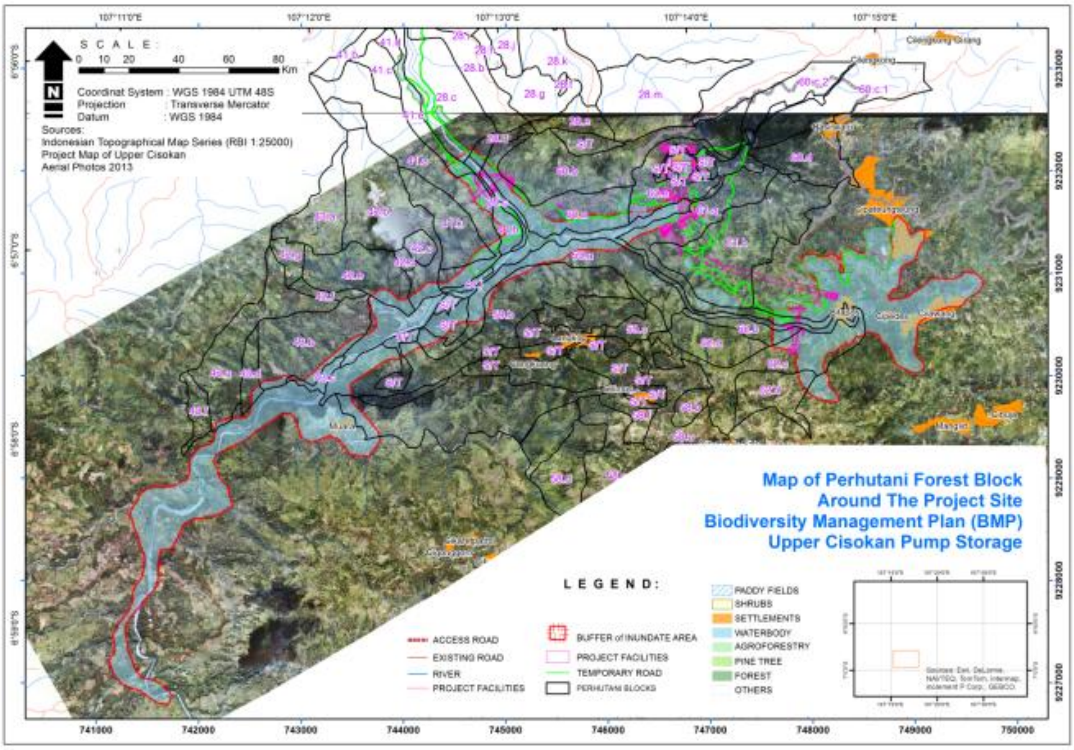


Figure 101. Perhutani Forest Block (BMP, 2014)

3. Society Land

Significant overlapping between society land ownership with the area used by Perhutani for the production forest is found in Cisokan region. Major village Lembur Sawah, Cimarel, Citapang, Cipateunteung, Cimanggu, Cipedes, and Cilawang altogether take possession of the land owned by Perhutani. Judicially a lot of land in area of Upstream Cisokan is owned by Perhutani, because of that there are informal use system which society pays to Perhutani for used production forest land. This matter happened a lot in Cisokan, especially in steeper area where slash-and-burn cultivation practice is used. This society land consists of the mixture garden, talun, agroforestry, rice land, and fishpond. Biodiversity values vary spatially depending on the size and ecological integrity of the remaining forest plots, but at the landscape level these values are generally low, one example of which is some forest plots that maintain highly endangered wildlife such as the Javan Gibbon.

4. Major Habitat

The UCPS hydropower project is located in the province of West Java, on the Indonesian island of Java. The watershed is in the west of Bandung, about 3 hours drive from the city via the existing road network. The Cisokan River originates from the highland forest area (maximum height of around 2,000 m asl), about 15 km south of the project development site. After leaving the project area, Cisokan waters flow north to the Jangari Reservoir and Jatiluhur Reservoir and finally to the Java Sea.

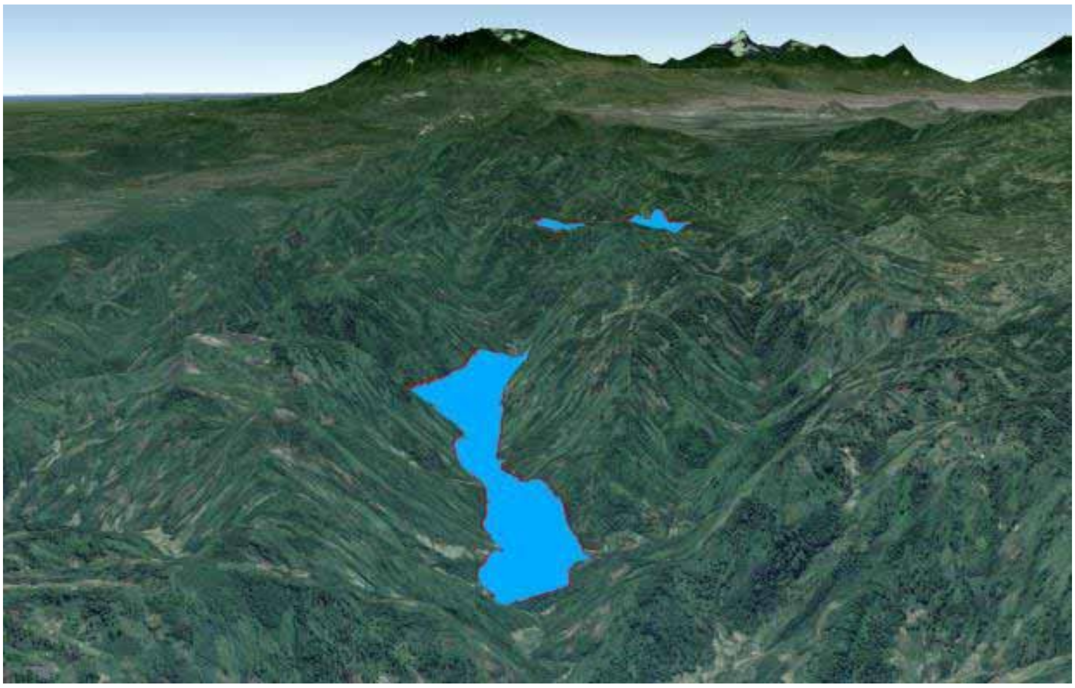


Figure 102. Google Earth view west to east direction from Cisokan Watershed, location estimation of lower dam (foreground) and upper dam (background)

The Cisokan and Cirumamis watersheds consist of steep hills with a maximum height of around 880 m asl. The upper dam area is located at an altitude of around 800 m asl, while the bottom of the Cisokan valley which will become a reservoir is at an altitude of around 460 m asl, this shows a significant height difference between the two reservoirs (Figure 102). Land cover in the hills around the reservoir is also uneven, with small patches of forest separated by grassy or open areas.

The biodiversity research elaboration was carried out on the results of the Indonesian Institute of Sciences (LIPI) research in 2012, as well as previous studies by Rahmat in 2009, the UCPS ANDAL hydropower study in 2007, the results of the RapidEye imaging map analysis 2011-2012 and the 2014 BMP study. The resulting analysis identified several types of ecosystems (or vegetation communities), including naturally degraded forests, production forests (with pine stands, teak, or *Altingia excelsa*), mixed garden areas or agroforestry (local talun), scrub areas, logging and burning of cultivation areas that form agricultural land on slopes, rice fields in flat areas, and fish ponds, settlements and yards (Figure 103).

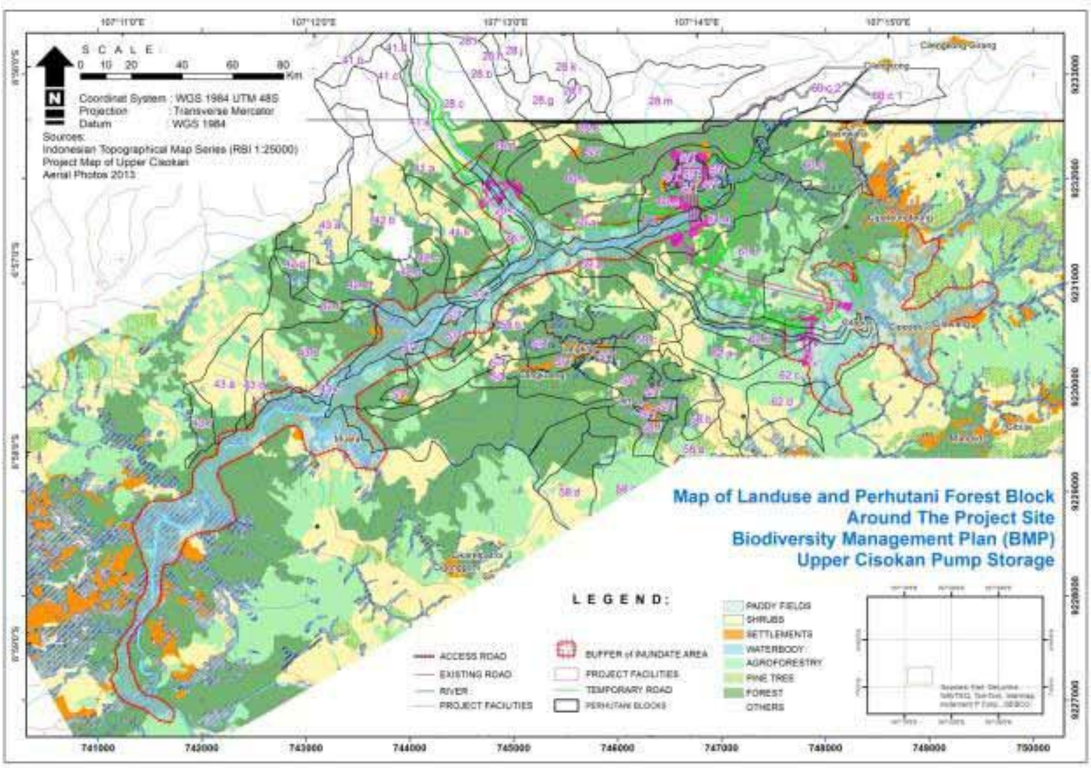


Figure 103. Land coverage and land usage map in UCPS area (BMP, 2014)

5. Nature Forest

LIPI (2012) and Rahmat (2009) research results noted that at least 376 plant species with 268 genera and 160 tribes in natural forest areas in the UCPS hydropower project site and surrounding areas. Of the 160 recorded tribes, the dominant tribes that make up the forest community include *Euphorbiaceae* (22 species), *Moraceae* (21 species), *Meliaceae* (15 species), and *Fabaceae* (23 species). These areas generally have the highest biodiversity.

6. Mixed Garden/ Talun/ Agroforestry

This system is also known as community forestry and includes a variety of plants. Some dominant plant species in this ecosystem type are sugar palm (*Arenga pinnata*), wood species such as *Albizia falcataria*, *Parasserianthes* sp, and mahogany (*Swietenia mahogany*), as well as a number of fruit trees that can be consumed by humans, including soursop (*Annona muricata*), menteng (*Bacaurearacemosa*), rambutan (*Nephelium lappaceum*), and mango (*Mangifera indica*). Some plant species here have high economic value such as durian (*Durio zibethinus*) and petai (*Parkia speciosa*). These areas can be very valuable for biodiversity, depending on species composition, area size, and also other threats such as poaching.

7. Bush and Higland Vegetation

This type of ecosystem can be found along the Cirumamis River, Cilengkong River and on the east side of the Cisokan River, especially on the slopes. Although the status of these areas in many cases is protected production forests, these areas are quite degraded due to illegal logging, collection of grass for animal feed and other resource extraction. This is also seen in production forests to the west of the Cisokan River where people have trees such as *Albizia falcataria*, teak (*Tectona grandis*) and kalandra (*Calliandra calothyrsus*). Local people also use the bush and plateau areas as slash-and-burn fields, then annual crops are used for planting under the stands of trees that have been planted before. This cultivated land system consists of lemongrass (*Andropogon citratus*), mixed with reed plants (*Imperata cylindrica*) and other grass species.

8. Settlement

The area around the settlement is generally planted with various types of plants with economic or aesthetic value. This is generally a small vegetation area measuring less than 150 m^2. Types of plants commonly found in residential yards include bananas (*Musa paradisiaca*), coffee (*Coffea* spp.), jackfruit (*Artocarpus heterophylla*), african umbrella tree (*Maesopsis eminii*), cloves (*Eugeuna aromatica*), avocado (*Persea americana*) and bamboo (*Bambusa* spp.).

9. Field, Fish Pond, and Rice Field

Fish ponds are used to keep fish such as tilapia (Thylapia mozambica). Fishponds are generally found inland areas near rivers where natural springs appear. Besides cultivation, fish ponds are alternately used to grow rice. Generally, rice is planted in the wet rice system using superior rice varieties, allowing harvests of 2 to 3 per year. Surveys in this environment indicate the presence of low native species.

B. Dam, Reservoir, Road, and Quarry Location

1. Upper dam, lower dam and reservoir

The upper dam is located on the Cirumamis River, approximately 200 m downstream from the river meeting the Cirumamis River with the Cidongke River. The 75.5 m high dam will fill a reservoir of 14,000,000 m^3 with a surface area capacity of 80 ha. Meanwhile, the lower dam is located on the Cisokan River, approximately 1 km from the river downstream where the Cisokan River meets the Cilengkong River. The location of the dam is approximately 3.5 km downstream of the upper dam river, and the reservoir will be filled with water from the Cisokan and Cilengkong rivers. The 98 m high dam will fill a reservoir of 63,000,000 m3 with a surface area of 260 ha.

The location of the upper dam is an area with habitat types that are dominated by talun bamboo and sugar palm directly adjacent to pine plantations. At the location of natural species of trees are still found such as baros (*Magnolia glauca*), bay (*Eugenia polyantha*), huru (*Litsea* spp.) and kitambaga (*Eugenia cuprea*). However, this location has become open due to land clearing and deforestation. Vegetation observations at this location are carried out in accordance with the main transects related to fauna. Observations and rapid assessments are carried out along the road to the Cilengkong river and the lower dam.

The lower dam is the only location that still has secondary forest even though the condition is damaged by illegal logging. This area is a remnant of natural habitat especially for large mammals and primates. The remaining secondary forests are located around the Curug Wallet waterfalls or along rivers have steep topography. At this location natural species of trees are found such as kopo (*Eugenia subglauca*), teureup (Artocarpus elasticus), and kibangbara (*Vitex quinata*).

The low number of species at the observation site is caused by damage to the habitat. Land clearing and illegal logging is a form of threat to habitats found in the field. In general, habitat conditions are no longer ideal for the life of wild animals, especially large mammals and primates, however in the field of observation still found endemic primates, such as Javan gibbons (*Hylobates moloch*) and Javan langur (*Trachypithecus auratus*) at the observation site so that the significance of the effort further conservation.

2. **Access Road**

The access road is located between the quarries on Gunung Karang, Karangsari to Cipari Village, Cijambu Village, and Cibitung Village, Rongga District. The area around the access road has a variety of plant conditions from species and habitat sections, the results of quantitative calculations show that natural species still have a high index value especially from trees such as sugar palm (*Arenga pinnata*), mara (*Macaranga tanarius*), and baros (*Magnolia galuca*).

In the Trunk category, Mane'e (*Maesopsis eminii*) trees dominate this category more than other types of trees. The species of this tree is a type of tree that grows quickly and is usually planted by the surrounding community. Whereas natural species of trees are also found at observation sites such as baros (*Magnolia glauca*), and manglid (*Magnolia blumei*). Species from plants in the long stem category are still the same as other types of vegetation in the previous category, but are dominated by production plants such as coffee (C*offea* spp.) and shrubs such as chirinyuh (*Chromolaena odorata*).

3. **Quarry**

Quarry is located in Gunung Karang, Karang Sari Village, Cipongkor City, West Bandung Regency. In general, habitat in this area is cultivated plants and the results of field observations do not show species that are locally, nationally or internationally important (Legal Protection, CITES & IUCN). Quantitative calculations for this area have been carried out in previous studies, repetition was not carried out given the condition of the habitat that is already open. At this location species recording is only carried out in accordance with the main transect.

4. **Transmission Line**

The landscape on the transmission line varies greatly, some of which consist of settlements, mixed gardens, rice fields and forests. There are only a few houses and residential areas along the transmission line. Plants found in the yard include mango, coconut, banana, peanuts, as well as food plants and other ornamental plants. Mixed gardens are the most common type of land use. Most of these mixed gardens are located on Perhutani land which is leased to residents around the area. Most of the rice fields in the path of the project area are mostly found in the Cisokan River plain, and generally in the Haurwangi and Mekarwangi Villages. The most common type of forest is production forest managed by Perhutani. The dominant trees are teak (*Tectona grandis*), mahogany (*Swietania mahagoni*), and jati belanda (*Guazuma ulmifolia*). The forests in this area are mostly young.

C. Flora

Four vegetation type surveys have been conducted since 1995. The most comprehensive survey is conducted by Rahmat (2009). Based on field observations, there are 226 plant species found from about 69 plant families. The access road location has the largest number of plant species, which is

173 species, quite large when compared to the quarry area, which has the smallest number of plant species, which is 86 species. The access road has a variety of habitats along the path, while in the quarry area it has been opened for forest vegetation for quite a long time and is now dominated by grasses and bushes.

No rare or protected plants were found during the survey period, although bay trees (*Eugenia polyantha*), baros (*Magnolia glauca*), manglids (*Magnolia blumei*), and kitambaga (*Eugenis cuprea*) were rarely encountered with land use pressure. The most intact and diverse native vegetation community is the secondary forest on the Cirumamis River site.

None of the plant species identified in Cisokan were internationally listed as threatened, either in a previous survey (LIPI, 2012; Rahmat, 2009; ANDAL, 2007) or during rapid assessment surveys in June and July 2013. One species was found to be registered with CITES (limiting international trade) ie Cyathea fern tree contaminans. The survey identified several species considered rare on Java, including Pangium edule, trees with edible fruits, *Syzygium polycephala*, rosewood, *Albizia procera*, *Bischofia javanica*, *Castanopsis javanica*, and *Arenga pinnata*. The last three types mentioned are known to be protected by law (Nurdjito & Maryanto, 2007).

D. Fauna

In the area directly affected by the development of the UCPS hydropower project (including quarries, access roads, dams and transmission lines) 213 species of vertebrates were found consisting of 36 species of mammals, 114 species of birds, 48 species of reptiles and amphibians.

Table 14. Key Species on variety development in Cisokan

Taxa	**Local Name/ English**	**Status**	
		Protection Status in	***IUCN Red List***
Artiodactyla			
Tragulus javanicus (Osbeck, 1765)	Pelanduk kancil/ Javan Mouse-Deer	P	DD
Carnivora			
Aonyx cinerea (Illiger, 1815)	Sero ambrang/ Small- clawed Otter	NP	VU
Arctictis binturong (Raffles, 1821)	Binturung muntu/ Binturong	NP	VU
Prionailurus bengalensis (Kerr, 1792)	Meong congkok/ Leopard Cat	P	LC
Panthera pardus melas (Cuvier, 1809)	Macan tutul jawa/ Javan Leopard	P	CR
Pholidota			
Manis javanica Desmarest, 1822	Trenggiling/ Pangolin	P	EN
Primata			
Presbytis comata (Desmarest, 1822)	Lutung surili/ Grizzled Leaf Monkey	P	EN
Trachypithecus auratus (Geoffroy, 1812)	Lutung budeng/ Javan Langur	P	VU
Hylobates moloch (Audebert, 1798)	Owa Jawa/ Javan Gibbon	P	EN
Nycticebus javanicus (Geoffroy, 1812)	Kukang/ Javan Slow Loris (see note)	P	CR

**DD = Data Deficient; LC = Least Concern; VU = Vulnerable; EN = Endangered; CR = Critically Endangered; P = Protected; NP = Not Protected,* (BMP, 2014; Husodo, et al., 2019)

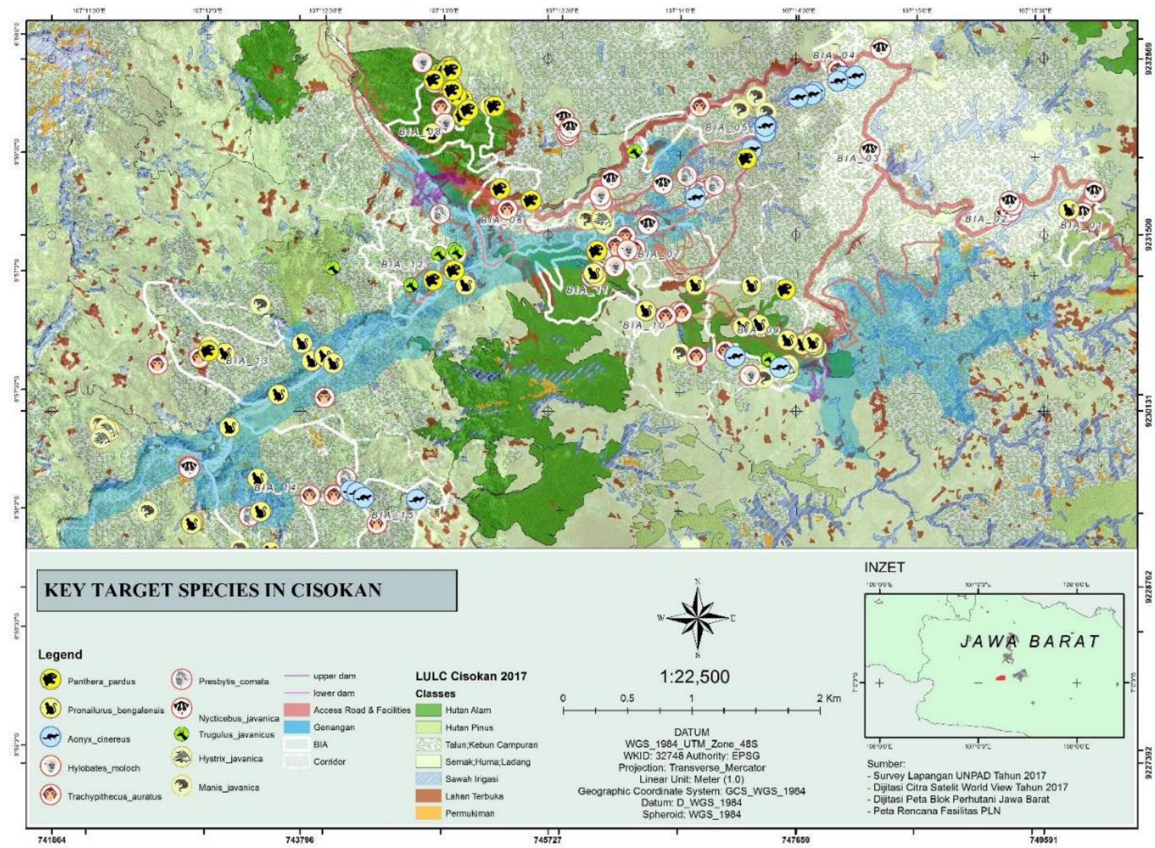


Figure 104. Presence spot of Key Species in UCPS area, Cianjur, West Java, Indonesia at year 2017 (Husodo, dkk., 2019)

Table 14 shows, of the animals found so far in Cisokan, there are several mammals of concern to global conservation. Two species namely Javan slow loris and Javan Leopard are categorized as Very Endangered on the IUCN red list of endangered species, which means that they face a very high risk of extinction in the wild. Their presence in Cisokan with their protected status in Indonesia also means that best efforts are needed to ensure that during project development and implementation none of these animals are negatively affected through direct or indirect project intervention.

1. Mamalia

Mammals found in the Cisokan area are 26 species (Table 15). Mammals tend to be concentrated in Batu Nagok, Japarana, and Walet Waterfalls blocks which are dominated by natural forest land cover, so it is assumed that mammals use natural forests as their habitat. In addition, these three locations are adjacent to rivers to fulfill water sources, including the Cisokan River and Cirumamis River. Primates are often found on river banks. This location is far from the settlement even though there are still agricultural activities around the natural forest. Other blocks such as Cilengkong, Pasir Taman, Cigintung, and Ciawitali also found mammals with land cover types dominated by production forests or agroforestry or Perhutani forests. The diversity of crops cultivated between perennials and agricultural crops allows for longer food and energy chains. This condition will further support the creation of high biodiversity. Regulated agroforestry with high species diversity and good canopy composition can be a habitat for several species, such as primates, bears and terrestrial mammals (Widiyanto 2013).

Some species are always found in various types of land cover, such as natural forests, production forests, bushes, rice fields, and agroforestry, including Javan leopards and wild boar. This shows that this species has a high tolerance level for environmental changes. In addition, predator-prey relationships occur when leopards follow the presence of wild boar.

Several mammal species found to have the status of Critically Endangered by IUCN (2018) and Appendix I by CITES (2018), including Javan Leopards (*Panthera pardus melas*), Pangolin (*Manis javanica*), and Slow Loris (*Nycticebus javanicus*). Javan leopards are more often found in natural forests than other land cover, which is assumed that Javan leopards use natural forests to meet their daily needs. The main habitat of the Javan Leopard consists of highly vegetated forests that are difficult to access by humans, and also the area has a steep topography with a slope of more than 40% and remote areas such as deep valleys or high hills that are difficult to reach. Similar to African Leopards who like thick bushes in rocky environments and riverside forests as their main habitat. Leopards especially prefer areas that have trees for shelter and hiding activities because they are strong climbers (Gunawan et al. 2012). Besides being found in natural forests, Leopards in Cisokan are also found in production forests - pine forests where there is a lot of human activity and planting of coffee plants (Shanida et al. 2018). According to Gunawan et al. (2012), Javan leopards not only use pine forests exclusively as their main habitat, but also use other types of vegetation for daily activities, even using caves, rocky outcrops, and dry streams or rivers as shelters.

Table 15. Types of mammals in Cisokan, West Java, Indonesia (Husodo, et al., 2019)

Species	English Name	Land Type	Protection Status			Data Type
			RI	IUCN	CITES	
Artiodactyla						
Suidae						
Sus scrofa (Linnaeus, 1758)	*Wild Boar*	Ag, Nf, Rf, Sc, Pf				CT, Tr
Tragulidae						
Tragulus javanicus (Osbeck, 1765)	*Lesser Mouse-Deer*	Sh, Ag	✓			CT, I, Tr, Fe
Carnivore						
Mustelidae						
Aonyx cinerea (Illiger, 1815)	*Oriental Small-clawed Otter*	Ri, Rf, Se, Ag		VU	II	CT, I, Tr, Fe, Ne
Viverridae						
Paradoxurus hermaphroditus (Pallas, 1777)	*Common Palm Civet*	Ga, Ag, Nf			III	DE, CT, Fe
Vivericula indica (Desmarest, 1817)	*Oriental Civet*	Ga, Ag			III	DE
Paguma larvata (C.E.H. Smith, 1827)	*Masked palm civet*	Ag				CT
Herpestidae						
Herpestes javanicus (E. Geoffroy Saint-Hilaire 1818)	*Small Asian Mongoose*	Sh			III	CT, Fe
Felidae						
Prionailurus bengalensis (Kerr, 1792)	*Leopard Cat*	Rf, Ri, Nf, Pf	✓		II	DE, CT, I, Tr, Fe
Panthera pardus melas (Cuvier, 1809)	*Javan Leopard*	Nf, Pf, Sh, Rf, Ag	✓	CR	I	CT, I, Tr, Fe
Pholidota						
Manidae						
Manis javanica (Desmarest, 1822)	*Pangolin*	Sh, Ag, Nf, Pf	✓	CR	I	CT, I, Lo, Tr

Species	English Name	Land Type	Protection Status			Data Type
			RI	IUCN	CITES	
Primate						
Cercopithecidae						
Macaca fascicularis (Raffles, 1821)	*Long-tailed Macaque*	Ag, Nf, Ri			II	DE, CT
Presbytis comata (Desmarest, 1822)	*Grizzled Leaf Monkey*	Ag, Nf, Sh	✓	EN	II	DE, I
Trachypithecus auratus (É. Geoffroy Saint-Hilaire, 1812)	*Javan Langur*	Ag, Nf	✓	VU	II	DE, I
Hylobatidae						
Hylobates moloch (Audebert, 1798)	*Javan Gibbon*	Nf	✓	EN	I	DE, I
Lorisidae						
Nycticebus javanicus (Boddaert, 1785)	*Slow loris*	Ag, Se, Sh	✓	CR	I	DE
Rodentia						
Sciuridae						
Sundasciurus lowii (Thomas, 1892)	*Squirrel*	Pf				DE
Callosciurus nigrovittatus (Horsfield, 1824)	*Black-striped squirrel*	Pf				DE
Callosciurus notatus (Boddaert, 1785)	*Plantain Squirrel*	Pf				DE
Ratufa bicolor (Sparrman, 1778)	*Giant Squirrel*	Pf	✓	NT	II	DE
Muridae						
Rattus argentiventer (Robinson and Kloss, 1916)	*Ricefield Rat*	Rf				MT
Hystricidae						
Hystrix javanica (F. Cuvier, 1823)	*Javan Porcupine*	Sh		✓		CT, Th, Lo
Sciuridae						
Lariscus insignis (F. Cuvier, 1821)	*Three-striped ground squirrel*	Pf				CT
Petinomys sp. (Thomas, 1908)	*Flying Squirrel*	Pf				DE
Soricidae						
Suncus murinus (Linnaeus, 1766)	*Asian Musk Shrew*	Sh				DE
Scandentia						
Tupaiidae						
Tupaia tana (Raffles, 1821)	*Javan Treeshrew*	Sh, Nf				CT
Tupaia javanica (Horsfield, 1822)	*Large Treeshrew*	Nf		II		DE

Information :
Sources: Husodo et al. (2017), IUCN (2018), CITES (2018), and Regulation of the Minister of Environment and Forestry of the Republic of Indonesia (MoEF 2018)
Protection Status: RI: PermenLHK No. P.20 (No. P.20/MENLHK/SETJEN/KUM.1/6/2018) about protected plant and animal species, IUCN : International Union for Conservation of Nature; CR: *Critically Endangered*; EN: *Endangered*; NT: *Near Threatened*; VU: *Vulnerable*; CITES: *Convention on International Trade in Endangered Species*; I: *Appendix* I; II: *Appendix* II; III: *Appendix* III
Data Type: DE: *Direct Encounter*, I: *Interview*, CT: *Camera trap*, MT: *Collapsible trap*, Tr: *Tracks*, Fe: *Feces*, Ne: *Nest*, Ha: *Hair*, Sct: *Scratch*, Scp: *Scrape*, Lo: *Leftover*, Th: *Thorn*
Land Type: Nf: *Natural forest*, Ri: *River*, Se: *Settlement*, Pf: *Production forest*, Rf: *Rice field*, Sc: *Swidden cultivation*, Ga: *Garden*, Ag: *Mixed garden*/talun*,* Sh: *Shrub.*

This shows that the leopard's home range overlaps with human land, so there is a possibility of human-leopard conflict. It needs to be studied further about the potential conflict of human leopards in Cisokan based on threats and disorders that affect mammals, especially endangered leopards.

Another species, slow loris, also has the potential for conflict with humans, as seen from its presence found in settlements, plantations, and agroforestry. According to Withanigsih (2019) that local residents living around the Javan slow loris habitat have high-intensity activities at the habitat location, so the possibility of habitat destruction and the chance of direct contact with these animals is also high. Therefore, local people play a very important role in direct protection, by not hunting or destroying their habitat.

Anteater is commonly found in shrubs, agroforestry, natural forests and production forests. Pangolins live in more than one habitat such as primary forest, secondary forest, rubber plantation area, oil palm or even open space near human settlement areas (Lekagul and McNeely 1977; Davies and Payne 1982; Nowak 1999). In other regions in Indonesia such as Tanggamus and West Lampung Regencies, pangolins are found in production forests and secondary forests (Wirdateti et al. 2013). Meanwhile in Cisokan, threats to the existence of pangolins continue to occur, such as hunting, trade, and land clearing for agriculture. Human activities in soil cultivation can cause disturbance to pangolins and cause the inability of pangolins to nest in disturbed locations (Withaningsih et al. 2018). Anteater is a sensitive wild animal that reacts to human activities. They tend to make nests / holes at least 1,000 m from the source of disturbance. This is because the Anteater cannot adapt well to noisy situations. Sounds coming from other animals or livestock and human voices will disrupt the activity of pangolins and most will scare them, causing stress to pangolins (Wu et al., 2003; Sawitri et al. 2012).

In 10 years (2007-2017) several species were always found in every study conducted, such as wild boar, Javan leopard, pangolins, Javan gibbons, etc. (Table 16). This shows that the habitat in Cisokan can still meet their needs. In addition, as discussed earlier, the source of leopard prey is always available every year as evidenced by the discovery of wild boar each year of study. Other leopard prey, such as long-tailed monkeys, javan langur and surili monkeys are also found in each study year.

However, the assumption that the habitat in Cisokan can still meet their needs does not indicate that there are no threats and disturbance to the habitat and mammals, so it is necessary to learn more about the characteristics of mammal habitat in Cisokan and the threats and disturbances that affect the presence of mammals in Cisokan. Endangered species such as Javan leopard and pangolin are always found every year during the study but need to be studied further the condition of the population of this species, so it is necessary to manage wildlife in Cisokan.

Table 16. Comparison Mamalia Existed Study in Cisokan, West Java, Indonesia (Husodo, et al., 2019)

Species	Cisokan Observation				
	2007	**2009**	**2012**	**2014**	**2017**
Artiodactyla					
Suidae					
Sus scrofa (Linnaeus, 1758)	+	+	+	+	+
Tragulidae					
Tragulus javanicus (Osbeck, 1765)		+	+	+	+
Carnivore					
Felidae					
Panthera pardus melas (Cuvier, 1809)	+	+	+	+	+
Prionailurus bengalensis (Kerr, 1792)		+	+	+	+
Herpestidae					
Herpestes javanicus (E. Geoffroy Saint-Hilaire, 1818)		+	+		+
Mustelidae					
Aonyx cinerea (Illiger, 1815)		+	+	+	+
Viverridae					
Arctictis binturong (Raffles, 1821)		+	+		
Paguma larvata (Smith, 1827)		+	+		+
Paradoxurus hermaphroditus (Pallas, 1777)		+	+	+	+
Viverricula indica (E. Geoffroy Saint-Hilaire, 1803)		+	+		+
Eulipotyphla					
Soricidae					
Suncus murinus (Linnaeus, 1758)			+		+
Pholidota					
Manidae					
Manis javanica (Desmarest, 1822)	+	+	+	+	+
Primate					
Cercopithecidae					
Macaca fascicularis (Raffles, 1821)	+	+	+	+	+
Presbytis comata (Desmaret, 1822)	+	+	+	+	+
Trachypithecus auratus (E.Geoffroy, 1822)	+	+	+	+	+
Hylobatidae					
Hylobates moloch (Audebert, 1798)	+	+	+	+	+
Lorisidae					
Nycticebus javanicus (E.Geoffroy, 1812		+	+	+	+
Rodentia					
Hystricidae					
Hystrix javanica (Cuvier, 1823)		+	+		+
Hystrix brachyura (Linnaeus, 1758)	+				
Sciuridae					
Callosciurus nigrovittatus (Horsfield, 1823)		+	+		+
Callosciurus notatus (Boddaert, 1785)		+	+		+
Lariscus insignis (Cuvier, 1821)		+	+	+	+
Petinomys sp. (Thomas, 1908)		+			+
Ratufa bicolor (Sparman, 1778)	+	+			+
Sundasciurus lowii (Thomas, 1892)	+		+		+
Muridae					
Rattus argentiventer (Robinson and Kloss, 1916)		+	+		+
Scandentia					
Tupaiidae					
Tupaia javanica (Horsfield, 1822)		+	+	+	+
Tupaia tana (Raffles, 1821)					+
Total	**10**	**24**	**24**	**14**	**26**

Source: ANDAL-PT. PLN (2007), Rahmat (2009), LIPI (2012), UNPAD (2014), Husodo et al., (2017) The diversity of mammals in Cisokan found 26 species and among them are endangered species, such as Javan leopards, anteater and Javan slow loris. These three species occupy a variety of land cover from natural forests to human land, such as production forests, settlements, rice fields, and agroforestry or mixed gardens. The existence of this species on human land has the potential to cause human-wildlife conflict, so it needs to be studied further in the management of wildlife in Cisokan.

2. Reptiles and Amphibians

Herpetofauna found in the study area consisted of 24 species. 18 of these species are in the Reptile Class, and 6 other species are in the Amphibian Class. Herpetofauna in the field has a very important function in nature, which is a species included in the ecology of the food chain. Some of these species are the main predators, for example water monior (*Varanus salvator*), which belong to the *Lacertidae* genus of the *Lacertilia* order .

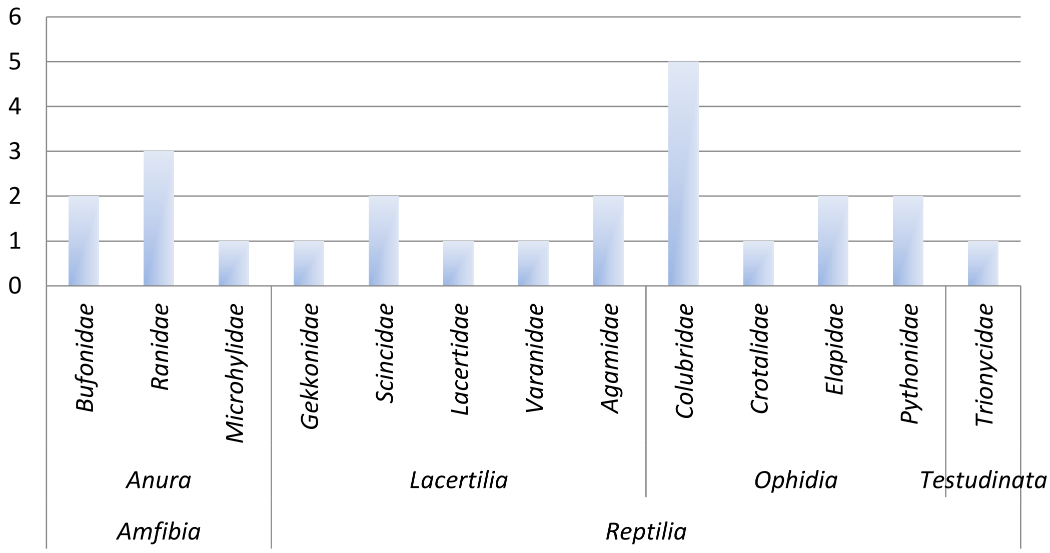


Figure 105. Comparison amount of species among Orde Herpetofauna in Cisokan (Rahmat, 2009)

Other reptile groups are feared by some people, because of the deadly poisons that some of these species have, such as snakes from the Ophidian race. Based on the research results, there are at least 10 species of snakes found in the study area. The species that originated most from the *Colubridae* order (Figure 105), because it has the highest species variant in its class is the *Ophidian* race. A total of 5 species of snakes have been identified, two orders of this species only reach the level of the genus.

Based on national and international laws and regulations regarding wild animals, there are two species of snakes that are included in the list of protected animals. Reticulate pythons (*Python reticulatus*) are included in Appendix II of CITES which can be traded internationally with restrictions on certain quotas based on accurate data on populations and habits of these species in the wild. In addition, there are also burmese python species (*Python molurus*) included in Appendix II of CITES, where both of these species are also protected under Government Regulation No. 7 of 1999. Based on Table xx above, the highest number of reptile species found in the upper dam is 15 species. While the largest number of amphibian species are found in two places, namely the upper dam and the access road. Generally documented reptiles and amphibians are found in riparian habitat types. The role of water sources is important for the sustainability of herpetofauna's life, especially the amphibian group who spent part of their lives also in pre-adulthood in riparian areas. Six amphibian species are documented in this area, of which 3 are in the *Ranidae* order.

Table 17 Observation location of the Herpetofauna species in the Ciokan Area (Rahmat, 2009)

Class/ Orde/Family	Species Name	Local name	English Name	Documentation Locate			
				A	B	C	D
Reptil							
Lacertilia							
Gekkonidae	*Hemidactylus frenatus*	Cicak rumah	Spiny-tailed House Gecko	O	O	O	
Scincidae	*Mabuya multifasciata*	Kadal	Many-lined Sun Skink	O	O, W	O, W	O, W
	Lipinia vittigera	Kadal pohon	Striped Tree Skink			O	O
Lacertidae	*Takydromus sexlineatus*	Orong-orong	Long-tailed Lizard		O	O	
Varanidae	*Varanus salvator*	Biawak	Water Monior		W	O, W	O, W
Agamidae	*Calotes jubatus* (Gunther, 1988)	Bunglon	JavaGreen CrestedLizard		O	O, W	O, W
	Draco volans	Hap-hap	Common Gliding Lizard		O	O, W	O, W
Ophidia							
Colubridae	*Natrix vittatus* (Merrem, 1820)	Ular sawah	Garter Snake-Indonesian	O, W	W	W	W
	Elaphe radiata (Boie,1827)	Ular sapi	Copperhead RatSnake		O, W		
	Ahaetulla prasina	Ular hijau	Green vine Snake		W	W	W
	Calamaria sp.	Ular tanah	Reed Snake		O		
	Enhydris sp.	Ular lemah	Mud Snake		O		
Crotalidae	*Trimeresurus* sp.	Ular hijau berbisa	Pit viper Snake		W	W	W
Elapidae	*Bungarus fasciatus* (Schneider, 1801)	Ular Welang	Banded Krait		W	W	W
	Naja sumatrana	Kobra	Sumatran Cobra			W	W
Pythonidae	*Python molurus*	Sanca Bodo	Burmese Python			W	W
	Python reticulatus	Sanca Kembang	Reticulate Python			W	W
Testudinata							
Trionycidae	*Amyda cartilaginea*	Bulus	Common Softshell Turtle			W	W
Amfibia							
Anura							
Bufonidae	*Bufo melanostictus* (Schneider, 1799)	Kodok buduk	Asian Toad	O	O	O	O
	Bufo asper (Gravenhorst, 1829)	Kodok buduk sungai	River Toad		O	O	O
Ranidae	*Fejervarya cancrivora* (Gravenhorst, 1829)	Katak sawah	Marsh Frog	O	O	O	O
	Fejervarya limnocharis (Boie, 1835)	Katak Tegalan	Grass Frog		O	O	
	Rana chalconata (Schlegel, 1837)	Kongkang kolam	White-lipped Frog			O	
Microhylidae	*Kaloula baleata* (Muller, 1836)	Belentuk	Flower Pot Toad		O		

*****A = *Quarry*, B= Access Road, C= Upper Dam, D= Lower Dam, O= Observation, W= Interview

The reptile species most commonly documented is the many-lined sun skink (*Mabuya multifasciata*) which is commonly found directly in the upper dam and the lower dam that has riparian habitat is water monior (*Varanus salvator*). The species are documented in several rivers such as the Cirumamis, Cilengkong and Cisokan River.

The results of a recent Biodiversity Management Plan (2014) mentioned have recorded 21 amphibian species and 27 reptile species, including two snakes (*Python reticulatus and P. molurus*) that are protected in Indonesia. This number is greater than previous biodiversity studies in 2009 which recorded 18 reptile species and 6 amphibian species. This shows that the UCPS hydropower activity did not have an effect on the loss of amphibian or reptile species in the Cisokan area. In addition, no reptiles and amphibians found in the Cisokan area are of concern to global conservation.

2. Bird

Based on the results of observations made, there are 62 species of birds found. In addition, based on interviews there were an additional 8 species, so that the total number of bird species found in the study area was 70 species of birds (Table 18). A total of 10 types of them are included in endemic species, namely native speries which are only found on the island of Java. While 1 species of bird is a migratory species, where birds migrate from the northern or southern hemisphere to the tropics due to weather conditions in the area of origin that experiences winter, so for the preservation of several migratory bird species to find a warm location during food search . This bird species is called the common sandpiper (*Actitis hypoleucos Linnaeus*, 1758). The phenomenon of migration usually occurs around August to March (Howes et al. 2003).

Table 18. Bird species in Cisokan area (Rahmat, 2009)

No	Bird Species	Local Name	English Name	WJ	Status
1	*Actitis hypoleucos* (Linnaeus, 1758)	Trinil Pantai	Common Sandpiper	M	II, P
2	*Aegithina tiphia* (Linnaeus, 1758)	Cipoh Kacat	Common Iora		
3	*Aethopyga mystacalis* (Temminck, 1822)	Burungmadu Jawa	JavanSunbird	E	P
4	*Alcedo meninting* (Horsfield, 1821)	Rajaudang Meninting	Blue-eared Kingfisher		P
5	*Anthreptes malacensis* (Scopoli, 1786)	Burungmadu Kelapa	Brown-throated Sunbird		P
6	*Anthreptes singalensis* (Gmelin, 1789)	Burungmadu Belukar	Ruby-cheeked Sunbird		P
7	*Arachnothera longirostra* (Latham, 1790)	Pijantung Kecil	Little Spiderhunter		P
8	*Bubo sumatranus* (Raffless, 1822)	Beluk Jempuk	Barred Eagle-Owl		II
9	*Cacomantis merulinus* (Scopoli, 1786)	Wiwik Kelabu	Plaintive Cuckoo		
10	*Cacomantis sepulcralis* (S. Müller, 1843)	Wiwik Uncuing	Rusty-breasted Cuckoo		
11	*Centropus bengalensis* (Gmelin, 1788)	Bubut Alang-alang	Lesser Coucal		
12	*Chalcophaps indica* (Linnaeus, 1758)	Delimukan Zamrud	Common Emerald Dove		
13	*Chloropsis cochinchinensis* (Gmelin, 1789)	Cicadaun Sayap-biru	Blue-winged Leafbird		
14	*Cinnyris jugularis* (Linnaeus, 1766)	Burungmadu Sriganti	Olive-backed Sunbird		P
15	*Cisticola juncidis* (Rafinesque, 1810)	Cici Padi	Zitting Cisticola		
16	*Collocalia linchi* (Horsfield & F. Moore, 1854)	Walet Linci	Cave Swiftlet		
17	*Copsychus malabaricus* (Scopoli, 1786)*	Kucica Hutan	White-rumped Shama		
18	*Copsychus saularis* (Linnaeus, 1758)*	Kucica Kampung	Oriental Magpie-Robin		
19	*Coturnix chinensis* (Linnaeus, 1766)	Puyuh Batu	King Quail		
20	*Criniger bres* (Lesson, 1831)	Empuloh Janggut	Grey-cheeked Bulbul		
21	*Cypsiurus balasiensis* (J. E. Gray, 1829)	Waletpalem Asia	Asian Palm Swift		
22	*Dendrocopos macei* (Vieillot, 1818)	Caladi Ulam	Fulvous-breasted Woodpecker		
23	*Dendrocopos moluccensis* (Gmelin, 1788)	Caladi Tilik	Sunda Pygmy Woodpecker		
24	*Dicaeum trigonostigma* (Scopoli, 1786)	Cabai Bunga-api	Orange-bellied Flowerpecker		
25	*Dicaeum trochileum* (Sparrman, 1789)	Cabai Jawa	Scarlet-headed Flowerpecker	E	
26	*Dicrurus macrocercus* Vieillot, 1817	Srigunting Hitam	Black Drongo		
27	*Enicurus leschenaulti* (Vieillot, 1818)	Meninting Besar	White-crowned Forktail		
28	*Gallus gallus* (Linnaeus, 1758)*	Ayamhutan Merah	Red Junglefowl		

No	Bird Species	Local Name	English Name	WJ	Status
29	*Halcyon chloris* (Boddaert, 1783)	Cekakak Sungai	Collared Kingfisher		P
30	*Halcyon cyanoventris* (Vieillot, 1818)	Cekakak Jawa	Javan Kingfisher	E	P
31	*Hemipus hirundinaceus* (Temminck, 1822)	Jingjing Batu	Black-winged Flycatcher-shrike		
32	*Hirundo rustica* (Linnaeus, 1758)	Layanglayang Asia	Barn Swallow		
33	*Hirundo striolata* (Temminck & Schlegel, 1847)	Layanglayang Loreng	Striated Swallow		
34	*Hirundo tahitica* (Gmelin, 1789)	Layanglayang Batu	Pacific Swallow		
35	*Ictinaetus malayensis* (Temminck, 1822)*	Elang Hitam	Black Eagle		II, P
36	*Ketupa ketupu (*Horsfield, 1821)*	Beluk Ketupa	Buffy Fish-Owl		II
37	*Lanius schach* (Linnaeus, 1758)	Bentet Kelabu	Long-tailed Shrike		
38	*Leptocoma sperata* (Linnaeus, 1766)	Burungmadu Pengantin	Purple-throated Sunbird		P
39	*Lonchura leucogastroides* (Horsfield & Moore, 1858)	Bondol Jawa	Javan Munia	E	
40	*Lonchura punctulata* (Linnaeus, 1758)	Bondol Peking	Scaly-breasted Munia		
41	*Malacocincla sepiarium* (Horsfield, 1821)	Pelanduk Semak	Horsfield’s Babbler	E	
42	*Megalaima armillaris* (Temminck, 1821)	Takur Tohtor	Flame-fronted Barbet	E	P
43	*Megalaima australis* (Horsfield, 1821)	Takur Tenggeret	Blue-eared Barbet		
44	*Megalaima javensis* (Horsfield, 1821)	Takur Tulung-tumpuk	Black-banded Barbet	E	NT, P
45	*Motacilla cinerea* (Tunstall, 1771)	Kicuit Batu	Grey Wagtail		
46	*Orthotomus sepium* (Horsfield, 1821)	Cinenen Jawa	Olive-backed Tailorbird		
47	*Orthotomus sutorius* (Pennant, 1769)	Cinenen Pisang	Common Tailorbird	E	
48	*Otus lempiji* (Horsfield, 1821)	Celepuk Reban	Collared Scops Owl		
49	*Parus major* (Linnaeus, 1758)	Gelatikbatu Kelabu	Great Tit		
50	*Passer montanus* (Linnaeus, 1758)	Burunggereja Erasia	Eurasian Tree Sparrow		
51	*Pellorneum capistratum* (Temminck, 1823)	Pelanduk Topi-hitam	Black-capped Babbler		
52	*Pellorneum pyrrogenys* (Temminck, 1827)	Pelanduk Bukit	Temminck’s Babbler		
53	*Pericrocotus flammeus* (J. R. Forster, 1781)	Sepah Hutan	Scarlet Minivet		
54	*Pitta guajana* (P. L. S. Müller, 1776)	Paok Pancawarna	Banded Pitta		II, P
55	*Prinia familiaris* (Horsfield, 1821)	Perenjak Jawa	Bar-winged Prinia	E	
56	*Prinia inornata* (Sykes, 1832)	Perenjak padi	Plain Prinia		
57	*Prinia polychroa* (Temminck, 1828)	Perenjak Coklat	Brown Prinia		
58	*Prionochilus percussus* (Temminck, 1826)	Pentis Pelangi	Crimson-breasted Flowerpecker		
59	*Pycnonotus aurigaster* (Jardine & Selby, 1837)	Cucak Kutilang	Sooty-headed Bulbul		
60	*Pycnonotus goiavier* (Scopoli, 1786)	Merbah Cerukcuk	Yellow-vented Bulbul		
61	*Spilornis cheela* (Latham, 1790)	Elangular Bido	Crested Serpent Eagle		II, P
62	*Spizaetus cirrhatus* (Gmelin, 1788)	Elang Brontok	Crested Hawk-Eagle		II, P
63	*Spizaetus* sp.		Unidentified Spizaetus		II, P
64	*Stachyris melanothorax* (Temminck, 1823)	Tepus Pipi-perak	Crescent-chested Babbler	E	P
65	*Streptopelia chinensis* (Scopoli, 1786)	Tekukur Biasa	Spotted Dove		
66	*Turnix suscitator* (Gmelin, 1789)	Gemak Loreng	Barred Buttonquail		
67	*Zoothera andromedae* (Temminck, 1826)*	Anis Hutan	Sunda Thrush		
68	*Zoothera citrina* (Latham, 1790)*	Anis Merah	Orange-headed Thrush		
69	*Zoothera interpres* (Temminck, 1828)	Anis Kembang	Chestnut-capped Thrush		
70	*Zosterops palpebrosus* (Temminck, 1824)	Kacamata Biasa	Oriental White-eye		

Based on primary and secondary data in 2009, there were 20 species of birds under the protection of regulations and legal protection status, the Law of the Republic of Indonesia and the status of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) or

International Treaties governing trade between country of wild fauna species and endangered wild plant life. Like 18 bird species that are protected under the Law of the Republic of Indonesia, such as Law No.5 of 1990 and Law No.7 of 1999. As for species trading in the CITES list status Attachment II consists of 8 species, of which the species is protected by the Law of the Republic of Indonesia . Appendix II or Attachment II of CITES status means that these species may be traded internationally with certain quota amounts based on accurate data on people and their habitats in nature.

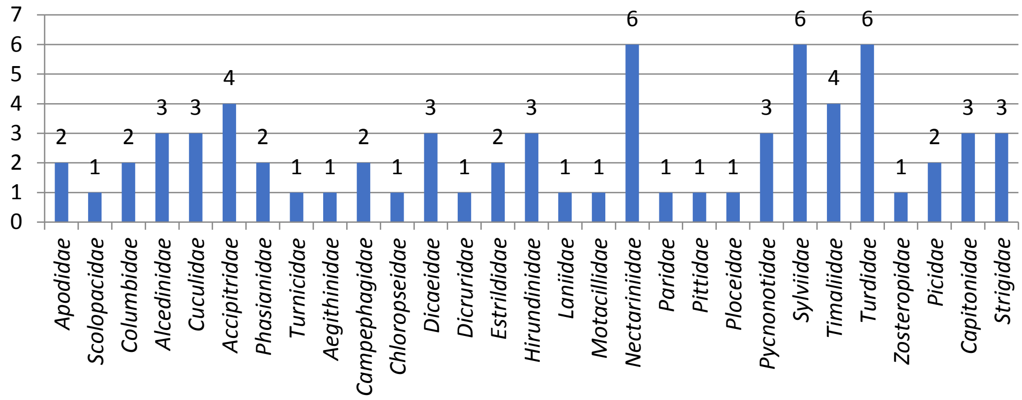


Figure 106. Comparison between amount of species with etnical bird group at Cisokan (Rahmat. 2009)

Based on criteria made by IUCN (International Union Conservation Nature) there is 1 species of bird that is included in the endangered category in the wild. This particular species is a black-banded barbet (*Megalaima javensis Horsfield*, 1821) which can still be found, especially in the location of the downstream dams around the Walet waterfall.

Based on bird observation table data, 70 bird species were found at the study site including 29 ethnic groups from 11 races. Race birds have ethnic groups namely Passeriformes with 18 ethnic groups including *Aegithinadae, Campephagidae, Chloropseidae, Dicaeidae, Dicruridae, Estrildidae, Hirundinidae, Laniidae, Motacillidae, Nectariniidae, Plorideidae, Dicaeidae, Dicruridae, Estrildidae, Hirundinidae, Laniidae, Motacillidae, Nectariniidae, Chloropseidae, Dicaeidae, Dicruridae, Estrildidae, Hirundinidae, Laniidae, Motacillidae, Nectariniidae, Paridae, Pittidaee, Dicruridae, Turquoiseidae, Turquoiseidae*. Next is the *Piciformes* race, which has 2 ethnic groups namely *Picidae* and *Capitonidae*. As for the other bird races, each has been represented by one ethnic race.

The most represented bird species by three ethnic groups from *Passeriformes* are *Nectariniidae*, *Sylviidae*, and *Turdidae* with ethnic groups, each numbering 6 species of birds. *Nectariniidae* are an ethnic group of honey-eating birds, such as the olive-backed sun bird (*Cinnyris jugularis Linnaeus*, 1766). *Sylviidae* are an ethnic group of insectivorous birds with thin sharp beaks, such as olive-backed tailorbird (*Orthotomus sepium Horsfield*, 1821). Whereas *Turdidae* are an ethnic group of worm-eating birds, for example chesnut-capped thrush (*Zoothera interpres Temminck*, 1828).

Biodiversity Management Plan research results (2014) 114 bird species have been recorded, with 72 species in the lower dam area and 43 in the upper dam area. This reflects that during the 5 years running (2009-2014) there was a greater forest cover than before so it also had an impact on increasing the number of recorded bird species. The forest areas in the lower and upper dams contain several typical forest bird species, such as flame-fronted barbet (*Megalaima armillaris*), blue-eared barbet (*Megalaima australis*), balck-banded barbet (*Megalaima javenensis*), black eagle (*Ictinaetus malayensis*), crasted hawk eagle (*Spizaetus cirrhatus*) and banded pitta (*Pitta guajana*).

Of the 114 bird species recorded, 11 are endemic to Java, and 18 of them are legally protected. Two of the barbet species mentioned above are listed as Critically Endangered by IUCN, but overall the avifauna in this region does not have the richness of bird species that is considered by international conservation. This could be due to high collection pressure for the sale of birds that are kept where bird hunters are often encountered during surveys in the area.

E. Terrestrial Biodiversities Summary

Some species of plants that are locally rare are found to be very important in gaining attention because habitat conditions tend to threaten the sustainability of local species. Local species can disappear drastically from their natural habitat due to land conversion, illegal logging and also because of competition with new species. These local species include bay (*Eugenia Polyantha*), baros (*Magnolia glauca*), manglids (*Magnolia blumei*) and kitambaga (*Eugenis Cuprea*). Conservation of this species becomes very important in efforts to restore local species at the project site.

Meanwhile, in the area directly affected by the development of the UCPS hydropower project (including quarries, access roads, dams and transmission lines) 213 vertebrate species were recorded, consisting of 36 species of mammals, 48 species of reptiles and amphibians, 114 species of birds (Husodo, et al., 2019). The number of species recorded tends to increase in the last 5-10 years represented by data from Rahmat (2009), EIA (2011), BMP (2014), Unpad (2017), Husodo, et al. (2019). This is due to an increase in forest land cover in several areas, especially in the upper dam and lower dam.

Some terrestrial animal species need attention because they have a certain protection status. In mammals, with the status of Critically Endangered by IUCN (2018) and Attachment I by CITES (2018), among others are Javan gibbon (*Hylobates moloch Audebert*, 1798), Javan leopard (*Panthera pardus melas*), pangolin (*Manis javanica*), and slow loris (Nycticebus javanicus). 2 reptile species are listed in Appendix II of CITES and are protected by Government Regulation No. 7 of 1999, namely Burmese pythons (*Python molurus*) and reticulate pythons (*Python reticulatus*). Two species of barbet namely the black-banded barbet (*Megalaima javensis Horsfield*, 1821) and the blue-eared barbet (*Megalaima australis Horsfield*, 1821) are listed as Critically Endangered by IUCN.

4.2.6 Watershed & Habitat Description

The description of river hydrogeomorphological conditions around the UCPS hydropower area is summarized in Table 19.

Table 19. River Hidrogeomorfology Summary

No.	River	Dimension*		Water Stream	Hill Material	Algae	Clearness	Water Color
		Width	Depth					
1	Cireundeu River	NE	1-3 m	NE	Large rocks, Deposits	NE	NE	NE
2	Cijambu River	10-30 cm	15-18 m	Swift, Stagnant	Round rocks, , Deposits, Sand	Green algae	Clear	Clear
3	Cirumamis River	20-50 cm	7-10 m	Quiet, Stagnant, Swift	Outcrop, Large rocks, Deposits, Sand	Green algae	Clear	Clear
4	Cilengkong River	10-30 cm	6-10 m	Quiet, Stagnant, Swift	Outcrop, Deposits, Sand	Greean algae	Clear	Clear
5	Cisokan River	30-150 cm	20-30 m	Quiet, Stagnant, Swift	Cliff rocks, Gravel, Large rocks, Sand	NE	Murky	Brown, Greenish, , Murky

NE= not observed ; *= estimate (Rahmat, 2009)

A. Cirendeu River Watershed (around Quarry)

The Cireundeu River is located around the stone quarry on Mount Karang specifically in Bojongpari Hamlet, Karangsari Village, Cipongkar District, West Bandung Regency. This river has a relatively small width of around 1-3 m. The basic substrate of the river consists of small pebbles (φ 10-30 mm) and sand.

The relatively small water stream causes the water flow from the Cireundeu river to become unusable by the community for irrigation of rice fields or for daily needs. Community water needs are met from water sources that originate from the bottom of Mount Karang through water pipes that are separately supplied by the surrounding community. According to information from the community, the water source around Muara Karang has never been reduced even during the dry season so that the surrounding community is very dependent on it.

Fish species that exist in the Cireundeu River are unknown due to the small water stream, which makes fish species difficult to catch and also difficult to observe fish in this river. So information related to fish species in the Cireundeu River was obtained from interviews with the surrounding community which suggested that the river did not contain.

B. Cijambu River Watershed (around Access Road)

Cijambu River is a river that is passed by an access road that connects the Cipari junction to the upper dam site. This river is quite large, which is approximately 15-18 m with a width of 4-5 m. This river has parts that flow and ponds. Cijambu River has a high level of clarity where the water looks clean enough and the river bed can be seen clearly. However, due to the results of the high use of water from traditional washing and irrigation water, it is possible that river water is contaminated by detergents and fertilizer residues. This is further strengthened by the discovery of green algae in some parts of the river.

During the dry season, the water level is at its lowest. Surface water in the dry season is only about 10-30 cm. Based on community statements, during the rainy season the water level reaches a depth of 1-1.5 m. The bottom layer of the river consists of large, round stone like sand. During the dry season puddles are found along the side of the river where small fish such as guppy (*Poecilia reticulata*) and bleeker (*Rasbora agryotaenia*) live.

The use of land along the Cijambu river is dominated by talun bamboo (*Bambusa* spp) from the Bombacaceae family or talun sugar palm (*Arenga pinnata*) from the Arecaceae family in the upstream area of the hill as well as irrigated rice fields and rain-fed rice fields along the river side with extensive settlement conditions along the river. In some parts, there are ponds belonging to the community where they keep processed fish such as carp (*Cyprinus carpio*), tilapia (*Oreochromis niloticus*), tilapia (*Oreochromis mossambicus*), and catfish (*Clarias batrachus*).

Water in this river has a significant role for the surrounding community. Water from this river is used by the community to meet their primary needs such as bathing, washing as well as drinking water needs. In addition, the community also uses water from the Cijambu river to irrigate rice fields by making simple dams on some parts of the river that hold water.

The use of river water by the community is during the dry season when the water level is low also during the rainy season when the water level is high. The fishing habits of local people in the river sometimes use poison (portas) to kill small fish, but what is usually done by the local community by fishing with electricity.

C. Cirumamis River Watershed (Upper Dam)

Cirumamis River is a tributary of the Cisokan River and is the main source of water in filling the upper dam. This river is located in a valley in a hilly area with a height of ± 800 m asl. Has a width of 7-10 m accompanied by river side vegetation in the form of talun, bushes and rice fields. The basic substrate of this river generally consists of outcrops, rocks, silt and sand deposits.

Cirumamis River has high clarity with relatively clear colors so that the river bed can be seen clearly. This type of river flow is riffles, pools and runs. Based on observations, this river water is estimated to have a high nutrient content. This can be seen from the many findings of green algae including the species Microcystis sp. which grows along this river. High nutrient content is very likely caused by the discharge from agricultural land along the river and the use of detergent/ soap by the people in the upper reaches of the river. Some people use river water for bathing and washing, while most others use water sources for their daily needs.

Cirumamis River has several tributaries with a width of about 2-5 m, including the Citapos River, Cidongke River, and Cilengkong River. The community uses river water mainly for irrigating rice fields or agricultural activities. Along the Cirumamis River there are three beautiful natural waterfalls (in the local language called Curug) that fascinate with different heights, namely:

1. Munding waterfall, this waterfall has a height of ±5 m and is located between rice fields and bushes in the upper reaches of the Cirumamis River in the upper dam area.

2. Jagaprana waterfall, has a height of ±80 m surrounded by vegetation in the form of bushes with a height of 3-5 m, in the surrounding area there are still natural trees even though the main part of the area has been cleared. Location Curug is located in the upper dam area.

3. Walet waterfall, has a height of about 125 m with large stones in the lower reaches of the river. The type of vegetation around the waterfall is a secondary forest which is a habitat for several species of birds and some primates. According to local community information, although access to this location is not easy, but every weekend, the waterfall is visited by the community on holidays. .

D. Cilengkong River Watershed

Cilengkong River is a tributary of Cirumamis which will also become a pond for the upper dam. This river has a width of 6-10 m with a depth of 10-30 cm. Water clarity is generally clear with clear water color. The dominant substrates are sand, mud and outcrop.

During the dry season, at the time the survey was conducted, the river flow velocity was moderate. The flow in the Cilengkong River consists of pools, riffles and runs. Like in the Cirumamis River, this river also has a lot of green algae found because of the surrounding agricultural activities that use organic fertilizer.

Cilengkong River water is the main water source for people in Kampung Lembur to irrigate rice fields and other agricultural activities. Some communities also use water from rivers to produce electricity by simple turbines (picohydro). At least two picohydro installations were found around the Cilengkong River during a field survey.

E. Cisokan River Watershed (Lower Dam)

The Cisokan River is located on a planned lower dam location. Cisokan River is a large river with a width of 20-30 meters with a depth of between 30-150 cm and has a fairly large discharge. The flow in the Cisokan River consists of pools, riffles and runs. From time to time the river has a brown water color which indicates high levels of sedimentation. But at other times the color of the water is murky green.

River substrate consists of gravel and large rocks as well as bedrock in certain areas of this river. Although there are agricultural activities along the river, but the presence of green algae around the observation site was not detected. This is of course caused by the low level of water clarity.

Land management along this river is generally agriculture (rice fields and talun) accompanied by bushes. At some point it is known that plants are still found along the river bank and are separated in certain locations. The surrounding community uses the Cisokan River to irrigate rice fields, fisheries and bathe their livestock. In addition, some people use the river for bathing, washing and toilet facilities.

4.2.7 Water Biodiversities

A. Plankton dan Benthos

Changes in water quality as a result of many nutrient loads entering the watershed will affect the life of plankton and benthos. The complexity of the food chain and food webs and the importance of phytoplankton as primary producers will have an enormous influence on the dynamics of ecosystems that include the watersheds of the Cijambu, upstream Cirumamis, downstream Cirumamis, Cilengkong, upstream Cisokan and downstream Cisokan River. The more stable the aquatic environment is, it will directly affect the stability of the plankton and benthos communities. The existence of plankton is very influential on the survival of fish and aquatic larvae. Meanwhile, the abundance and diversity of benthos are very well used as bio-indicators of water quality, because the level of sensitivity of these organisms varies with the type of pollutants and gives a fast reaction, low mobility ability so that it is directly affected by environmental substances, relatively easy to obtain, identified and analyzed compared to other organisms.

Table 20. Plankton and Benthos Identification Year 2019

		Cijambu	Upstream Cirumamis	Downstream Cirumamis	Cilengkong	Upstream Cisokan	Downstream Cisokan
Phytoplankton							
1	Individual Amount/L	1620	1200	3630	1380	1140	2400
2	Dominansi Index	0,84	0,87	0,86	0,85	0,9	0,88
3	Variety Index	2,26	2,33	2,31	2,2	2,52	2,44
Zooplankton							
1	Individual Amount/L	210	210	510	180	180	210
2	Dominansi Index	0,82	0,82	0,81	0,78	0,83	1
3	Variety Index	1,75	1,75	1,71	1,56	1,79	1,28
Plankton							
1	Individual Amount/L	1830	1410	4140	1560	1320	2610
2	Dominansi Index	0,87	0,9	0,89	0,88	0,92	0,89
3	Variety Index	2,55	2,58	2,54	2,49	2,73	2,57
Benthos							
1	Individual Amount/m^2	45	20	15	45	20	15
2	Dominansi Index	0,28	0,38	0,33	0,28	0,38	0,33

		Cijambu	Upstream Cirumamis	Downstream Cirumamis	Cilengkong	Upstream Cisokan	Downstream Cisokan
3	Variety Index	1,43	1,04	1,1	1,43	1,04	1,1

(RKL-RPL, 2019)

The results of the identification of plankton in Table 20, show that the abundance of plankton identified shows variation in each river with a range of 1320-4140 ind/L. These results are divided into 2 categories, namely oligotrophic waters consisting of the Cijambu river, upstream Cirumamis, Cilengkong, and Cisokan upstream with the number of plankton 1410-1830 ind/L. The oligotrophic category also indicates that the waters are still clean and have not been polluted by nutrients with a plankton number of less than 2000 ind/L (Suryanto and Umi, 2009). According to Zulfa and Aisyah (2013), oligotrophic waters are generally clear and there is no abundance of aquatic plants and algae. These conditions represent a low nutrient. Meanwhile, the downstream Cirumamis river and downstream Cisokan are mesotrophic with an abundance of plankton 2610-4140 ind/L which means they have moderate fertility. This result can also mean the high flow of nutrients into the waters that can be produced from anthropogenic activities in downstream areas such as agricultural activities.

Plankton is an organism that floats or moves with the flow. Plankton consists of phytoplankton and zooplankton and both have important roles in aquatic ecosystems. Phytoplankton productivity is influenced by the availability of nitrogen and phosphorus. Phytoplankton can only live in places that have sufficient light, this is related to the photosynthesis process, so that phytoplankton is more found in the surface area of the water, or areas that are rich in nutrients (Hutabarat and Evans, 1995).

Based on the plankton diversity index (H'), the waters can be classified as follows: if the value of H'>3 means that the waters are clean or not polluted, 3<H'<1, it means that the waters are moderately or lightly polluted and H'<1, means the waters heavily polluted (Sudinno, et al., 2015). The results in Table 20, show that the plankton diversity index is in the range of 2.49-2.73, which means that the waters are moderately or mildly polluted. Furthermore according to Shannon and Wiener in Poole (1974), the diversity index range of 2.34-3.00 is still categorized as a criterion of good water quality.

Plankton dominance index results ranged from 0.87 to 0.92. Dominance index values obtained indicate that at the location of the waters there is a dominant type of plankton. One of the species that is predominant is *Chrysophyta* (yellow algae) which is found in almost every waters with a high amount. According to Odum (1996), if the dominance index value approaches the value of 1, it indicates that there are certain species that dominate the plankton community structure in the area.

Table 20 also shows the results of identification of benthos in waters around the UCPS hydropower plant. Benthos are various types of animals that live and breed at the bottom of waters such as rivers, lakes, seas, and so on. Organisms of this group usually live at the bottom by sticking to rocks, immersing themselves in mud and sand, moving with the flow.

Benthos abundance in Table 20 shows the results vary in the range of 15-45 individuals /m^2. These results also show a higher number of benthos in upstream waters (45) than downstream waters (15-20). This is presumably because the physical-chemical factors of upstream waters are better than downstream waters. The bottom of the upstream waters are rocky sand, gravel with coral fragments, seagrass and algae. The substrate is the place where most macrozoobenthos are found because the sand substrate and coral fragments can be a macrozoobenthos shelter from currents (Meisaroh, et al, 2019). This is supported by the statement of Fadli et al. (2012) that the basic substrate in the form of gravel is a support substrate for macrozoobenthos because it can protect from current movement. Seagrass is also a habitat for macrozoobenthos to find food, shelter from currents and predators (Hitalessy et al., 2015). Meanwhile, downstream waters have a muddy sand substrate which makes macrozoobenthos difficult to protect from currents, according to the statement of Koesbiono (1979) that the bottom waters in the form of muddy sand are an unfavorable environment for benthos. The existence of several parameters of water quality whose value is not optimal, there are few seagrasses and human activities, namely the frequent residents of the surrounding area taking aquatic biota is also thought to affect the level of abundance of macrozoobenthos (Meisaroh, et al, 2019).

The dominance index results show a range of 0.28 to 0.38, which according to Odum (1993) results are included in the low dominance criteria. These results indicate no species dominate and the number of species obtained is high. A low dominance index means that no species dominates significantly, stable environmental conditions and low ecological pressure in these waters. These results are in accordance with medium, owning substrate sand, cobblestone, ponder and alga.

B. Fish and Shrimp

Fifteen fish species so far have been found in area Cisokan (LIPI, 2012). If compared with the number Fifteen species of fish so far have been found in the Cisokan area (LIPI, 2012). When compared with the number of freshwater fish species on Java, which is 135 species, the location shows poor local fish species. Fish species found in Cisokan are all very common in Java, and are often used for consumption by local people. Eighty percent of fish species found in Cisokan are native to Java, with 20% being introduced, including *Poecillia reticulata*, *Xiphophorus helleri* and *Aequidens rivulatus*. Overall the quality of aquatic habitat is still good. However, some types of fish such as *Rasbora lateristriata* and *Hemibagrus nemurus* which are usually found in highland rivers, are difficult to obtain (LIPI, 2012).

Meanwhile, in a previous study by Rahmat (2009), there were at least 19 other species that might be in the Cisokan River Basin and the Saguling dam tributaries in the study area. Fish listed in this study include guppy, tilapia, carp, hambala, and cork. Fish found are fish commonly found in watersheds commonly found on Java.

Tilapia, goldfish, catfish are categorized as food species and can live in a variety of habitats, including in habitats with slow flow, river and lake environments and environments with soft sediments. Catfish can also live in rice fields and hypoxic and muddy environments. Tilapia is among the top 100 IUCN lists of the worst foreign migrant species that can disturb native species from their habitat. Cork is not a native fish that has a high tolerance to changes in temperature and pH. Platyfish and swordtail are categorized as migrant fish that are not a food source. Both of these fish are omnivorous fish and can survive with a variety of food sources. Swordtail prefers swift current habitat.

Hampala is the fish most commonly found in bodies of water and other reservoirs, but these fish prefer clear, fast-flowing water. The fish is a native species from Indonesia, and is a source of food for the surrounding community.

According to fish surveys and interviews with communities around carp, guppy, tilapia, bogo and catfish found in the Cirumamis River (EIA, 2011). Upstream tributaries have fewer species than in the Cisokan River. Through interviews with the surrounding community, the Cisokan River was considered to have native fish such as gout, which is a type of catfish, kehkel, kancera, genggehek, arelot and jeler. Kehkel and Kancera prefer clear and oxidized water and forest habitat. Meanwhile, the Cijambu River, has at least 10 species of fish and one species of shrimp. The fish found in the river are the same as the fish in the Cisokan watershed.

Figure 107. Carp, catched in Cijambu River (Rahmat, 2009)

Species that are generally found are not too different among the rivers observed. The rivers in the upper dam (Cirumamis river and Cilengkong river) have a smaller number of species, whereas in Cijambu River the number of species found is higher. The highest number of fish found in the Cisokan River where this species is slightly different than the fish in the Cirumamis River and Cilengkong River. Fish species that exist at the site consist of fish species that are often found as well as fish species that are rare or difficult to find. These fish species are difficult to find because of disturbance to the fish's natural habitat and different adaptability of these fish species.

1. Sungai Cijambu

Observation of fish species in the Cijambu River was carried out in two locations namely Sirnagalih Village and Cibitung Village, Cipongkor District, West Bandung Regency. There are 10 types of fish in the river. In this river also found river shrimp (Macrobrachium sp.). All fish species found in the Cijambu River are not included in the list of protected fish based on PP No. 7 of 1999 concerning Conservation of Wild Plants and Animals.

Table 21. Fish and shrimp type in Cijambu River, Sirnagalih Village

No.	Local Name	Scientific Name	Information	Status *Red List* IUCN	Habitat	Migration
1	Hampal/ hampala	*Hampala macrolepidota*	f	NE	Benthopelagic	Potamodromous
2	Beunteur/ common carp	*Puntius binotatus*	f, i, p	NE	Benthopelagic	Potamodromous
3	Impun/ guppy	*Poecilia reticulata*	f, o	NE	Benthopelagic	non-migratory
4	Nila/ Nile tilapia	*Oreochromis niloticus*	i	NE	Benthopelagic	Potamodromous
5	Mas/ carp	*Cyprinus carpio*	i	DD	Benthopelagic	Potamodromous
6	Udang/ shrimp	*Macrobrachium rosenbergii*	o			

Source: Rahmat, 2009

Table 22. Fish and shrimp type in Cijambu River, Cibitung Village

No.	Local Name	Scientific Name	Information	Status *Red List* IUCN	Habitat	Migration
1	Beunteur/ common carp	*Puntius binotatus*	e, f, p, i	NE	Benthopelagic	Potamodromous
2	Impun/ guppy	*Poecilia reticulata*	f	NE	Benthopelagic	non-migratory
3	Impun paris/ platyfish	*Xyphophorus maculatus*	e, f, p	NE	Benthopelagic	non-migratory
4	Baster/ geleng/ swordtail	*Xyphophorus helleri*	e, f, p	NE	Benthopelagic	non-migratory
5	Mujair/ Tilapia	*Oreochromis mossambicus*	e, i, p	NE	Benthopelagic	amphidromous
6	Bogo	*Channa gachua*	i	NE	Benthopelagic	Potamodromous
7	Lele dumbo/ catfish	*Clarias gariepinus*	i	NE	Benthopelagic	Potamodromous
8	Udang/ shrimp	*Macrobrachium rosenbergii*	i			

Source: Rahmat, 2009

Information: e= electric fishing, f= cricket net fishing, i=interview, o=direct found without observation, NE=not evaluated (IUCN version 3.1. criteria)

Table 23. Fish and shrimp type in Cijambu River at 5 last year

No.	Local Name	Scientific Name	2015	2016	2017	2018	2019
1	Hampal/ hampala	*Hampala macrolepidota*					
2	Beunteur/ common carp	*Puntius binotatus*	√	√	√	√	√
3	Impun/ guppy	*Poecilia reticulata*					
4	Impun paris/ platyfish	*Xyphophorus maculatus*					
5	Baster/ geleng/ swordtail	*Xyphophorus helleri*					
6	Nila/ Nile tilapia	*Oreochromis niloticus*	√	√	√	√	√
7	Mas/ carp	*Cyprinus carpio*	√	√	√	√	√
8	Mujair/ tilapia	*Oreochromis mossambicus*	√	√	√	√	√
9	Bogo	*Channa gachua*	√	√			
10	Lele dumbo/ catfish	*Clarias gariepinus*	√	√	√	√	√
11	Genggehek	*Mystacoleucus sp.*			√	√	√
12	Kehkel	*Glypthothorax sp.*			√	√	√
13	Parai	*Puntius sp.*			√	√	√
14	Kancra	*Tor douronesis*			√	√	√
15	Senggal	*Macrones nemurus*	√	√	√	√	√
16	Udang/ shrimp	*Macrobrachium rosenbergii*	√	√			

Source: (RKL-RPL, 2019)

2. Cirumamis River

Fishing in Cirumamis River done at location 50 m before Jagaprana waterfall/ Curug up at river Fishing in the Cirumamis River is done at a location 50 m before the Jagaprana waterfall/ curug towards the top of the river. Large rocks with a diameter of 20-50 cm are found along the observation site. The depth of the river water is around 10-20 cm with relatively calm water. Fishing with a net is done in a fairly large pond. Bodies of water along the river are filled with thick algae which indicate high water fertilization.

The results of fishing using a net in the Cirumamis River get 1 type of fish, namely mujair (*Oreochromis mossambicus*). According to community information the absence of fish is caused by the practice of fishing with poison (portas) by the local community, which has an impact on the loss of large and small sized fish.

Table 24. Fish and shrimp type in Cirumamis River

No.	Local Name	Scientific Name	Information	Status *Red List* IUCN	Habitat	Migration
1	Beunteur/ common carp	*Puntius binotatus*	i	NE	Benthopelagic	Potamodromous
2	Impun/ guppy	*Poecilia reticulata*	o	NE	Benthopelagic	non-migratory
3	Mujair/ tilapia	*Oreochromis mossambicus*	f	NE	Benthopelagic	Amphidromous
4	Bogo	*Channa gachua*	i	NE	Benthopelagic	Potamodromous
5	Lele/ catfish	*Clarias batrachus*	i	NE	Benthopelagic	Potamodromous
6	Udang/ shrimp	*Macrobrachium rosenbergii*	i			

Source: Rahmat, 2009
Information: e= electric fishing, f= cricket net fishing, i=interview, o=direct found without observation, NE=not evaluated (IUCN version 3.1. criteria)

Table 25. Fish and shrimp type in Cirumamis River at 5 last year

No.	Local Name	Scientific Name	2015	2016	2017	2018	2019
1	Beunteur/ common carp	*Puntius binotatus*	√	√	√	√	√
2	Impun/ guppy	*Poecilia reticulata*					
3	Mujair/ tilapia	*Oreochromis mossambicus*	√	√	√	√	√
4	Bogo	*Channa gachua*	√	√			
5	Lele dumbo/ catfish	*Clarias gariepinus*	√	√	√	√	√
6	Nila/ Nile tilapia	*Oreochromis niloticus*	√	√	√	√	√
7	Mas/ carp	*Cyprinus carpio*	√	√	√	√	√
8	Genggehek	*Mystacoleucus sp.*			√	√	√
9	Kehkel	*Glypthothorax sp.*			√	√	√
10	Parai	*Puntius sp.*			√	√	√
11	Senggal	*Macrones nemurus*	√	√	√	√	√
12	Kancra	*Tor douronesis*			√	√	√
13	Udang/ shrimp	*Macrobrachium rosenbergii*	√	√			

Source: (RKL-RPL, 2019)

3. Cisokan River

Fishing in Cisokan River done on the top and under estuary of Cirumamis River. Fishing on the top Fishing in the Cisokan River is done at the top and bottom of the Cirumamis River estuary. Fishing at the top or bottom of the river does not produce any fish, this is due to the rocky river conditions that make the process of fishing with a net difficult to do. Information about the types of fish in the Cisokan River can be obtained through interviews.

In general, fish species in rivers at site activities are *potamodromous* species that migrate locally from freshwater to other freshwater. The *amphidromous* species found are only tilapia which are species that migrate from fresh water to sea water during their lifetime, but not to breed eggs. From the data shown in the above table it can be seen that fish species in the Cisokan River are not registered at IUCN. However, these fish species need safeguards for their existence given that along the conditions in the Citarum river where the species of fish mentioned above become increasingly difficult to find .

Table 26. Fish type at Cisokan River

No.	Local Name	Scientific Name	Information	Status *Red List* IUCN	Habitat	Migration
1	Mas/ carp	*Cyprinus carpio*	i	DD	Benthopelagic	Potamodromous
2	Mujair/ tilapia	*Oreochromis mossambicus*	i	NE	Benthopelagic	amphidromous
3	Sengal/ tagih	*Macrones nemurus*	i	NE	Benthopelagic	Potamodromous
4	Kehkel	*Glyptothorax platypogon*	i	NE	Benthopelagic	Potamodromous
5	Kancra	*Tor tambroides*	i	NE	Benthopelagic	Potamodromous
6	Genggehek	*Mystacoleucus marginatus*	i	NE	Benthopelagic	Potamodromous
7	Arelot	-	i			-
8	Jeler	*Cobitis choirorhynchos*	i	NE	Demersal	Potamodromous
9	Udang/ shrimp	*Macrobrachium rosenbergii*	i			

Source: Rahmat, 2009

Information: e= electric fishing, f= cricket net fishing, i=interview, o=direct found without observation, NE=not evaluated (IUCN version 3.1. criteria)

Table 27. Fish type at Upstream Cisokan River

No.	Local Name	Scientific Name	2015	2016	2017	2018	2019
1	Mas/ carp	*Cyprinus carpio*	√	√	√	√	√
2	Mujair/ tilapia	*Oreochromis mossambicus*	√	√	√	√	√
3	Tagih/ senggal	*Macrones nemurus*	√	√	√	√	√
4	Kehkel	*Glypthothorax sp.*			√	√	√
5	Kancra	*Tor douronesis*			√	√	√
6	Genggehek	*Mystacoleucus sp.*			√	√	√
7	Arelot	-					
8	Jeler	*Cobitis choirorhynchos*					
9	Bogo	*Chana sp.*	√	√			
10	Lele dumbo/ catfish	*Clarias gariepinus*	√	√	√	√	√
11	Nila/ Nile tilapia	*Oreochromis niloticus*	√	√	√	√	√
12	Parai	*Puntius sp.*			√	√	√
13	Benteur	*Puntius binotatus*	√	√	√	√	√
14	Udang/ shrimp	*Macrobrachium rosenbergii*	√	√			

Source: (RKL-RPL, 2019)

Table 28. Fish type at Downstream Cisokan River

No.	Local Name	Scientific Name	2015	2016	2017	2018	2019
1	Mas/ carp	*Cyprinus carpio*	√	√	√	√	√
2	Mujair/ tilapia	*Oreochromis mossambicus*	√	√	√	√	√
3	Tagih/ senggal	*Macrones nemurus*	√	√	√	√	√
4	Kehkel	*Glypthothorax sp.*			√	√	√
5	Kancra	*Tor douronesis*			√	√	√
6	Genggehek	*Mystacoleucus sp.*			√	√	√
7	Arelot	-					
8	Jeler	*Cobitis choirorhynchos*					
9	Bogo	*Chana sp.*	√	√			
10	Lele dumbo/ catfish	*Clarias gariepinus*	√	√	√	√	√
11	Nila/ Nile tilapia	*Oreochromis niloticus*	√	√	√	√	√
12	Parai	*Puntius sp.*			√	√	√
13	Benteur	*Puntius binotatus*	√	√	√	√	√
14	Udang/ shrimp	*Macrobrachium rosenbergii*	√	√			

Source: (RKL-RPL, 2019)

C. Water Biodiversities Summary

Overall, the water quality in the Cisokan and Cijambu watersheds is on average poor, and does not meet Indonesian river water quality standards. The main problems are pathogenic bacterial contamination, which can cause stomach and intestinal health problems in humans and animals, and mercury concentration, which can cause acute and chronic health problems such as bioaccumulants. This water quality data is supported by a macro invertebrate survey that indicates poor water quality.

Fish surveys indicate that there were at least 19 species of fish in 2009 and were recorded to be 15 species of fish in 2014 in the UCPS hydropower area, a decrease in the number of species occurred but none were protected (BMP, 2014). As a result of field observations, fish species do not indicate national or international protection status. However, local species that are categorized as rare should be recorded on species such as kancra (*Tor douronensis*), and gout (*Macrones nemurus*), given their ecological characteristics which are local migratory species and originate from potential changes in riverbank habitats that flow to inundated rivers. As is the case with the horizon (Hampala macrolepidota) found in a 2009 study, but in the last 5 years it has not been found anymore. The low diversity of fish species may be caused by the activities of people who take fish using insecticides (Potassium, Thiodan and Takodan), especially in the dry season (LIPI, 2012).

4.2.8 River Users

Along the river in the upper watershed used by villagers for public bathing, washing, and toilet facilities purposes. Also used as a means of recreation, fishing, and also for washing clothes, motorcycles and other cleaning purposes. The river is also used as a source of drinking water. People usually use the river during the dry season when the river stream is low. In the rainy season the larger rivers become too high and too fast to use, especially in the main part of the Cisokan River.

Nearby settlements depend on fisheries from the river to support them, but they do not fish for commercial purposes. Anglers use nets, fishing lines, and electric and poison fishing equipment to catch fish. The location of the location is close to the Cirata reservoir, making anglers more interested in finding fish in the reservoir compared to the Cisokan River. Even so, in the rainy season where the water in the Cisokan River is in flood conditions, several fish anglers are seen around the Cisokan dam.

Figure 108 Fish Anglers in Cisokan Weir

Water for irrigated rice fields, fish ponds and non-drinking water is taken from smaller tributaries. Small-scale hydroelectric power plants (households) also exist in smaller tributaries.

The Cihea Irrigation System Dam is approximately 3 km downstream of the lower dam location which is currently taking water from the Cisokan River to paddy fields at a maximum of 6.0 m^3/sec, through various irrigation ditches. The system has a capacity for irrigation of up to 5,607 ha but the amount of land that needs to be irrigated shrinks. A total of 5,401 ha of land was irrigated by the Cihea Irrigation System in 2000 (PLN/ Newjec Inc., 2002). The average water demand in the system is 5.2 m^3/sec. Over the years during the dry season the irrigation system can become a deficit of up to 3.0 m^3/sec, especially between August-October as noted by PT PLN, 1998. Observations in 2015-2018 show that the minimum conditions for water withdrawals in Cihea irrigation channel of 0.22 m^3/sec in October. No downstream river use has been documented in the previous ANDAL study, but many communities use the river for livestock drinking water and irrigation purposes, and the use of river banks to feed cattle.

Figure 109 Cisokan Weir as the Main Benefit of the Cisokan River Stream Cisokan

Wastewater in upper watershed water flow includes drainage of water from rice fields and animal cages that have nutrient loads, mercury from gold mining, high sedimentation streams from agricultural land, roads and vacant land in residential areas, and which have nutrients, heavy metals, needs biological oxygen (BOD) and pathogenetic bacteria from community activities that wash and carry out public bathing, washing, and toilet facilities activities in and near rivers.

4.3 Social and Economy Baseline

Most community in the Upper Cisokan hydropower area have a small land and low income. Most of them lives in remote areas with good communication networks and have a low level of education with limited expertise outside of expertise in farming. Approximately 34.1% of the population is at or below the poverty line in the Upper Cisokan hydropower area, and only 41.9% in the transmission network area. Inhabited houses by the community are usually non-permanent houses.

Woman as a head of household is rarely discovered, although she had family income contribution. Village officials and religion are a very important decision maker for social development, infrastructure, and problem-solving. The community are susceptible to economic change, social and environmental.

Social impact interviews, surveys and data analysis have been carried out three times, in 1997, 2001 and 2006. For this EIA, 2006 data (PLN / Newjec Inc; 2007a, 2007c,) are considered the most relevant data, but the details of previous studies were included if applicable. Besides that, there are other interviews as an update of the current conditions up to the range of 2019 and even 2020 on a smaller scale.

Table 29 Summary of Social Impact Analysis and Methodology

Year	Collecting data and analysis method for social impact	Sample
1997	Demographic information collected from demographic maps Sampling interviews to identify cultural contexts. Public health information was collected from population sample interviews and from secondary data from Cibeber and Campaka health centers.	30% of the affected population by the project
2001	Structured interviews conducted with the head of the family. Questionnaires are closed questions.	Selected Sample Population: - 1642 respondents from 11 villages - 863 households directly affected (inundation area, quarry location and disposal area) - 779 households directly affected (other areas)
	Structured interviews were held with village officials, religious leaders and informal leaders. Questionnaires are usually done with closed questions.	63 relevant parties were randomly selected from 10 villages
2006	A structured (questionnaire) interview conducted with the head of the family. Intensive interviews with informal leaders, institutions, sub-district staff, entrepreneurs Secondary data on demographic and economic data from district government bodies	All directly affected households by the project surveyed, of which 16% of the sample were interviewed. 987 households surveyed out of a total of 1539 households considered to be directly affected.

Year	Collecting data and analysis method for social impact	Sample
2006	A structured (questionnaire) interview conducted with the head of the family. Intensive interviews with representatives community, related institutions, sub-district heads, village officials, village administrators and entrepreneurs Focus groups with communities from selected villages	Transmission network lines 380 households that have been interviewed. - 177 households/land owners directly affected - - 203 samples of households that are not directly affected
2016	Structured interview conducted with WTP around access road, reservoir and transmission line (Larap midterm, 2016)	Selected sample population was 308 respondents from 4 districts in Bandung and Cianjur districts.
2019	Structured interviews were held with village officials, religious leaders and informal leaders. Questionnaires are usually done with closed questions (Social mapping Document, 2019).	The selected sample population is 56 respondents from 11 villages - 11 village apparatus respondents - 13 community leaders - 32 community respondents
2020	Structured interviews with village officials and community leaders	Random population chosen consisted of 4 respondents representing 4 sub-districts in Bandung Regency and Cianjur Regency. The sample is community leaders, village officials and the community.

4.3.1 Location of Settlement and Housing

Residents had left the inundation area and occupy the newprovided location. Based on RKL-RPL Monitoring Report Semester I 2019, Resettlement activities for the planned inundation area are in the villages of Sukaresmi, Cicadas, Bojongsalam, Karangnunggal and Margaluyu. Most of residents chose to move by himself / in groups, only residents from Sukaresmi Village joined the Resettlement program from PLN.

PLN will provide public and/or social facilities for affected residents who move in groups of more than 30 families. The location that has been used for resettlement of residents is Kp. Pasir Laja and Kp. Tapos, Sukaresmi Village. Provision of basic facilities such as land maturation and improvement of road access before moving to the relocation site of the residents' choice is a priority. So that the provision of basic facilities is done in a labor intensive manner by residents affected by the project themselves with the support and cooperation of PLN with the Site Planning Team of the Regional Government of West Bandung Regency.

Along the transmission line, approximately 70% of houses are 'non-permanent' houses (made of bamboo, rarely made of concrete or brick). Approximately 75% of households do not have transportation (including bicycles). Of the approximately 25% who have a vehicle, what is commonly used is a motorcycle which is the most common conveyance. Within the Upper Cisokan hydropower area, there are 93.7% of non-permanent houses. The same percentage of houses owned by residents (93.9%).

4.3.2 Demography

General demographics of each village can be seen in Table 30. Based on Social Data and Stakeholder Mapping of PLN UCPS 2019, the administrative area covers the diversity of each village between 3.23 km^2 (Cibarengkok) to 29.84 km^2 (Bojongsalam), and the population of each village ranges from 4,362 people (Girimulya) up to 9,626 people (Jatisari). The different area of village administration area and population shows the density (people / km^2) which also varies in each village throughout the project area ranging from 130 inhabitants / km^2 (Kemang) to 3,181 inhabitants / km^2 (Mekarwangi).

Table 30 Total Population and Density

No	Location	Width	Demography				
			Population (people)			Density (Per/km^2)	Gender Ratio
		km^2	Male	Female	Total		
WEST BANDUNG DISTRICT							
I	**Kecamatan Cipongkor**						
1	Desa Karangsari	6.02	2,836	2,774	5,670	932	102.24
2	Desa Sirnagalih	3.94	3,041	2,821	5,925	1,488	107.80
3	Desa Cijambu	4.90	3,162	2,974	6,202	1,252	106.32
4	Desa Sarinagen	7.27	3,868	3,914	7,865	1,070	98.82
II	**Kecamatan Rongga**						
5	Desa Bojongsalam	29.84	2,762	2,705	5,467	397.5	102.11
6	Desa Cicadas	21.78	2,155	2,290	4,445	106.8	94.10
7	Desa Sukaresmi	16.61	4,347	4,362	8,709	531.7	99.66
8	Desa Cibitung	14.82	4,422	4,439	8,861	567.6	99.62
CIANJUR DISTRICT							
III	**Kecamatan Cibeber**						
9	Desa Girimulya	6.06	2,205	2,156	4,362	719	102.26
10	Desa Karang Nunggal	15.66	2,828	2,706	5,534	353	104.53
11	Desa Salamnunggal	9.43	4,947	2,303	7,250	769	214.76
IV	**Kecamatan Campaka**						
12	Desa Margaluyu	8.19	2,745	2,768	5,513	673	99.17
13	Desa Sukajadi	10.47	3,422	3,257	6,679	638	105.07
V	**Kecamatan Bojong Picung**						
14	Cibarengkok	3.23	2,963	2,597	5,560	445	114.09
15	Haurwangi	3.2	4,610	4,424	9,034	2,806	99.32
16	Hegarmanah	3.89	4,353	3,775	8,128	1,318	115,31
17	Jatisari	8.41	4,982	4,644	9,626	2,088	107.28
18	Kemang	25.18	3,077	3,005	6,082	242	102.40
19	Mekarwangi	1.77	2,750	2,880	5,630	3,181	99.07
20	Neglasari	3.76	3,290	3,143	6,433	1,711	104.68
21	Ramasari	2.65	3,539	3,274	6,813	2,571	108.9
22	Sukaratu	10.25	4,506	4,177	8,683	847	107.88
23	Sukajaya	4.34	2,821	2,538	5,359	1,235	111.15
24	Sukarama	11.86	2,269	3,007	6,197	473	75.46

Sources : BPS District Data in Figures, 2018

Gender balance is usually around 5%. The village with the highest gender imbalance was in Salamnunggal Village, with a male and female ratio of 214.76%. The reason for this incident is not documented, but it might be because women leave the village to work in cities or abroad, or there is a male-dominated industry in the village.

4.3.3 Community Structure

A. Community Structure and Services

The population is distributed throughout Kampungs (hamlets) and comprises small rural families and communities with strong kinship and traditional social and cultural attitudes. Their day to day activities are strongly influenced by the Muslim religion, and village and religious leaders play an important role in decision-making, problem solving and village development. Men are considered the „heads of households“ and the main bread-winners and decision-makers, whilst women manage household and family matters, as well as undertaking planting and harvesting activities. Education levels are low throughout the area, and most people have only attended elementary schools.

The overall level of education is generally low. Survey results showed Most adult respondents had completed primary school education (58% of hydropower areas and 72% in transmission network lines). The small number of adults surveyed completed education above elementary school (approximately 4% in the hydropower area, 14.4% in the transmission network). The rest of the respondents never went to school, or did not finish elementary school. Education level data of of PAPs based on project location can be seen in Appendix 14.

Based on survey data around PLTA location, it was reported that children at school age (7-15) both boys and girls were forced to drop out of school to help families generate income. The results of this survey differ from the results of the transmission network survey, which shows that there is motivation from families to raise their children's education level compared to the education they have, to provide better employment opportunities outside agriculture / village. These differences reflect the differences in employment and educational opportunities available to villagers surveyed in each study. It is likely that villagers located farther from the Upper Cisokan hydropower area cannot provide better education opportunities for children and may need their children to work, compared to children closer to the subdistrict center who can provide better education for their children.

B. Family and Community Structure

Topography affects community relations in the project area. For the communities living in hilly areas, with dry land or forestry agricultural activities, settlements are divided into small hamlet groups. With limited transportation and accessibility, these small group areas are relatively isolated.

In general, kinship patterns are characterized by the traditional Sundanese community kinship system which which draws descendent lines bilaterally. In areas characterized by dry land and forestry agriculture, this kinship pattern is very common and has considerable influence on the settlement group. In the communities with rice field agriculture, the kinship patterns are present, but do not influence settlement patterns as much.

The topographical features and transportation challenges, in combination with local kinship patern in the settlement, leads to strong feelings associated with being in the ”in group”. Almost every hamlet has a prominent figure who is considered influential, and obedience to these formal and informal leaders is strong.

In areas dominated by dry land and forestry agriculture, leaders are determined through kinship and socio-religious interests and dominate the decision-making process. Disagreements among residents are usually discussed between family members and the head of the family as the biggest influence holder. Leadership patterns such as preventing one leader from influencing more than one small area.

With strong kinship among hamlet groups, cohesiveness in society usually worsens when had disagreed opinions. Community organizations such as youth groups and farmer organizations (which do not always have a relationship with family or hamlet) often harmed from the tendency for hamlets to unite against other hamlets. Therefore, even though there is an administrative area (for example a village), its citizens may not necessarily be able to function as a solid society.

Kinship and social-religious relations become the most common modes of exchange information because no local media existed to social activities to the wider community to develop individual position exchanges and ideas between villages. Important images in the kinship network play the most important role in the decision-making process.

Different patterns of social relations developed in paddy farming communities close to the quarry and the existing road. The area is more open and more receptive to the change with broad settlement patterns. Social stratification emerges as a result of educational differences as well as a result of differences in wealth and control of resources, such as landlords. Although kinship networks still have influence, the power differencial are more defined by wealth and resource control. The occurrence of this pattern depicts people who have a higher level of education and greater wealth compared to other communities in the area. Village leaders and landlords reportedly form mutually profitable business relationships that solidify their position of leadership and influence.

C. Religion and Culture

Islam is the dominant religious beliefs are reflected in daily life, such are shalat, recitation of the Qur'an, etiquette and social interaction between communities. Social interaction exceeds the scope of work, family and friends wich is dominated by religious activities, including reading the Qur'an, prayer and religious rituals. Religious life is well preserved, one of the factors is the spread of 97 Islamic boarding schools in Cipongkor and Rongga Districts.

Beside from Islam religion and its classical educational institutions, Sundanese cultural values are well preserved. Starting from language, mutual cooperation to mysticism. For the latter it is still thick in the lifestyle. For example, about the presence of Malela waterfall watchman in Cicadas Village, a person known as Eyang Taji Malela and cannot bathe on Monday especially for individuals who are no married.

Based on the Social and Stakeholder Mapping of PLN UCPS 2019, customary values are still maintained, including a variety of traditional ceremonies that are still being carried out, such are Sunatan, Sawer Penganten, Lamaran, Ngurus Bali, Nujuh Bulan, Puput Puser and Turun Taneuh. Cultural arts that still exist include jaipong, saweran and mawalan (qasidah), calung and Pencak Silat.

One interesting tradition is the Traditional Ceremony in farming activities, namely Mantra Tandur in Karangnunggal Village, Cibeber District. It is an ancestral tradition, a symbol of farmers maintaining an agrarian culture. The existence of the mantra is an attempt to ask for protection to those outside of human power. This shows the awareness that humans have limitations and have the ability to try, one of which is to pray to the master.

Another popular entertainment is 'arisan', which is a money saving that is organized in turn. Communities can also gather to discuss and cooperate on local issues, build and maintain community facilities, business opportunities and employment, help in food scarcity or other difficulties in the form of cooperation.

D. Social Relation and Gathering

Distributed population in the villages (hamlets) and includes small village families and communities that have kinship relationships and strong traditional and cultural attitudes. Their daily activities are strongly influenced by Islam, and religious leaders. The village has a strong role in decision making, problem solving and village development. Men are considered as a head of household, supporter to their family livelihood and the decision makers while women manage household and family affairs, also carry out planting and harvesting activities. The level of education are low in all regions, and almost all people have only received elementary school education.

Family and Community Structure Topography influences community relations in the project area. For community life in hilly areas, with dry land or agricultural activities in forestry, settlements are divided into small hamlet groups. With difficult transportation and accessibility, these small group areas are isolated.

In general, kinship patterns are characterized by a traditional Sundanese system of society that determines bilateral relations. In areas characterized by dry land and forestry agriculture, types of bilateral kinship patterns are common and have a strong influence on settlement groups. In societies with rice farming, types of bilateral kinship patterns still exist but do not have much influence on settlement patterns.

Challenging conditions of topography and transporation, in combination with local patterns of kinship in the settlement, are a strong bond as part of 'this group'. Almost all hamlets have characteristics, who is considered to have influence, and adherence to formal and informal leaders is usually very strong.

Different patterns of social relations develop in paddy farming communities close to the quarry and the existing road. The area is more open and more receptive to change with broad settlement patterns. Social stratification arises as a result of differences in education and also as a result of differences in wealth and control of resources, such as landlords. Although kinship networks still have influence, power differences are more determined by wealth and resource control. The occurrence of this pattern clearly depicts people who have a higher level of education and greater wealth compared to other communities in the area. Village leaders and landlords are said to form profitable business relationships that further strengthen their leadership positions and influence.

4.3.4 Community Infrastructure

A. Water

Shallow wells are the main source of drinking water, although some houses or hamlets have a water/ small stream near their settlement will use surface water 6% of the total population (PLN / Newjec Inc., 2007a). Water quality samples from both wells in 2006 indicate pathogenic bacterial contamination that can cause abdominal pain. Well water that may be contaminated from ground level activities because the well is not protected safely (not covered and paved).

Communities around the UCPS project have direct beneficiaries of environmental services, one of which is water supply and land use for food supply services.

Table 31 Index of natural resource capital (2019)

No.	Villages	Air Quality	Ease and Adequacy of Water	Land area	Agricultural Water Availability	Reservoir / river conditions
1.	Cicadas	5.00	3.80	1.57	1.20	2.43
2.	Bojong Salam	2.93	2.67	0.87	1.50	0.87
3.	Cinengah	3.07	2.07	0.60	0.93	1.03
4.	Cibitung	3.93	2.67	0.40	1.90	2.17
5.	Karangsari	4.84	3.19	0.91	1.66	2.25
6.	Sirnagalih	4.42	3.54	0.85	1.35	2.27
7.	Cijambu	4.71	3.64	0.93	1.25	2.07
8.	Sukaresmi	5.00	4.30	1.07	1.93	2.50
9.	Haurwangi	2.97	1.60	0.17	1.67	2.80
10.	Ramasari	3.37	2.27	0.43	1.27	2.57
11.	Sukatani	3.77	2.50	0.30	1.70	2.80
12.	Sukarama	3.50	2.87	0.77	2.87	3.37
13.	Sukajaya	3.30	2.30	0.83	2.63	3.03
14.	Jatisari	3.90	2.60	0.53	2.10	2.87
15.	Cibarengkok	3.80	3.33	0.40	3.27	3.27

Source : Social and Stakeholder Mapping PLN UCPS 2019

Based on Social and Stakeholder Mapping of PLN UCPS 2019, it shows that the Capital of Natural Resources in West Bandung Regency and Cianjur Regency are in the sufficient category. From a scale of 5, the quality of water access is still quite good with an index ranging from 2.93 (Bojongsalam) to 5.00 (Sukaresmi / Cicadas) while the ease of getting it ranges from 1.60 (Haurwangi) to 4.30 (Sukaresmi). On the other hand, the availability of water is still not enough to meet the residents' agriculture needs, with an index ranging from 0.93 (Cinengah) to 3.27 (Cibarengkok). Most residents only have land under 100 m2. This is indicated by an area index ranging from 0.17 (Haurwangi) to 1.57 (Cicadas). Regarding rivers, with an index of 0.87 (Bojongsalam) to 3.37 (Sukarama), most residents stated that the situation was sufficient, with the availability of sufficient fish but located some distance away. As for the villages of Bojongsalam and Cinengah, most residents stated that the situation was bad because it was polluted and there were rarely any fish.

B. Electricity

Based on Larap Midterm Report 2016, 84% of PAP respondents received electricity from PLN transmissions, 15% of them received it through their neighbors, and the rest of them received it from power plants and windmills. The respondents said that the transmission was adequate. The quality and costs are fair too. Meanwhile, on the issue of distance, the community stated that the source of electrical energy could be accessed. More detailed data can be seen in figure 110.

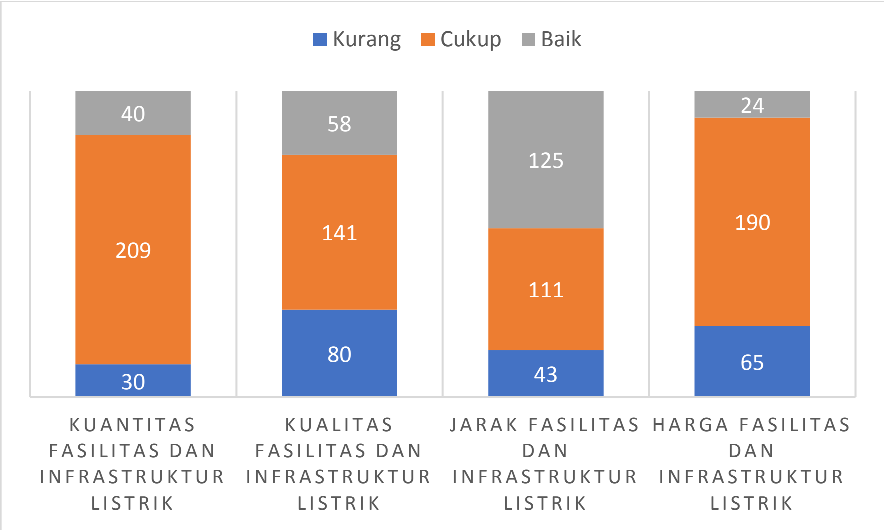


Figure 110 Public perception of access to electricity

Based on Social and Stakeholder Mapping at PLN UCPS 2019, majorities of residents in the Upper Cisokan hydropower area already have electricity. With a percentage of at least 75% in each village the residents have received information. This electricity has helped the economy of the village community significantly. The remaining total household still depends on kerosene and firewood.

C. Road

Based on interviews with community stakeholders in January 2020. Development of access road from Baranangsiang village to Sirnagalih for 4.8 km and from Cibenah to Cinta Asih for 7 km. almost all pivot roads that connect between villages and sub-districts with Upper Cisokan have been felt by the community. Economic impacts such as land prices with access roads have increased by Rp 25.000 / square meters and now up to 400 thousand / square meters, in addition to the distribution activities carried out by residents can be faster.

PLN Parties and Bandung Barat Residence has been prioritize sub-districts outside of Rongga sub-district to build the district protocol road from Cihampelas T-junction to Bunijaya to Kuban along 35 kilos from Community Development PLN, Bunijaya - Cipari, Cinengah-Cimarel, Narogong Bojong already, Cibedug - Bojong salam already built. Just a little more construction of village roads. Health facilities such as Puskesmas have also been built. There are several tourism potentials such as the

Malela waterfall, halu mountain, arab village and the construction of an access road will facilitate access to these locations.

In general, the community's economy has improved because of easier access to Bandung city. For economic change data, it can be represented from the houses of residents who used to be slums, but now there are many houses that are more suitable for use and livable. There are many Residents have vehicles after the construction of Upper Cisokan. As an example, village officials did not have vehicles before but now many of them have vehicles either motorcycle or car.

D. Sanitation and Waste

In general, Community rarely pay attention to the importance of toilet facilities. MCK facilities are available but are very simple both indoors and outdoors. Instead, some rural communities use rivers and ponds as bathing, washing and toilet facilities. The monitoring results in appendix 15. indicate that the existence of MCK facilities before and after the project operation. Improvement of permanent housing built by post-project WTP operations and post-compensation especially in lower reservoirs and new roads has led to the use of indoor private MCK facilities. The situation is different from the PAP above the reservoir, where dry land is the dominant type of land in the area, which depends on rivers and outdoor public MCK. A small portion of solid waste is disposed of or burned on site, although careless disposal on public land still occurs.

The integration of urban lifestyle culture, health culture, and rural culture of people who depend on natural resources and hereditary habits, also affect the development of MCK facilities. The various types of MCK facilities represent an integration and cultural diversity of health and culture. In reality, the types of toilets in the area are upper reservoirs and new roads are more diverse. The more open and more access to information and education, the more improved their toilet facilities. From a socio-cultural perspective, the trend of toilets in private spaces has reduced public space of communication. Therefore, the existence of a healthy community toilet needs to be developed so that its role and function for the community (where they can interact in rural communities in space) as stated by WHO is important to be maintained in order to keep going

Only a few houses have a septic tank management system, and there is no separate and centralized wastewater management in the village. The general pattern in the Upper Cisokan hydropower area is the people who live near their waterways use it for MCK purposes. People who lives far from the water flow usually have a toilets, but that is not connected to a septic tank. Only a small number of houses have a septic tank, and are usually the result of government education and funding. Public toilets are available in several areas. In the transmission network survey, there were 75.5% of respondents who had private toilets (PLN / Newjec Inc., 2007a).

A small portion of solid waste is disposed of or burned on site, although careless disposal on public land still occurs.

4.3.5 Livelihood

The main livelihoods are generally related to agriculture (rice fields), mixed plantations and home gardens that provide food for families, more production can be sold in the local market.

The main source of income comes from agriculture, which generally relates to rice fields, mixed garden and home gardens wich provide food for families, as well as additional income from the sale of excess production in the local market. The majority of family heads in the project area are farmers and farm laborers. Because rice fields are rain-fed rice fields which are only harvested twice a year, almost all productive laborers have additional work to support their livelihoods, which are usually located in the surrounding area. A small number of family heads are retirees, traders, and private employees. Data on the results of the survey of respondents can be seen in Appendix 16.

The main occupation of women in their main family is based on agriculture. About 3% of them work abroad and send the money back to their families, and 4.5% of them are shopkeepers. Around 44% of women have additional work, usually related to agriculture. Based on the West Bandung Regency Development Database in 2018, the number of residents working as migrant workers in Cipongkor and Rongga Districts totaled 1052 people with 282 male workers and 770 female workers. The majority of the destination countries for the migrant workers are Saudi Arabia (Appendix 17).

Communities in the Upper Cisokan hydropower area, which are more remote, work more in agriculture, while people in the transmission network area are more involved in private businesses, factory workers and laborers. Data on Population Numbers 10 Years and Over According to Livelihoods and Villages around the affected areas in West Bandung Regency in 2018 can be seen in appendix 18.

A. Employment Opportunity

There is a better change in employment from the affected areas. There was a significant increase in land ownership and reduction in agricultural workers, and a slight change from land agriculture workers to other job.

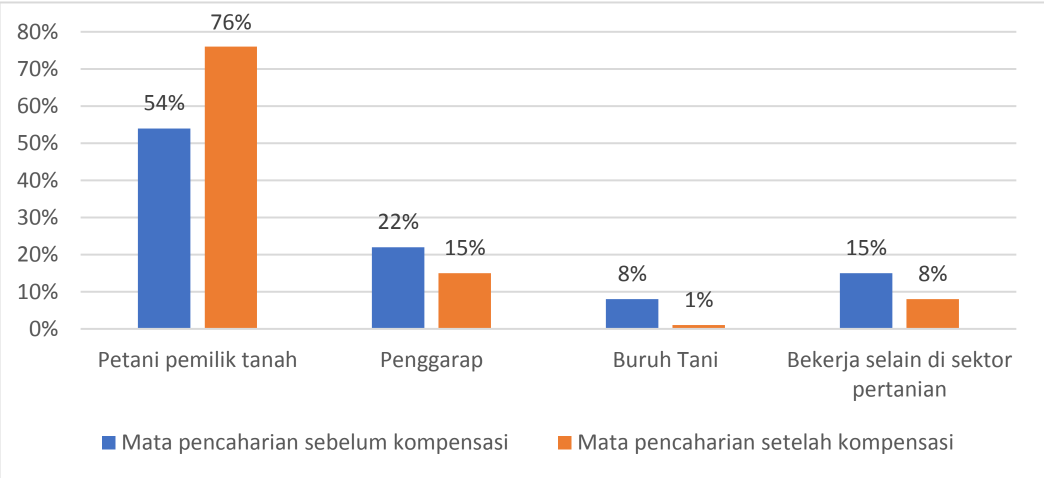


Figure 111. Job Changes Before and After Compensation
(Source : Larap midterm report 2016)

majorities of people affected by the project depend on the agricultural and related sectors such as farmers, poultry farmers, sharecroppers, and tractor operators. Whereas a small portion of the community works in trading and handicraft sectors (which depend on creativity) and most depend heavily on third people such as farmers, construction workers, or private workers.

Field observations show that some new livelihood was formed after the project started, such as traders, motorcycle or taxi drivers, security workers, construction workers, food traders, tire repairmen, public transportation drivers. However, some of the affected people's livelihood have also disappeared with the existence of new infrastructure such as timber transporters and input / production carriers.

Meanwhile, women's participation either in the field or non-agriculture in general was not very high (figure 111). This shows that there is no major change in the main work among Project Affected Citizens from a gender perspective. This situation also shows that there are job opportunities for women. Craftsmen / food traders, village officials, Islamic school staff and home traders are some of the work carried out by women at the project site.

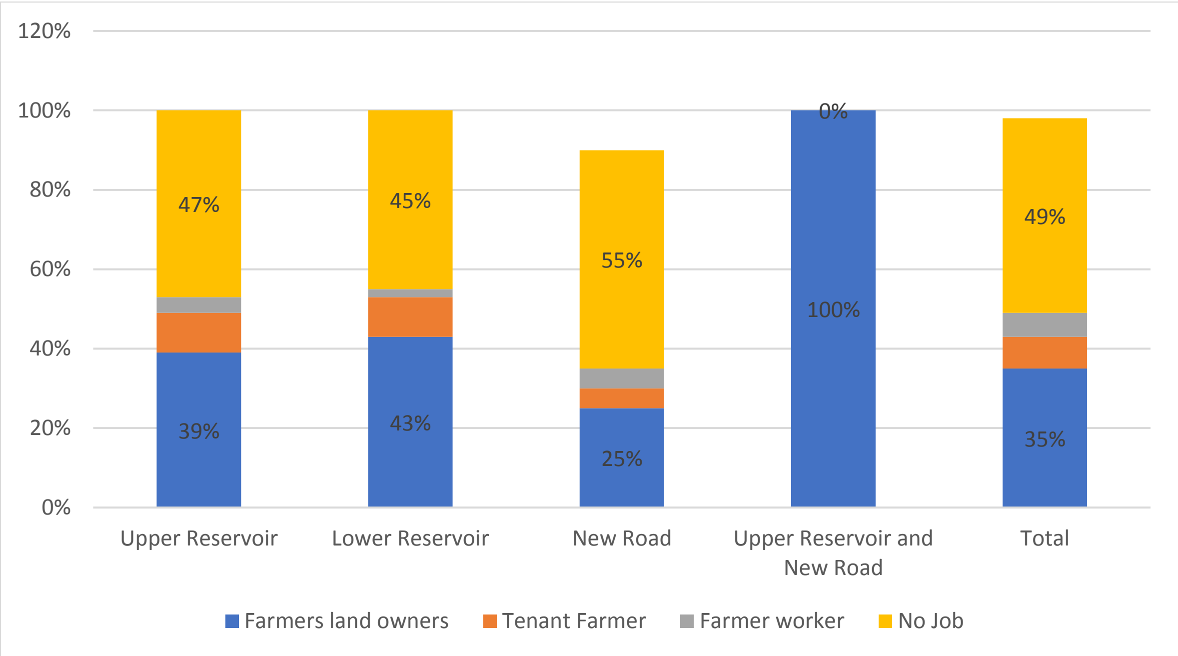


Figure 111. Housewife Main Occupation
(Source : Larap midterm report 2016)

The existence of the UCPS Hydropower Project also provides employment opportunities for the surrounding community. Workers in the construction of UCPS hydropower plant are employed as an unskilled workers such as heavy equipment operators, drivers, security officers and construction workers. Construction Workforce Data can be seen in Appendix 19.

B. Income and Poverty Levels

The poverty line in Indonesia determined by the basis of a minimum calorie intake of 2,100 kcal per capita per month. In March 2019, the Central Statistics Agency determined the poverty line was recorded at Rp425,250 / capita / month with the composition of the Food Poverty Line at Rp313,232 (73.66 percent) and the Non-Food Poverty Line at Rp112,018, - (26.34 percent).

Based on RKL-RPL Monitoring in 2019, majority of survey respondents worked as a farmers (39%) with dominant yield of rice and secondary crops. From each profession has a different level of income, and the average respondent from his income is used for the necessity and needs of his life as well as a living for his family at home. In addition, the majority of respondents' income was above the UMK Cianjur and West Bandung in 2019, which amounted to Rp. 2,336,005 to 2,898,744, with professions as Village Officials, Entrepreneurs, Traders and Contractor Workers.

Affected communities income in general are increased in the upper reservoir while the new road area has decreased. Landowners are feeling increased incomes, but both private and state-owned landowners have decreased. The WTP income data for 2016 can be seen in Appendix 20.

C. Land Ownership and Use

Land is the main source of income for agricultural communities,. Ownership or control of agricultural land affects the economic status of the individual in the community. Mastery of agricultural land in the form of rent or profit sharing does not have the same rights as ownership, so it is very vulnerable to the transfer of hands to land. A summary of land tenure by type of land use, based on survey results, can be found in Table 32 Land tenure (for any type of land use) is usually smaller than 0.25 ha.

Table 32 Land Ownership Summary

Land ownership		**Percentage of survey respondents who own land**	
Land use	**Area (ha)**	**Survey Area**	
		Transmission Line	**PLTA *Upper* Cisokan**
Irrigated rice fields	<0.25	48%#	29.00%
	>0.25	8%#	16.90%
	No ownership	44%	45.90%
Non-irrigated rice fields	<0.25	#	14.90%
	>0.25	#	5.00%
	No ownership	#	80.10%
Garden/ Estates	<0.25	16%	14.00%
	>0.25	2%	7.50%
	No ownership	82%	79.50%
Cultivating Perhutani area	<0.25	NR	32.70%
(no ownership, only informal occupancy)	>0.25	NR	12.40%
	No ownership	NR	54.90%
Fish ponds	<0.25	2%	NR

Land ownership		Percentage of survey respondents who own land	
Land use	**Area (ha)**	**Survey Area**	
		Transmission Line	**PLTA *Upper* Cisokan**
	>0.25	0%	NR
	No ownership	98%	NR

type of irrigation is not specified; NR not recorded

There are 72.3% of surveyed households who own land, 50% of landowners own land less than 0.25 ha in the Upper Cisokan hydropower area. These farmers are usually called small or small farmers. Difficult to have benefit from small land, this indicates that these small farmers could being a poor citizens in the project area and are also categorized as vulnerable. In addition, there are many households that rent land to increase land for farming, both those who initially own land and those who do not own land at all.

Based on data on the carrying capacity and environmental capacity of West Bandung Regency in 2016, Bojongsalam Village has a residential area of 1.12% of the total area of the village and 98.88% is open land consisting of rice fields, fields, plantations, forests and others. For Cicadas Village, an area of 2.22% of the village area is in the form of settlements and 97.78% is open land. Sukaresmi village area of 6.02% is a settlement and 93.98% is open land consisting of rice fields, fields, plantations, forests and others. Residential land in Cibitung village is 6.47% of the total area of the village and 93.53% is open land consisting of rice fields, fields, plantations and others. Compared to the population in 2016, the capacity of the land to anticipate population growth in the four villages is still adequate.

4.3.6 Ecosystem Services

The Millennium Ecosystem Assessment (2005) defines ecosystem services as the benefits that humans obtain through ecosystems. Ecosystems are complex entities consisting of a dynamic community of plants, animals and micro-organisms and their abiotic environments that interact with each other as a single functional unit (MEA, 2005). An ecosystem can consist of plants, animals, microorganisms, soil, rocks, minerals, water sources and local atmosphere interacting with one another.

Ecosystem function is the ability of ecosystem components to carry out natural processes in providing materials/goods and services needed to meet human needs, both directly and indirectly (De Groot et al., 2002). Thus ecosystem services are the benefits or benefits derived by humans from ecosystems both directly and indirectly (De Groot et al., 2002, MEA 2005, Contanza et al., 2011) or in other words ecosystem services are benefits that humans can obtain from various natural resources and processes that are jointly provided by an ecosystem.

A. Type of Ecosystem Services

Millennium Ecosystem Assessment (2005) classifies ecosystem services into 4 categories of ecosystem services, namely:

1. Provisioning services such as sources of food, water, genetic resources and fiber, fuels and other materials.
2. Regulatory services such as: air quality regulation, climate regulation, regulation of water flow and flooding, prevention and protection against natural disasters, water purification, waste treatment, and natural pollination control of pest control
3. Cultural services such as cultural identity and diversity, religious and spiritual values, knowledge (traditional and formal), inspiration, aesthetic values, social relations, heritage values, recreation and others.
4. Supporting services such as primary production, land formation, oxygen production, soil resistance, pollination, habitat availability, nutrient cycle.

Detailed description of the Ecosystem Services can be seen in Table 33.

Table 33. Ecosystem Services Classification according to the Millennium Ecosystem Assessment (2005)

Ecosystem Services Classification	**Description**
Provisioning Services	
Food	Including a variety of food products derived from plants, animals and microbes.
Fiber	Materials included here are wood, jute, cotton, hemp, silk, and wool.
Fuel	Wood, dirt, and other biological materials function as a source of energy.
Genetic resources	This includes genes and genetic information used for animal and plant breeding and biotechnology.
Biochemistry, natural medicines, and pharmaceutical drugs	Many medicines, biocides, food additives such as alginates, and biological materials derived from ecosystems.
Ornamental resources	Animal and plant products, such as leather, shells and flowers, which are used as decoration, and all plants used for landscaping and ornamental plants
Water	People get clean water from ecosystems and thus the water supply can be considered as a supply service. River water is also a source of energy. However, because water is needed for other lives, it can also be considered a support service
Regulating Services	
Air quality regulation	Ecosystems contribute to adding chemicals and extracting them from the atmosphere, affecting many aspects of air quality.
Climate regulation	Ecosystems affect climate both locally and globally. At the local scale, for example, changes in land cover can affect temperature and rainfall. On a global scale, ecosystems play an important role in climate by capturing or emitting greenhouse gases.
Water regulation	The timing and magnitude of runoff, flooding, and aquifer filling can be greatly influenced by changes in land cover, in particular, changes that change the water storage potential of the system, such as conversion of wetlands or conversion of forest to agricultural land or agricultural land to urban areas.
Erosion regulation	Vegetative cover plays an important role in soil retention and prevention of landslides.

Ecosystem Services Classification	Description
Water purification and waste treatment	Ecosystems can be sources of impurities (for example, in water) but can also help filter and decompose organic wastes that enter land waters and coastal and marine ecosystems and can assimilate and detoxify compounds through soil and sub-soil processes.
Disease regulation	Ecosystem changes can directly change the abundance of human pathogens, such as cholera, and can change the abundance of disease vectors, such as mosquitoes.
Pest Management	Ecosystem changes affect the prevalence of pests and diseases of plants and livestock.
Pollination	Ecosystem change affects the distribution, abundance and effectiveness of pollinators.
Management of hazards or natural disasters	The presence of coastal ecosystems such as mangroves and coral reefs can reduce damage caused by storms or large waves.
Cultural Services	
Cultural diversity	Ecosystem diversity is one of the factors that influence cultural diversity.
Spiritual and religious values	Many religions attach spiritual and religious values to the ecosystem or its components.
Knowledge system (traditional and formal)	Ecosystems affect the types of knowledge systems developed by different cultures
Inspiration	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture and advertising.
Educational Values	Ecosystems and their components and processes provide the basis for formal and informal education in the community.
Aesthetic value	Many people find beauty or aesthetic value in various aspects of the ecosystem, such as reflected in the form of parks, beautiful scenery, and the choice of housing locations.
Social Relationship	Ecosystems affect the type of social relationships that are built in certain cultures. Fishing communities, for example, differ in many ways in their social relations from nomadic herding or agricultural communities.
The feeling of sense of a place	Many people appreciate the "sense of place" associated with recognized environmental features, including aspects of the ecosystem.
The value of cultural heritage	Many communities place a high value on preserving historically important landscapes ("cultural landscapes") or culturally significant species.
Recreation and ecotourism.	People often choose where to spend their free time based on the characteristics of natural or cultivated landscapes in certain areas.
Supporting Services	
Land Formation	Because many service provision depends on soil fertility, the rate of land formation affects human welfare in many ways.
Photosynthesis	Photosynthesis produces oxygen which is needed for most living organisms.
Primary production	Assimilation or accumulation of energy and nutrients by organisms.
Nutrient cycle (Nutrient)	About 20 essential nutrients for life, including nitrogen and phosphorus, cycle through the ecosystem and have different concentrations in different parts of the ecosystem.
Water cycle	Water flows through the ecosystem and is very important for living organisms.

B. The Use of Natural Resources and Ecosystem Services

Ecosystems have arranged and provided natural resources for humans to be utilized to meet their needs and livelihood. These natural resources are called ecosystem services or products. Each community group varies in needs and dependence on the type of ecosystem service. Certain ecosystem services such as various types of edible nuts or tubers, wood production, and extreme climate balancing are very important services for the lives and food security of the poor. Meanwhile, for other community groups, cultural and religious services can be more valuable than other services (Rosa et al., 2008). In general, all individuals are very dependent on the existence of ecosystem services (Rosa et al., 2008).

Therefore, based on literature studies of existing documents such as: BPS Data (Kecamatan in Number 2019), Monitoring Report on RKL/RPL Implementation, Journal or the results of previous studies on ecosystem services in Cianjur Regency and West Bandung Regency, several ecosystem services can be identified in the UCPS project area that can and has been utilized by the PAPs, and other Citizens.

Provisioning Services

Ecosystems in the UCPS region can provide benefits in the form of provision of food derived from biological sources (plants and animals) and water (fish), both processed and untreated, which are designated as human consumption. Food supply by ecosystems can be derived from agricultural and plantation products, and fishery products. This is reflected by the existence of paddy fields in Bojongpicung District (2,661.73 ha), Campaka District (Margaluyu Village: 275 ha, Sukajadi Village (304 ha), Cibeber District (Girimulya Village: 115 ha, Karangnunggal Village: 201.7 ha, and Salamnunggal Village: 194.5 ha). For Cipongkor and Rongga Districts, there are plantations for vegetables and fruits such as long beans, large chillies, cayenne pepper, mushrooms, tomatoes, eggplant, beans, cucumbers, squash, kale, spinach, melons, watermelons and cantaloupe Fishery products in the form of freshwater fish wre catched by residents both for consumption and for sale.

Ecosystems in the UCPS region also provide the benefits of water supply, namely the availability of water both from surface water and ground water (including its storage capacity), even rainwater can be used for domestic and agricultural purposes. The provision of clean water services is strongly influenced by rainfall conditions and layers of soil or rocks that can store water (aquifers) as well as factors that can affect groundwater storage systems. There are dug wells, pump wells, springs and piped water that are used as a source of clean water and drinking water for residents in the UCPS area.

Energy supply can also be obtained from ecosystems in the UCPS region. Alternative energy sources from nature such as hydropower and solar energy can be developed for community use. Based on BPS data (2019), some residents, especially in Bojongpicung District (Jatisari Village) and Cibeber District (Cibeber Village) use firewood as an energy source.

Regulating Services

Naturally the ecosystems in the UCPS region have the function of climate regulation services, which include the regulation of temperature, humidity and rain, wind, control of greenhouse gases & carbon sequestration. The function of climate regulation is influenced by the presence of biotic factors, especially vegetation, location and physiographic factors such as altitude and landform. The UCPS area has a dense vegetation density and large elevations such as mountains. This will result in a better climate regulation system that directly benefits in reducing carbon dioxide emissions and the greenhouse effect and reducing the impact of global warming. The condition of climate trends in the UCPS region can be seen in section 3.2.1.

Hydrological cycle, is the movement of water in a hydrosphere which includes the process of evaporation, condensation, rain, and flowing. Hydrologic cycles that occur in the atmosphere include the formation of rain clouds, the formation of rain, and evaporation, transpiration, evapotranspiration. While the hydrologic cycle that occurs in the biosphere and lithosphere is the aquatic ecosystem which includes surface runoff, freshwater ecosystems, and sea water ecosystems. A normal hydrological cycle will have an impact on good water management for various purposes such as water storage, flood control, and maintenance of water availability. Water management by hydrological cycle is strongly influenced by the presence of land cover and the physiography of an area. Data on the hydrology of the UCPS region can be seen in section 3.2.2.

Ecosystems also contain regulatory elements in natural infrastructure for the prevention and protection of several types of disasters, especially natural disasters. Some functions of preventing natural disasters from land fires, erosion, abrasion, landslides, storms and tsunamis are closely related to the presence of land coverage and landforms. In the UCPS area which has close vegetation coverage can prevent the area from erosion and landslides. Besides the specific landforms can directly impacting the source of the disaster, for example erosion and landslide disasters generally occur in structural and denudational landforms with hilly morphology.

The ability to "cleanse" pollutants through chemical-physical-biological processes that occur naturally in water bodies is one of the ecosystem services regulatory functions. The ability to purify water naturally (self purification) takes time and is influenced by the high and low load of pollutants and natural recovery techniques, especially the activity of natural bacteria in remodel organic matter, so that the capacity of water bodies in thinning, breaking down and absorbing pollutants increases. Data on water quality in the UCPS area can be seen in Appendix 11. This data indicates the ability of ecosystems to clean pollutants.

Ecosystem services include location capacity in neutralizing, extracting and absorbing waste and rubbish. In a limited capacity, the ecosystem has the ability to neutralize the organic substances present in wastewater. Nature provides a variety of microbes (aerobes) that are able to decompose organic substances contained in wastes and rubbish into inorganic substances that are stable and have no environmental impact. Aerobic microbes provided by the ecosystem and play a role in the process of neutralizing, breaking down and absorbing waste and garbage including bacteria, fungi, protozoa, algae.

Good air quality is one of the benefits provided by the ecosystem. Air quality is strongly influenced by interactions between various pollutants emitted into the air by meteorological factors (wind, temperature, rain, sunlight) and utilization of the earth's surface space. The higher the intensity of space utilization, the more dynamic the air quality. Air quality maintenance services in vegetated areas and in high-topographic areas are generally better than non-vegetation areas. Data on air quality in the UCPS region indicates the ability of ecosystems in the current air quality regulation can be seen in Appendix 12.

Natural pollination is the process of pollination (the transfer of pollen from the anthers to the pistil) which specifically occurs in the same flower or between different flowers but in one plant or between flowers in the same plant clone. Ecosystems provide natural pollination regulation services, especially through the availability of habitat species that can assist the natural pollination process. Natural habitats such as forests and vegetation areas generally provide more abundant pollinating species media.

Pest control is the regulation of disturbing creatures or organisms called pests because they are considered to interfere with human health, ecology, or the economy. Pests and diseases are biotic threats that can reduce yields and can even cause crop failure. Ecosystems naturally provide a system for controlling pests and diseases through the presence of habitat for trigger species and controlling pests and diseases.

Cultural Services

Ecosystems provide positive benefits for humans, especially space to live and prosper. This living space is supported by the ability and suitability of land that is high so as to provide life support both socially, economically and culturally. Ecosystem services as a place to live and social space are strongly influenced by physical and geographical environmental conditions and greater regional development opportunities. UCPS region which has a high slope level is an area that does not have enough space to develop a good and quality residential area and living space. Areas that have mountainous ecoregions and folded hills are also areas that have large low and very low carrying capacity. Despite the fact that many settlements and community settlements are in areas of high slope, such settlements and settlements are certainly not within the carrying capacity of their environment.

Ecosystems provide landscape features, natural uniqueness, or certain values that become a tourist attraction. Various forms of landscape and the unique flora and fauna as well as the biodiversity contained in ecosystems provide characteristics and beauty for tourists. From the economic side, many benefits will be obtained as a large source of foreign exchange. The UCPS region which has mountainous ecoregions or folded hills has a high carrying capacity for this ecosystem service.

Ecosystems in the UCPS region that have landscapes such as mountains, valleys, rivers and so on have given a feel of natural beauty and amazing aesthetic values. The combination of landscape and cultural landscape further strengthens the beauty and aesthetic value that ecosystems have provided.

Supporting Services

One type of supporting ecosystem services is the formation of soil layers and maintenance of fertility. Land and its fertility is an important capital for humans in developing agriculture, and sustaining other life, such as for building settlements, developing tourist activities and others. Land is one of the main natural resources on planet Earth and is the key to the success of living things. The soil is a thin layer of the earth's crust and is the outermost. Soil is the result of weathering or erosion of host rock (inorganic) mixed with organic matter. Soil contains rock or mineral particles, organic matter (organic compounds and organisms) water and air. Minerals are the main soil elements formed from inorganic solids and have a homogeneous composition. Ecosystems provide support services in the form of soil formation and maintenance of fertility which varies between locations. Locations that have fast weathered rock types, with conditions of rainfall and high sun exposure due to the shape of the earth's surface and are supported by the presence of organisms in soil and ground cover plants. Soil formation and fertility maintenance services support the provision of food, fiber, energy and genetic resource services to be able to develop due to the availability of fertile soil media for the growth of plants that produce food, produce fiber and energy, and the development of genetic resources. Fertile soil is also needed to support the growth of plants, so that photosynthesis occurs in absorbing carbon dioxide which pollutes the air and releases oxygen, so that air quality is maintained. The part of the UCPS area is in the form of forests that have good vegetation cover and have a high carrying capacity for this service.

The nutrient cycle in an ecosystem is an integrated process of movement/transfer of energy and nutrients within the ecosystem itself and also its interactions with the atmosphere, biosphere, geosphere and hydrosphere. The energy needed to drive the nutrient cycle is obtained from the processes that occur in the biosphere which is the process of photosynthesis. Ecosystems naturally provide nutrients needed by plants from the soil through their absorption of nutrients and then accumulated in plant tissues and return to the soil either directly or indirectly as organic material. The process of nutrient uptake, nutrient accumulation in plant bodies and return to the soil through various cycles according to plant conditions, climate and soil type itself so that ultimately affects the soil fertility and high levels of agricultural production. This nutrient cycle supports agricultural activities, because with a good nutrient cycle, the fertility of agricultural land is well maintained, and ultimately produces other ecosystem services such as food services, fiber services, energy, climate regulation, maintenance of air quality and other ecosystem services. The UCPS region which is a mountainous region is indicated to have a high carrying capacity for this ecosystem service.

Ecosystems in the UCPS region can also provide primary production services in the form of oxygen production and species habitat provision. This is proven by the existence of diversity of flora and fauna that need oxygen for the survival of life. Ecosystems provide oxygen-producing services while reducing carbon dioxide levels and air populations on earth. The existence of vegetation such as forests that absorb carbon dioxide for food production (photosynthesis). The result of photosynthesis is oxygen. This is the gas that living things need on earth to move and allow the growth of many species' habitats. Oxygen production services vary between locations and are closely related to the presence of vegetation and forests. Forested areas provide a very high and high carrying capacity. It can be understood that on the land thus there is an intensive process of photosynthesis. This photosynthesis process produces primary production, namely oxygen, fiber and other primary production. The process of photosynthesis at the same time also absorbs carbon dioxide in the results of the photosynthesis process which is stored in the form of fiber.

Ecosystems in the UCPS region have provided biodiversity services among living things from all sources, both terrestrial and other aquatic ecosystems and ecological complexes that are part of its diversity; includes diversity within species, between species and ecosystems that constitute a breeding habitat for flora and fauna. The higher the character of biodiversity, the higher the function of ecosystem support for livelihoods. In areas that have high primary production services, carrying capacity and capacity for biodiversity services are also high. Data on UCPS Biodiversity can be seen in Appendix 13.

4.3.7 Health Service

At present the health service closest to the area affected by the UCPS 1040 MW hydropower development project has changed since the 2011 EIA study. The health services are in the form of Puskesmas, Supporting Puskesmas (Pustu) facilities and Hospitals managed by the Regional Government and the private sector. There are also health services in the form of clinics/polyclinics, private practice doctors and midwives, and posyandus which are managed by the community. There is also a mobile health service to expand the scope of health services to residents who find it difficult to come to the puskesmas because it is far away so that patients can be treated.

For West Bandung Regency, there is a Rongga Health Center that can serve Sukaresmi Village, Cibitung Village, Bojongsalam Village and Cicadas Village. There is also a Supporting Puskesmas in each affected village in Rongga District. The existence of the Pustu serves to increase the reach and quality of health services for the community in the village and surrounding areas. For Cipongkor District, there is a Puskesmas service that can serve Karangsari Village, Sarinagen Village, Sirnagalih Village, and Cijambu Village. Data on health facilities in West Bandung Regency can be found in appendix 21.

For the visible area in Cianjur Regency, Puskesmas services in Sukajadi Village, Campaka Sub-district can also serve Margaluyu Village and Puskesmas Services in Cibaregbeg Village, Cibeber Sub-District can serve Karangnunggal Village, Girimulya Village, and Salamnunggal Village. In the Village of Girimulya there is a Supporting Puskesmas (Pustu).

In Bojongpicung Subdistrict, there are Puskesmas in Neglasari Village and Pustu in Sukarama Village, Jatisari Village, Kemang Village, Bojongpicung Village, and Sukaratu Village. This health service facility can also serve other affected villages such as Cibarengkok Village, Haurwangi Village, Hegarmanah Village, Mekawangi Village, Ramasari Village, Sukajaya Village.

Health care workers are available in each District or other health facilities. This can be seen from data collected directly at the Puskesmas and data from the Central Statistics Agency (BPS).

Based on the District Report in Figures 2019 of Cianjur Regency, the number of health workers living/staying in Cibeber District is 5 Doctors, 2 Dentists, 32 Midwives, 14 other Health Workers, and 77 shaman baby. There are 1 Doctor, 11 Midwives, 7 other Health Workers, and 73 shaman baby in the Campaka District. In Bojongpicung District, there are 1 doctor, 24 midwives, 26 other health workers, and 51 shaman baby.

Based on the Semester RKL-RPL Monitoring Report in 2019, the number of health service personnel in Cipongkor Health Center consists of 17 Midwives, 2 General Practitioners, 1 Dentist, 5 Nurses, 1 Dental Nurse (PNS), 1 Pharmacist, 1 Pharmacist Assistant, 1 Sanitarian , 1 Health Promotion, 1 Health Analyst, 1 Registration, 1 Administration, 1 Medical Record, 1 Safety, 1 Cleanliness, 1 Ambulance Driver. As for the Rongga Health Center, the number of health service personnel consists of: 17 Midwives, 2 General Practitioners, 6 Nurses, 3 Community Health Instructors, 1 Sanitarian, 1 Medical Record, 1 Health Analyst, 1 Assistant Pharmacist, 1 Accountant, 1 General Admin, 3 Cleaning Staff.

Communities will have good health services if the community is supported by easy access for them. Mobile health services are provided, but very rarely visit remote villages and hamlets because health workers have difficulty accessing the village. In remote areas, communities are more dependent on traditional medicines made by family members or traditional healers in the community.

Current health services in Bojongpicung, Rongga and Gununghalu:

- Bojongpicung: 1 doctor, 1 dentist, 1 teeth expert, 13 nurses and 12 midwives.
- Cavity: 1 doctor, 1 dentist, 1 teeth expert, 7 nurses and 10 midwives.
- Gununghalu: 1 doctor, 1 dentist, 2 teeth expert, 18 nurses and 14 midwives.

The nearest hospital is located in Cianjur Regency, about 25km from the UCPS 1040 MW hydropower development site, with more adequate facilities where emergency services, outpatient services, inpatient services, intensive services, central surgery services, laboratory services, anatomic pathology services, Radiology Services, Medical Rehabilitation Services, Forensic Medical Services, Pharmacy Services, Nutrition Services, One Day Care Services, Blood Bank Services, and Medical Check Up Services (RSUD Sayang Cianjur, 2020).

Based on the trend of monitoring results of the implementation of the UCPS 1040 MW PLTA RKL-RPL for public health aspects in 2012-2019, the dominant types of diseases suffered by the community include; Acute Respiratory Infection (ARI), Diarrhea, Hypertension, Febris or Fever, Dermatitis, Influenza, etc. This data does not experience significant changes when compared with the results of the 2007 AMDAL Study and the 2011 AMDAL Study. A list of the top ten diseases obtained from the Cipongkor Health Center and the Rongga Health Center in West Bandung Regency and Cibeber Health Center and Campaka Health Center in Cianjur District from 2012-2019 can seen in Appendix 22.

4.3.8 Public Opinion

A. Activity Engangement and Community Feedback

Based on RKL-RPL Monitoring Report 2019, all respondents (100%) had already known about PLTA UCPS construction activity, these can not be separated from socialization and construction activity which had started again since 2018. Residents are also involved in the UCPS hydropower development activities as a part of the local worker. While for plans and schedules for ongoing development activities, the most community did not know (68%). Most respondents (32%) stated that the benefits felt during construction activities are easier accessibility road. While as many as 29% of respondents satated that employment opportunities were opened, where the implementing contractor always prioritized the recruitment of local workers. In addition, 23% of respondents stated that they obtain better public and social facilities, such as the construction / roads development and bridges, religious facilities, health facilities, MCK facilities, clean water facilities, electricity networks and so on. Based on observations in the field, the most positive impact had felt by residents is the construction of new roads.

Feedback during relocation activity from community exhibit 83% of residents were satisfied and 17% were dissatisfied with the relocation activities provided by PT.PLN. On the other hand, 33% residents stated sufficient and 67% insufficient for relocation facilities, also the respondents stated that the benefits felt during construction activities were the opening of employment opportunities, where the implementing contractor always prioritized the recruitment of local workers. In addition, respondents stated that they obtained better public and social facilities, such as the construction / improvement of roads and bridges, religious facilities, health facilities, MCK facilities, clean water facilities, electricity networks and so on. Based on observations in the field, the most positive impact felt by residents is the construction of new roads. The road makes it easy for residents in their daily economic activities. Data on community perceptions regarding relocation activities and perceived benefits can be seen in appendix 23.

Regarding the progress of land acquisition, as many as 40 respondents (69%) stated that it had been completed, 24 respondents (24%) stated that it had not been fully completed, while the remaining 4 respondents did not know it (Appendix 24). Meanwhile, detailed community responses can be seen in Appendix 25.

Regarding to the construction plan for the SUTET 500 kV PLTA UCPS transmission line activity, all respondents (100%) were aware of the plan for the SUTET 500 kV PLTA UCPS Transmission Line since the socialization had been going on since 2007. The respondent's knowledge of the planned 500 kV SUTET PLTA transmission line 2012 is increasing (figure). With the results of the primary data from 2014 to 2019, all respondents know about the planned activities (100%). Regarding the respondents' concerns during the monitoring period, they included health problems due to radiation and land / building compensation values that were not in line with expectations.

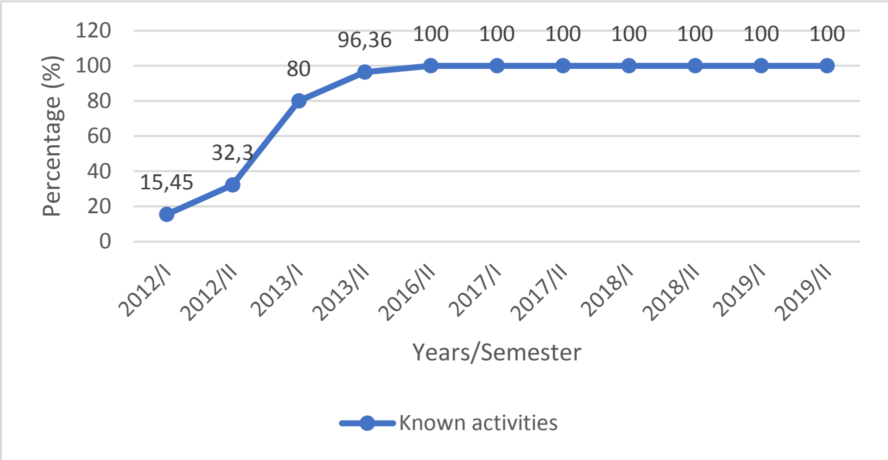


Figure 112 Trend of Respondents' Knowledge of Action Plans
(Source: Sutet 500kv Implementation Monitoring Report, 2019)

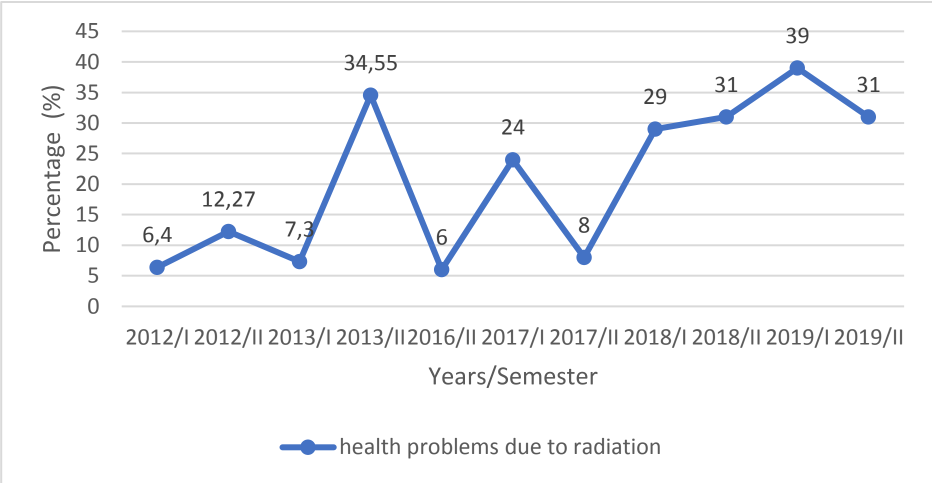


Figure 113 Trend of Respondents' Concerns About Health Problems
(Source: Sutet 500kv Implementation Monitoring Report, 2019)

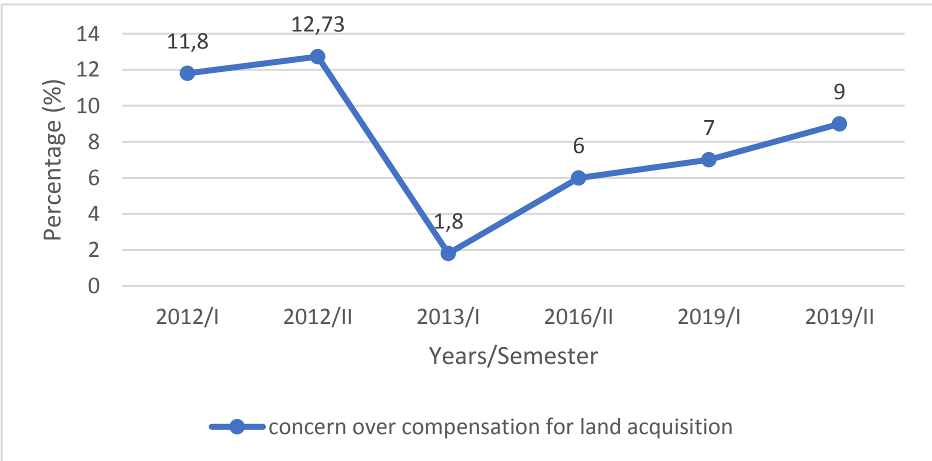


Figure 114 Trend of Respondents' Concerns About Land Acquisition Compensation
(Source: Sutet 500kv Implementation Monitoring Report, 2019)

Community concerns related to the development plan for the UCPS 500 kV SUTET transmission line can be seen in appendix 26.

B. Mechanisms and Types of Complaints

Complaints Mechanism

1. Project Affected Residents (WTP) submit complaint documents to the Complaints Task Force for advocacy and problem solving.
2. WTP complaints relating to land acquisition must be submitted to the Task Force within 14 calendar days after the announcement of asset inventory by P2T (Article 41 Paragraph 2 of the Regulation of the Head of the National Land Agency No. 3/2007). The Governor must provide a response within not less than 30 calendar days (Article 41 Paragraph 2 of Regulation of the Head of the National Land Agency No. 3/2007).
3. The Task Force will classify each complaint to be followed up. Complaints can be handled here or sent to other institutions for further action. Follow-up must be done 7 calendar days after receiving the complaint. Institutions related to complaint handling must provide a response / solution to the Task Force within 14 calendar days
4. The Task Force for advocating and handling complaints must provide a response / way out to the PAPs within 21 calendar days.

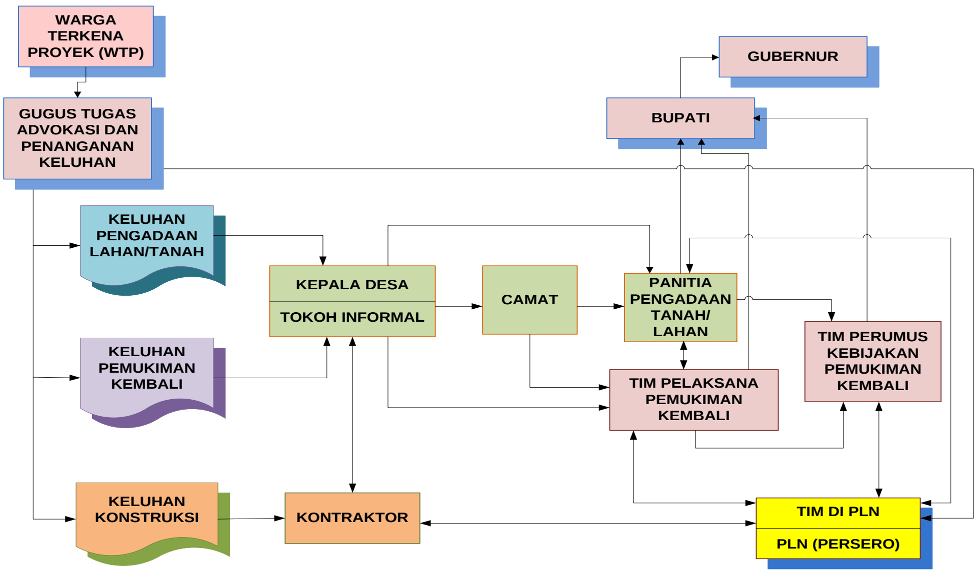


Figure 115 Compensation and Relocation Mechanisms

To ensure that the implementation of compensation and relocation is smooth and effective, an appropriate consultation and discussion strategy is needed as in Table 34. The focus, time scale, and consultation and discussion strategy will cover several aspects, namely:

1. Consultation and discussion of lost assets;

Two things must be discussed in the consultation and discussion:

a. Information obtained from P2T's inventory of land and land-related assets. This information should be announced both at the village and sub-district level.

b. Complaints from WTP. Based on the results of the inventory, the PAPs can approve and / or raise objections to the contents of the announcement. Within one month, PAPs have the opportunity to make various complaints / complaints to the Complaints Handling Team. Based on this complaint, P2T will clarify the core of the complaint including various matters including complaints on land and project affected assets.

2. Consultation and discussion on compensation for assets;

There are three activities related to asset compensation, namely:

a. Get the price of the land the WTP wants. The purpose of this activity is to obtain information about prices as a consideration for determining the price of land compensation.

b. Discussion to determine land prices and asset compensation. In this discussion negotiations on the price of land desired by the PAPs and approved by PT PLN.

c. Time socialization and compensation payment mechanism. This activity will be carried out after the price is decided by P2T.

3. Resettlement consultation and discussion;

There are two activities for this consultation and discussion, i.e

a. Provide information for PAPs about resettlement plans.

b. The design of resettlement plans made by the Local Government. This activity aims to identify the public facilities and social infrastructure needed by the PAPs at the relocation site.

4. Consultation and discussion on income improvement;

Consultation and discussion for income improvement includes information on income improvement after the land acquisition / compensation program, including health insurance for PAPs who are in the transmission line. The purpose of consultation and discussion is to identify and determine the types of income improvements that need to be done including training.

Table 34. Consultation and Discussion Strategy

Consultation data	Involved Parties	Place	Time	Consultation Strategy
Missing Assets:				
Announcement of an inventory of land and assets by P2T result	P2T, National Land Agency, Village Office, District Office;PLN, WTP	Village and sub-district offices	After P2T completed inventory	Dissemination through bulletin boards, and other print and electronic media
Objections of the PAPs to land size, building area, number of plants, ownership status	P2T, complaint handling team, Village Pamong, District Employees, Bandung District Employees; Cianjur Regency employees, West Bandung Regency Agriculture Office, Cianjur Regency Agriculture	Project Office	One month after inventory result announcement	Complaint handling mechanism

Consultation data	Involved Parties	Place	Time	Consultation Strategy
	Office, WTP, Local NGOs and PLN			
Compensation:				
Obtain desired land price for the PAP and the latest market price and price from the Independent Appraisal Agency	P2T, PLN, Pamong Desa, District District Employees; West Bandung Regency Employees, Cianjur District Employees; Local NGO.	Village office	One month after inventory result announcement	Get the price of land desired by the PAPs through the FGD
Negotiations (Discussion) for an agreement on land prices	P2T, PLN, WTP, Independent Monitoring Agency, Pamong Desa, District District Employees; West Bandung Regency employees; West Bandung Regency Agriculture Department; West Bandung Regency Public Works Office, Cianjur Regency Office; Cianjur Regency Agricultural Agency; Cianjur Regency Public Works Office, police	Village office	Before land price considered by P2T	P2T determines the form and value of compensation based on negotiations with the PAPs and negotiations with PLN
Prices dissemination for compensation, time and payment mechanism	P2T, Pamong Desa, District District Employees; West Bandung Regency employees; West Bandung Regency Agriculture Department; West Bandung Regency Public Works Office, Cianjur Regency Employees; Cianjur Regency Agriculture Office; Cianjur Regency Public Works Office, PLN, Bank, WTP, POLRI, Local NGOs	Village office	After P2T decides the price of land compensation and after the local government decides the price of buildings and plants	Dissemination to WTP
Resettlement:				
Give WTP information about resettlement plan	Resettlement Team, Village Pamong, District Employees, West Bandung Regency Employees; West Bandung Regency Agriculture Department; West Bandung Regency Public Works Office, Cianjur Regency, Office, Cianjur Regency Agriculture Office; Cianjur Regency Public	Village office	After the location selection by PLN	Socialization of revenue relocation and recovery plans

Consultation data	Involved Parties	Place	Time	Consultation Strategy
	Works Office, WTP, Local NGOs			
Design plan for resettlement is regulated by the local government	Resettlement Team, Village Pamong, District Employees, West Bandung Regency Employees; West Bandung Regency Agriculture Department; West Bandung Regency Public Works Office, Cianjur Regency Employees, Cianjur Regency Agriculture Office; Cianjur Regency Public Works Office, WTP, Local NGOs	Location of resettlement decided	After the location decided by PLN	FGD on public facilities needed by the PAPs at the resettlement site
Revenue Improvement				
Selection and implementation of Restoration Income and training related to PAPs after resettlement	Resettlement Team, Special task force in local government, training consultant, PLN, WTP.	Location of relocation and other places that have been determined.	After relocation	FGD income improvement types and training implementation

4.3.9 Vulnerable or Sensitive Community

In the implementation of the Upper Cisokan Hydroelectric Power Plant and tower site project, potential disruption from the surrounding community could occur. As happened in the road infrastructure construction project that was built by the Regional Government of Cianjur Regency. Where during the implementation, there was a disturbance addressed to the project implementer. Disturbances occur, including theft of equipment and building materials, as well as threats under sharp weapons. (source: data from the results of interviews with the UCPS Social and Stakeholder Mapping PLTA, 2019). Based on these conditions, it is necessary to mitigate risks against the possibilities that occur.

The Upper Cisokan Hydroelectric Power Plant construction project in the Cianjur area is currently in the pre-construction stage. As for some potential security disturbances that may occur during the construction of hydropower plants and tower sites, can be seen in Table 35.

Table 35 Potential Safety Disturbances in the Construction Process

Pre-Construction Stage			
ISSUE	**RISK**	**LEVEL**	**MITIGATION**
Cash Land Acquisition of Girimulya Village	Intimidation Demo Disturbance to personal	High	• Settlement of agreements • Involvement of the head of Girimulya Village with Arts and Culture program
Residents affected by the Project Road Widening	Verbal Complaints	Low	Communication
Road repair plan for Margaluyu Village and construction of the GOR Gululya village GOR That hasn't been realized yet.	Demo Verbal Complaints and written	High	• Communication with village officials Margaluyu • Realization of Infrastructure development plant
Not agreed on land prices for Tread Tower and SUTET	Inhibit the planning	Medium	• Communication • Enforcement of rules
Pelibatan pekerjaan proyek	Complaint Intimidation Disturbance to personal	Low	• Coaching vendors or local contractors • Major local vendor systems and supporting local vendors
Construction stage			
ISSUE	**RISK**	**LEVEL**	**MITIGATION**
Unfinished Compensation payment	Protest Interference with workers	High	• Compensation Payment • Opening job opportunities
Loss of work, due to land affected by the project	Protest Interference with workers	High	• Open employment opportunities for young workers • Working capital assistance for farmers whose age over 40 years
Local Workers Involvement	Verbal protest to local government	Medium	• Communication • Training for people who will become prospective workforce • Recruitment of local workers
Fear of remote areas after watered dam	It is feared that the protest will involving the media	Medium	• Communication • Transportation facilities support • Socialization • CSR infrastructure
Concerns about current health problems development goes on	Protest	Medium	• CSR pemeriksaan kesehatan berkala
Local people can not become a provider of goods and services	Protest	Medium	• Training on procurement of goods and services at local business entities (BumDesa, Koperasi, CV)
Perception about SUTET can be distracting health	Verbal protest Protest through the media	Low	• Information about the impact of SUTET • Health checks for residents who live at the SUTET location

4.3.10 Traffic and Road Safety

The transportation aspect is an important aspect that must be considered in order to support activities in supporting the construction of the 1040 MW UCPS hydropower plant, including for the mobilization of vehicles either during construction or operation.

To have access to the Project location from the direction of Bandung/Jakarta, it can be accessed through the toll gate padalarang, then pass Jl. Rajamandala until entering the gate of the Saguling Hydroelectric Power Plant (± 20 km), then entering the Saguling Hydroelectric Power Road to the Cipari Jucntion intersection as far as ± 20 km, from the Cipari Intersection to the Project site can be described as follows:

a. In the direction of the quarry through the Baranangsiang-Karangsari road for ± 6.7 km
b. Head toward Cimarel Junction through Newroad ± 20 km along the intersection to go to the lower dam (± 6 km) and upper dam (± 2 km)

Transportation aspects include traffic conditions and road safety for mobilizing vehicles, equipment, goods and personnel.

Traffic conditions can be reported based on Monitoring Results of RKL-RPL Implementation from 2018 to 2019. Traffic Surveys have been conducted at 2 (two) monitoring points with the following description:

1) Cijenuk – Cipari Direction (Cipari Intersection)

Cijenuk - Cipari Road is access to the whole area of Cipongkor Subdistrict especially for Sarinagen and Karangsari villages. In Cijenuk there is a market and a bus terminal to the city of Bandung. This type of road is a two-way two-lane road without a median (2/2 UD). This road is not as crowded as the traffic at the Saguling (Rajamandala) intersection. Some of the community activities around the existing road are residential areas, commercial places such as kiosks, schools, Grand Mosque and Islamic Center, Office of Religious Affairs, Cooperatives and Cipongkor District Office

Based on the analysis of the Capacity and Characteristics of Service Levels of the Cipari Simpang Road Section from 2018 - 2019 (Appendix 27), the Cipari - Cijenuk road segment has service level A which means that the conditions of free flow at high speed, traffic density is very low at low speeds can be controlled by the driver based on maximum/minimum speed limits and physical road conditions, and the driver can choose the desired speed without obstacles.

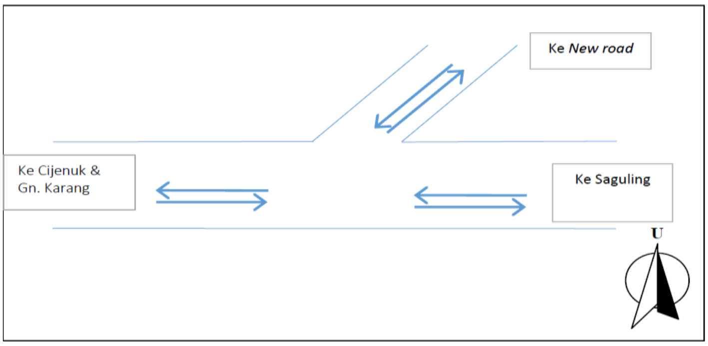


Figure 116. Skecth of Moving Direction in Cipari Intersection

Road capacity is the ability of a road segment to accommodate an ideal flow or volume of traffic in a certain time unit, expressed in terms of the number of vehicles that pass a particular piece of road in one hour (number of vehicle/hour), or by considering various types of vehicles that pass a road using a unit passenger car as a unit of vehicle in the calculation of capacity, the capacity of using passenger car units per hour or (passenger car unit)/hour.

Figure 117 Road Conditions and Traffic Flow at Cipari Intersectioni

2) Quarry Direction (Sarinagen Intersection)

The condition of the road at the site of the Gunung Karang mining plan has now been carried out by using asphalt pavement to the boundaries of the Mount Karang mining area. This is done to facilitate the movement of vehicles transporting andesite from the mine site to the lower dam and upper dam.

Figure 118 Road condition ini Sarinagen Village towards Quarry Location

Figure 119 Road condition in Karangsari village towards Quarry location

The road from Cipari to the Bojong Loa intersection is a village road and is access to the entire village area of Sarinagen and Karangsari Kec. Cipongkor. During the Saguling hydropower development project, this road was an access road to Mount Karang (quarry). With paved road conditions with a width of ± 10 m. This type of road is a two-way two-lane road without a median (2/2 UD). This T-junction comes from the direction of Cipari - Gunung Karang - Cililin. The condition of the old access road between Mount Karang and Cipari there are several community activities that are nearby, namely: grocery stalls, food stalls, kiosks, residential areas, SDN Cimega (Elementary School), SLB (Disability School) Cipongkor and Al-Barqunnajah Foundation Schools.

Based on the analysis of the Capacity and Characteristics of Service Levels of the Bojong Loa Simpang Road Section from 2018 - 2019 (Appendix 28), the road to PLTA has service level A which means that the condition of free flow at high speed, traffic density is very low at a very fast speed can be controlled by the driver based on maximum/minimum speed limits and physical road conditions, and the driver can choose the desired speed without obstacles. With a note that this road is going down towards the Saguling Hydroelectric Power Plant and precisely at the intersection there is a traditional market.

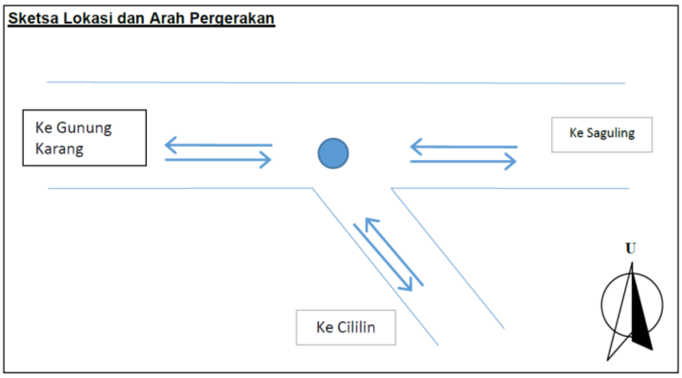


Figure 120 Sketch of Moving Direction in Bojong Loa Intersection

Figure 121 Road and Traffic condition in Bojong Loa Intersection

There are 2 (two) main road sections in the project location, namely the Baranangsiang - Karangsari Road (existing road) and the Cijambu - Sukaresmi Road (new road). Based on observations in the field, the level of traffic density on the access road is still very low, there has not been any congestion or traffic congestion. Based on the trend calculation v/c ratio of 2018-2019 (Appendix 29 and

Appendix 30), shows that at the Cipari Intersection the density level is monitored in the morning, afternoon and evening when conditions are still very quiet. In the morning v/c the ratio ranged from 0.02 to 0.12, during the day from 0.02 to 0.11, and in the afternoon from 0.02 to 0.15. If the v/c ratio size is> 0.8, it means that the road conditions are jammed and> 1 means the road conditions are overloaded. At the Bojong Loa Intersection based on the calculation of v/c the ratio of the density level is also still quiet, which ranges from 0.03 to 0.16 in the morning, afternoon and evening. The vehicles that mostly pass 2 roads that are related to the activity are motorcycles (> 80%), followed by light vehicles and heavy vehicles.

Based on field observations and trends on the results of the UCPS RKL-RPL Hydropower Reports for 2018 and 2019, road safety aspects have improved. The run off building control, groundwater seepage in the form of a drainage channel along the shoulder of the road and the location of the quarry Mount. The coral has been built made of mortar and masonry. Drainage channels need to be treated because there are several conditions where some of the channels are already covered with vegetation. Overall management of erosion and sedimentation related to the construction of the access road has undergone significant changes and has reached the lower dam limit.

From several landslide locations on the road that have been and are being repaired, 2 (two) locations identified as being of high potential are named ST.10 + 500 and ST.13 + 100. At present, handling and monitoring of landslide points have been carried out on access road access. Management of slopes that have the potential for landslides due to cutting road cliffs has largely been strengthened by building retaining walls/rocks (DPT) with a shotcrete surface covering system, making concrete buildings and or from stone pairs (gabions), as well as on slopes below the hill. There is also afforestation in areas that have erosion potential, namely in steep/sloping contour areas with plants in the category of ground cover in the form of planting Vetiveria zizanoides on the New road Cliff.

The placement of warning signs and maximum speed restrictions at locations in and out of project vehicles have been installed along the existing road and new road. Road markings as a sign on the road surface or on the road surface in the form of equipment or signs that form longitudinal lines, transverse lines, oblique lines and other symbols that serve to direct the flow of traffic and limit the area of interest of traffic have also been implemented. Road dividing fences have also been installed at each corner of the road leading. However, there are some road signs/marks that have been taken off or stolen by irresponsible people, for example a convex mirror mounted on the corner of the road that serves to find out/vehicles from the opposite direction. The plan is that the sign will be installed again and monitoring will be carried out so that the incident does not happen again. Noise barriers are currently not installed along existing and new roads.

Street lighting has been installed on the left/right of the existing road that is used to illuminate the road and the environment around the road. For lighting on access to the new access road has not been done.

4.3.11 Natural Disaster Assessment

A. Seismic

Indonesia is located in a very active seismic zone, along the Pacific Ring of Fire. The project area is located in Seismic Zone 4, with small to medium earthquake risks for building construction (PLN / Newjec Inc., 2007b). As an example of the frequency and nature of earthquakes in the area, 62 earthquake events were recorded in Cianjur Regency in the period 1992-1993, located at a depth of 344km from the project site, and of magnitude up to 5 on the Richter scale (PT. PLN, 1998) .

B. Slope Stability

Slope stability is a problem in the hilly landscape of the project area. Landslides occur quite often, due to loss of dense vegetation, high rainfall, earthquakes, modifications to the surface and slides, weathered rocks and thick topsoil and steep slopes.

Nine landslides occurred in the period 1990 to 1994 that affected the livelihoods of the people (but there were no fatalities) from nearly 1000 people in Cianjur District (PT. PLN, 1998). In 2009 an earthquake with a magnitude of 7.3 on the Reichter scale triggered a landslide in Cianjur District and killed several people.

Slope stability in the project area was examined in detail in 2007 to assess the risk of landslides in the reservoir area. A number of areas with potential for landslides have been identified in the upper reservoir, as shown in Appendix 31.

Table 36 Summary of Slope Stability Risk at Upper Dam

Location (Appendix 19)	Landslide characteristics	Estimated volume (m^3)	Potential civil, housing and agricultural buildings at risk
A	On surface	Few units, each amounting to 100-500	<10 houses above the water level
B	On surface	Few units, each amounting to 200-600	*Intake*
C	Curved avalanches or slope collapse	5,000-8,000	<10 houses above the water level
D	On surface	Few units, each amounting to 100-700	Access Road
E	On surface	50-200	Upland rice, taro and corn
F	On surface	150	None
G	On surface	100-300	Ginger plant

Land Movement

Land movement is defined as the movement of rock mass, soil or slope forming material downward towards the slope (SNI 8291: 2016). According to this definition, it seems clear that the land movement can occur on any soil or rock mass alone or a mixture of both in the form of shredded material.

The mechanism of movement of which is included in the land movement include a wide range of mass transfer controlled by the force of gravity as fall, topple, slides, lateral spread, flow as defined by Varnes (1978).

The type of material involved in land movement can be rock, soil, or shredded material produced from a mixture of the two materials. What is meant by the rock material here can be igneous, sedimentary, and metamorphic rocks which is a collection of one or more types of minerals, naturally formed, and attached to one another by a cohesion force that is strong and permanent. Included in the soil material is the type of soil that has a predominantly fine size, in the form of silt and clay. Meanwhile, shredded material is basically soil material dominated by coarse-sized fragments.

Based on the mechanism of movement and type of material, Varnes (1978) classifies land movements into several types (Table 37). Based on the table, it appears that the combination of two or more types of material movement is referred as complex landslide movement. Meanwhile, Verhoef (1994) illustrates several examples of types of ground motion by also showing the position of the slip plane and weathering zone, as shown in Figure 122.

Table 37. Type of Material and Land Movement

<table>
<tr><td colspan="3" rowspan="3">Type of movement</td><td colspan="3">Type of material</td></tr>
<tr><td rowspan="2">Bedrock</td><td colspan="2">Engineering soils</td></tr>
<tr><td>Freedom, Coarse</td><td>Predominantly fine</td></tr>
<tr><td colspan="3">Falls</td><td>Rock falls</td><td>Debris falls</td><td>Earth falls</td></tr>
<tr><td colspan="3">Topples</td><td>Rock topple</td><td>Debris topple</td><td>Earth topple</td></tr>
<tr><td rowspan="3">Slides</td><td>Rotational</td><td>Few units</td><td>Rock slump</td><td>Debris slump</td><td>Earth slump</td></tr>
<tr><td rowspan="2">Translational</td><td rowspan="2">Many units</td><td>Rock block slide</td><td>Debris block slide</td><td>Earth block slide</td></tr>
<tr><td>Rock slide</td><td>Debris slide</td><td>Earth slide</td></tr>
<tr><td colspan="3">Lateral spreads</td><td>Rock spread</td><td>Debris spreads</td><td>Earth spread</td></tr>
<tr><td colspan="3" rowspan="2">Flows</td><td rowspan="2">Rock flow/deep creep</td><td>Debris flow</td><td>Earth flow</td></tr>
<tr><td colspan="2">Soil creep</td></tr>
<tr><td colspan="3">Complex</td><td colspan="3">combination two or more creep</td></tr>
</table>

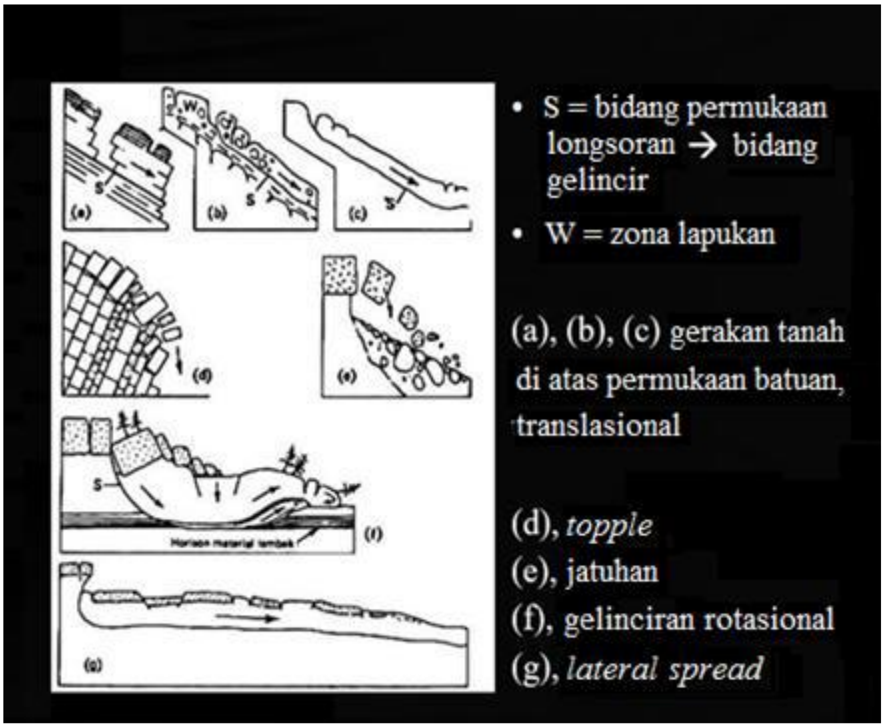


Figure 122 Model of Land movement/Landslide

The mechanism of land movement includes a series of movements on slopes in stages which are influenced by factors that cause land movement. For example, the mechanism of land movement that is initiated by heavy rainfall for a long time causes some of the rain water to seep into the ground through inter-porous space and cracks. This further causes the soil to become saturated with water so that the soil becomes loose and the unit weight of the soil increases and the shear strength decreases. Due to the reduced retaining force, one of which is influenced by the roots of perennials which can bind the soil to the slope, causing the soil to become unstable and soil movement occurs. The mechanism of ground motion as previously described, can further be explained based on SNI 13-6982.1: 2004 as follows.

1) Falls are a detachment of soil/rock from a steep slope or cliffs along a surface on which little or no shear displacement has occured. The material subsequently descends mainly by falling, bouncing, or rolling.
2) Topple is a soil/rock mass that moves under the influence a forward rotation out of a slope around a point or axis below the center of gravity of the displaced mass. Toppling occurs on very steep slopes to cliff, driven by gravity exerted by the weight of material upslope from the displaced mass or due to water pressure.
3) Slide movement is divided into two mechanism of movement, namely Translational Landslide and Rotational Landslide.
    a. Translational Landslide is a mass of rock / soil that moves on a relatively planar surface with little rotational movement or backward tilting. or wavy ramps. This movement is controlled by a weak slide in the form of a geologic discontibuity. This type of landslide includes a wedge slide in the form of rock / soil mass movement through two areas of discontinuity that intersect and are aligned with the slope.

b. Rotational Landslide is a landslide on which the surface of rupture is curved upward under the influence of rotational force, where the pivot point is located above the center of gravity of the mass (circular). Generally followed by cracks and the head of the displaced material may move almost vertically downward.

4) Lateral spread movement is the movement of material that usually occurs on gentle slopes, especially where a stronger upper layer of rock or soil undergoes extension and moves above an underlying softer, weaker layer resulting in lateral movement (Highland and Bobrowsky, 2008).
5) Flow is a movement of material that is not cemented and generally forms a flow, whether fast or slow, wet or dry can occur in rocks, but more often occurs in soil.

Landslide Characteristics

The landslide observed on the main road of the Upper and Lower Cisokan Hydroelectric Power has different characteristics, both the type and causes. The results of the field survey found that there were 55 observed landslide locations (details can be found in Appendix 31). In general, these locations are on a slopes with an angle that have more than 45 degree. Aside from the slope, there are several other causes that cause landslides, namely weathering, erosion, weak field position, and the presence of clay shales. Landslides can occur due to various reasons including:

1) Landslides due to weathering

   Landslides caused by weathering occurs at the top of the slope system and below the road. This happens because the weak slide is in the weathering boundary of the slope composing rock. Usually these landslides have a curved shape due to rotational (circular) movement. The volume produced from these landslides is generally very large because it carries the soil material on it. The formation of slopes was clearly seen on several landslides which had escarpment lengths of more than 20 m (Figure 123). The material carried by the landslide is in the form of trees, boulders, and soil. Water conditions greatly affect the occurrence of landslides because at the weathering limit there is a high enough water content that will cause the formation of slip surfaces. This landslide can be overcome by improving the geometry of the slope and installing reinforcement systems based on detailed landslide investigation data.

Figure 123 Erosion due to weathering

2) Landslides due to erosion

   Landslides caused by erosion are usually associated with surface water flow paths. The surface river flow can be a seasonal river or a permanent river. These landslides occur at the foot of the slope in the downhill road. The surface runoff erodes the foot of the slope and causes the foot of the slope to be unable to withstand the load on it. The degree of erosion will have a greater degree in the surface water flow path that turns rather than the straight path. In the field there are usually reinforcement systems to prevent landslides caused by erosion such as gabion walls or retaining walls. In some locations gabion walls still fail to hold the rate of erosion resulting in landslides (Figure 124). Securing surface water flow paths with an appropriate drainage system will be able to hold the rate of erosion and prevent subsequent landslides.

Figure 124 Landslides due to erosion in the area treated with gabion walls

3) Landslides caused by slide discontinuity occur on slopes of rocks that are blooming and enlarged. The relationship of the position of the weak slide with the slope will affect the type of landslide that occurs on the rock slope. A weak slide in the direction of the slope will cause planar landslides. Conversely, when the position of the weak slide is in the opposite side of the slope there will be a Toppling. An example of a Toppling is presented in Figure 125. If there are two weak fields that intersect and are aligned with the slope of the rock, a wedge will occur (Figure 126).

Figure 125 Landslides due to field differences

Figure 126 Landslides due to wedge failure

The bloomed and raised rock slopes will have cracks with different characteristics. Scanline surveys will be very helpful in describing the characteristics of weak areas that exist. This survey is carried out by stretching a line at least 10 meters long on a rock mass making up the slope. All weak fields crossed by this line will be described in each parameter. Descriptions include weak field type, length, continuity, width of openings, fillings in openings, shape, roughness, joint roughness coefficient (JRC), weathering level, and water conditions. These parameters will be analyzed to obtain rock mass classification. The rock mass classification used can be in the form of a rock mass rating (RMR) and can be used to determine the safe slope cutting angle. The results of the RMR classification will be used in the slope mass rating (SMR) analysis to obtain empirical reinforcement system recommendations for landslide safety.

4) Landslide caused by the presence of claystone layer

   Clay stone layers are clay shale, which will resemble the shape of cracked scales when exposed to the surface (Figure 123). The condition occurs because of the stress release of the clay stone which was previously under the surface is now in contact with the atmosphere which has a smaller pressure. This causes the strength of the stone making up the slope to be weak. Sliding plane will usually occur in the lining of the claystone. Specialized knowledge regarding claystone must be known to improve the slope system that has been eroded.

Figure 127 Landslides due to clay shale layer

Characteristics of Landslides at the Project Area

The distribution of landslide prone roads on the UCPS Hydropower road has 55 landslides, but the location of the landslide-prone areas has been strengthened. Landslide prone locations consist of 44 Rotational landslides, 1 Translational (Planar) landslide, 3 Wedge landslides, and 7 Toppling landslides. Rotational landslides are very dominant in job sites due to weathering and erosion.

Based on observations made on 10-11 October 2016 of 3 road alignment, 43 landslide observation points were found, mainly around the access road to Upper Cisokan (Figures 128 and 129). The most common types of landslides are rock falls and debris slide. Even so there are several other types of landslides such as falling debris material and debris flow. Landslide points in the study area are presented in the following map.

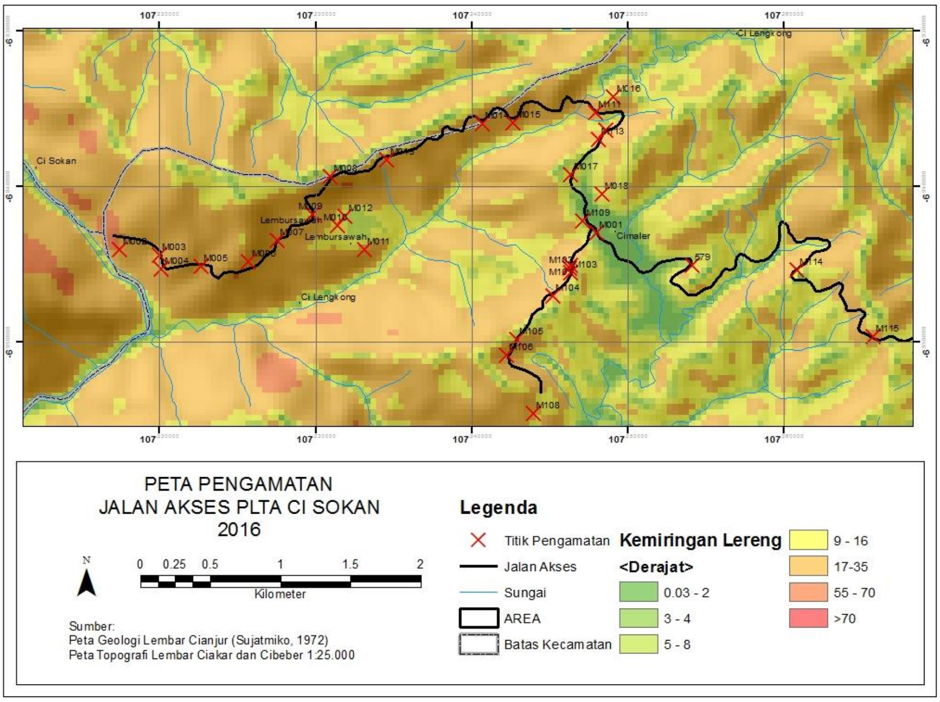


Figure 128 Map of Western Landslide Observations

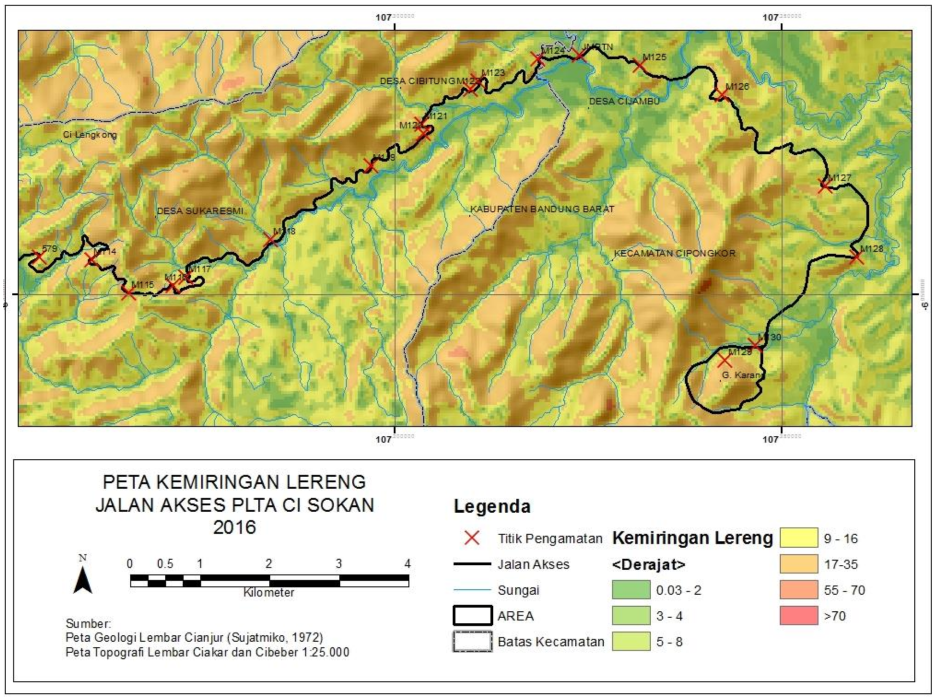


Figure 129 Map of Eastern Landslide Observations

Landslides generally occur at the boundary between bedrock and soil. Landslides occur in many slopes. Soil on slopes are generally thin, with steep slopes of 40°-60° soil easily eroded, even leading to landslides. In hard sandstone lithology or in igneous rocks, the soils are so thin that folding them leaves only the rock layer. Potential landslide locations on either side of the road leading to the cliff reinforcement have been carried out with various models. Strengthening the cliff with terracing, gabion ornaments or other reinforcement models.

C. Management of Slope and Landslide Areas

Work on management of slope and landslide areas was carried out in 2018, after the road construction in 2013 - 2016. This work was also accompanied by road repairs and coatings. Work on handling the slope and landslide areas has been carried out at more than 60 points and the maintenance are still carried out until 2020. Some of the work at this stage includes work on gabion walls, soil retaining wall, river stone retaining wall, shortcrete work and rock bolt / soil nailing.

(A)

(B)

(C)

(D)

(E)

Figure 130 Slope and Landslide Management Work; Soil Retaining Wall (A); Gabion (B); River Stone Retaining Walli (C); Rockbolt (D); dan Shortcrete (E)

D. Rock Porosity

The level of porosity of rocks is important for predicting potential loss of water from the reservoir, groundwater formation, and interactions between surface water and ground water. The level of water loss from dam foundation has been measured using a water pressure test on bore hole (dalam lubang uji). The level of porosity of bedrock in the upper and lower dam areas, are generally low to very low except for one sample in the upper dam. Most of the results of tests on boreholes show a higher level of porosity in weathered rock near the surface at each dam location.

4.3.12 Cultural Heritage

Cultural heritage survey, which includes religious buildings and private graves, conducted in 2009 and carried out in consultation with the community includes the identification of the location, grid reference location using GPS, and photographic recording. The report (Neneng, 2009) is shown in Appendix 32, and contains maps and photos of each location. A complete list of surveyed locations is shown in Table 38.

There are no locations registered with local and national authorities that have legal and important protections. Locations that have special interests, because they have religious or other significance, are considered sacred graves, by the surrounding community and pilgrims, namely Batu Bedil and Maqom Mbah Tubuy (famous religious grave), and Mama H. Ilyas Grave which is included in the historical heritage preserved by the Department of Tourism and Culture of West Bandung Regency. However, there are also many private graves and religious buildings in the project area which must also be respected and protected during reservoir construction and preparation.

Table 38 List of Cultural Objects, Cemeteries and Mosques That Have Been Surveyed

Name	Description
Upper Reservoir	
Batu Bedil	Named *Batu Bedil* because it is shaped like a cannon that is ready to be fired. The stone is considered to have magical abilities. Similar stones that exist elsewhere in Indonesia have links to ancient religions. The stone is placed in a park.
Sacred Old Gave	Mbah Dongkoherang's grave. Person who is considered to have natural powers. Rarely visited Mbah Kabayan's grave (A friend of Mbah Dongkoherang's). Rarely visited Shaykh Maulana Muhammad syafei's grave, also known as the Prince of the King of the Winds. He is a figure who is seen as playing a role in the development of Islam. The tomb is located in Cijenuk Village, Cipongkor District with preserved status
Mosque	Located village: Cimarel, Lembur Panjang, Cimanggu, Tapos, Ciputeungteung, Cipedes, Cibima and Cilawang.
Public cemetery	Cijambu (58 graves) Saninten, Baru, Hanjawar village and Cipedes (275) Cibimat village (40), and Tapos (150)
Family cemetery	Lembur Panjang. 22 graves.
Lower Reservoir	
Public cemetery	Ciawitali village – area of Perhutani (72 graves) – lahan desa (50). Muaracitali village –Bantarpicung bridge (56) area of Perhutani (35) Pamipiran village –Pamipiran bridge (53), No 2 (106) No 3 (29) Cipedes village (170)

Name	Description
Sacred old graves	The grave is also called the Tomb of Syeh Maulana Mansur. This place is a shelter for Syeh Maulana Mansur while traveling to Banten from Cirebon. Syeh Maulana Mansur is a propagator of Islam and is known as Banten's saint. This place has been around for around 400 years. This place is visited during the holy period of the Islamic Calendar, for example the month of the Prophet's Birthday and the Sya'ban, with hundreds of visitors. The visitors carry out religious activities with a hope to get a blessing or "Karamah".
Religious buildings	Ciawitali village – 1 mosque, 1 madrasah dan 6 prayer room Pamipiran village – 1 mosque, 1 madrasah and 4 prayer room Cipedes village– 2 mosques, 2 madrasah and 5 prayer room
Access Road and Basecamp	
Cemetery	Ciangkrong village with approximately 1000 graves, Cicadas village (8), Pesantren Al-Ummah Islamic Boarding School area (64), Pangkalan village (17), Anglaya village (147), Ciawi village (52) Sirnagalih village settlement. A number of individual graves on private land.
Sacred Old Graves	Grave of Mbah Santri: Known as a freedom fighter against the Dutch. Part of a family that is a direct descendant of Mbah Ngabuy, founder of the oldest boarding school in West Java, in Cibitung Village. People often visit the tomb and carry out religious activities. Mbah Sampan Grave. People often visit the tomb and carry out religious activities. Grave of Mbah Udin. People often visit the tomb and carry out religious activities. The grave of Mama H. Ilyas. Founder of Sukamanah Islamic Boarding School. People often visit the grave and carry out religious activities. Mama H. Ilyas's grave. Founder of Sukamanah Islamic Boarding School. People often visit the tomb and carry out religious activities. The tomb is in the Village Cibitung Kec. Cavities with preserved status. Bebuyutan Grave, Pangkalan Hamlet, Sirnagalih Village. H.Kosasih's garve who is in Kp. Ginaya, Cibitung Village, Rongga District Mbah Bale's grave in Kp. Cibadak, Cibitung Village, Rongga District
Religious buildings	Ciangkrong mosque
Transmission Line (2 lanes to the North)	
Sacred Old Graves	Grave of Eyang Jaga Karsa Cibarengkok. The graves of the ancestors who are believed to have a special "Karamah". "Karamah" is people's understanding of something that can give blessings to people's lives. People usually visit the Grave of Eyang Jaga Karsa during the special Islamic month, usually in the month of Mawlid. During the pilgrimage the ritual activities that are carried out are the reading of the Qur'an, prayers and admonition. Grave of Eyang Jaga Karsa Sukaratu. The same story and pilgrims to the cemetery with the same name in Cibarengkok
Public Cemetery	22 unknown graves, Cinangsi village (>4,000) Kemang village, 10 graves 5 ha of Sukaratu village area. Former Sukaratu villages, Neglasari and Bojong Picung village
Sasak Luhur Bridge	A historical bridge built in the Dutch colonial period.

The number and location of Cultural Property, Religious Buildings, and Graves are subject to verification during mitigation efforts.

Chapter V. Closing

Thus the Baseline Report on the Environmental and Social Conditions of the UCPS 1040 MW Hydropower Project in 2020. Hopefully this report can provide a complete and overall picture of environmental and social conditions to facilitate the planning and impact analysis during the construction and operation of hydropower.

Jatinangor, June 2020

Faculty of Agroindustrial Technology– UNPAD

(Dr. Ir. Edy Suryadi, MT.)

Dean

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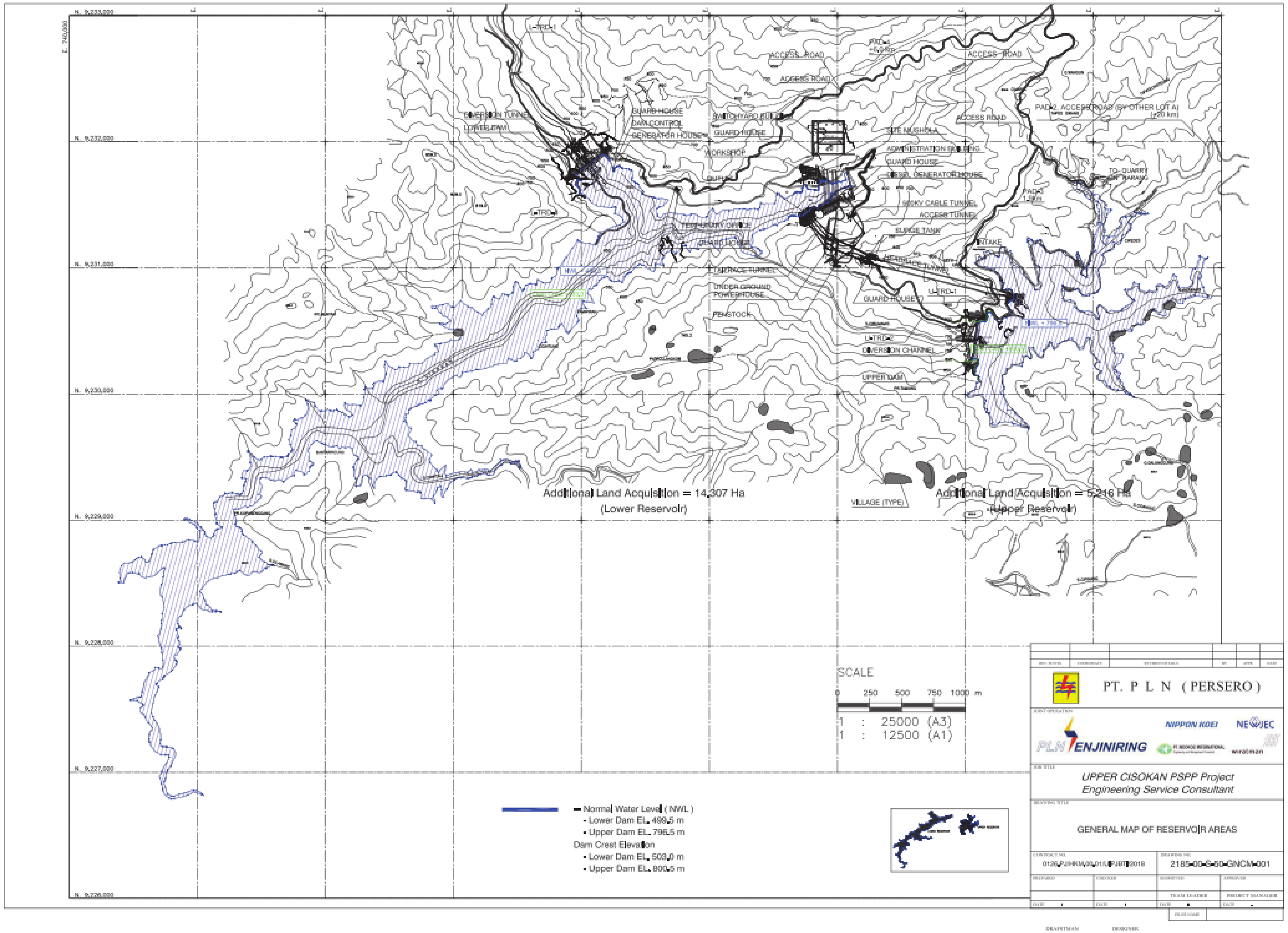
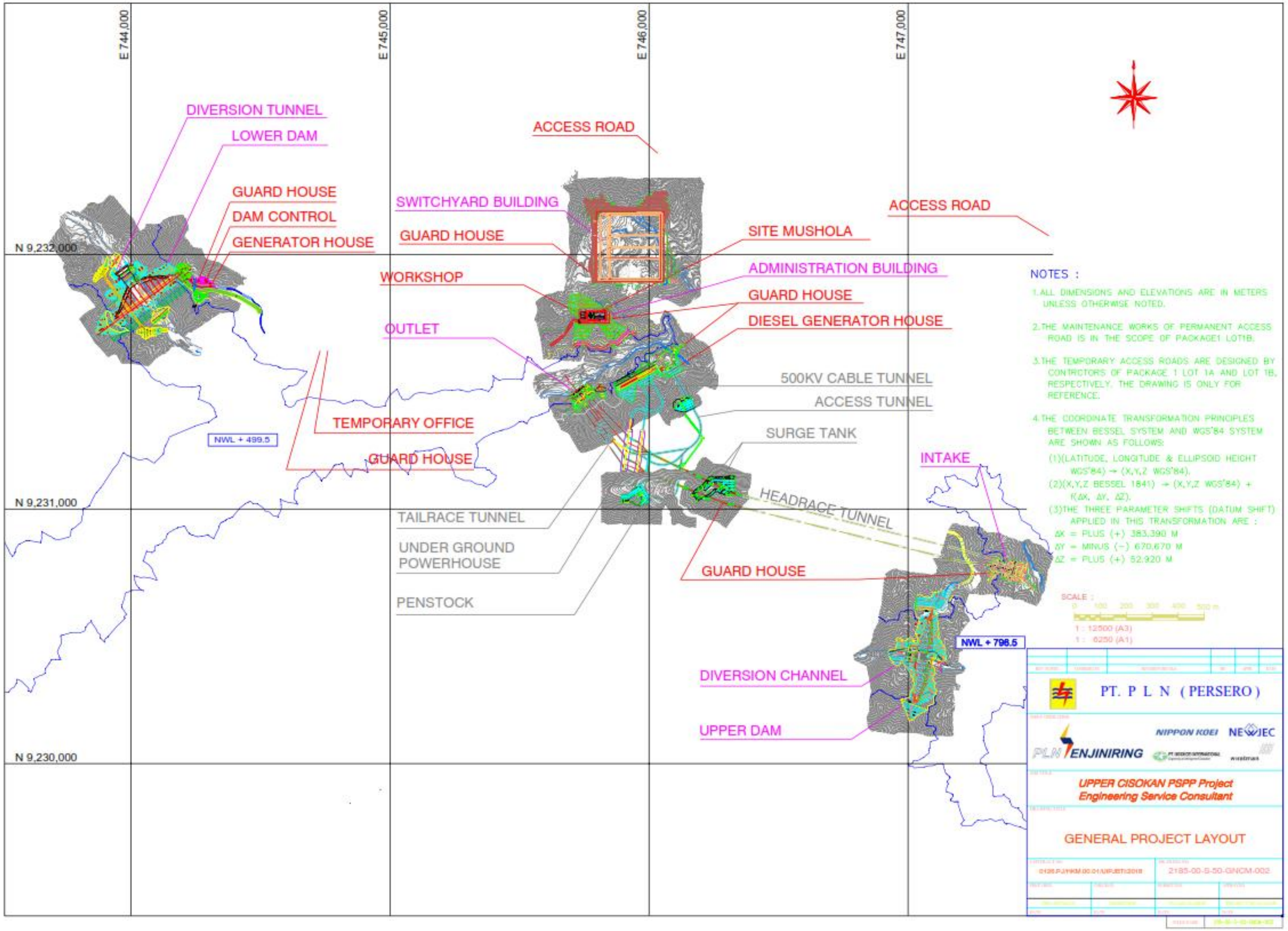
APPENDICES

Appendix 1 General Maps of Reservoir Area

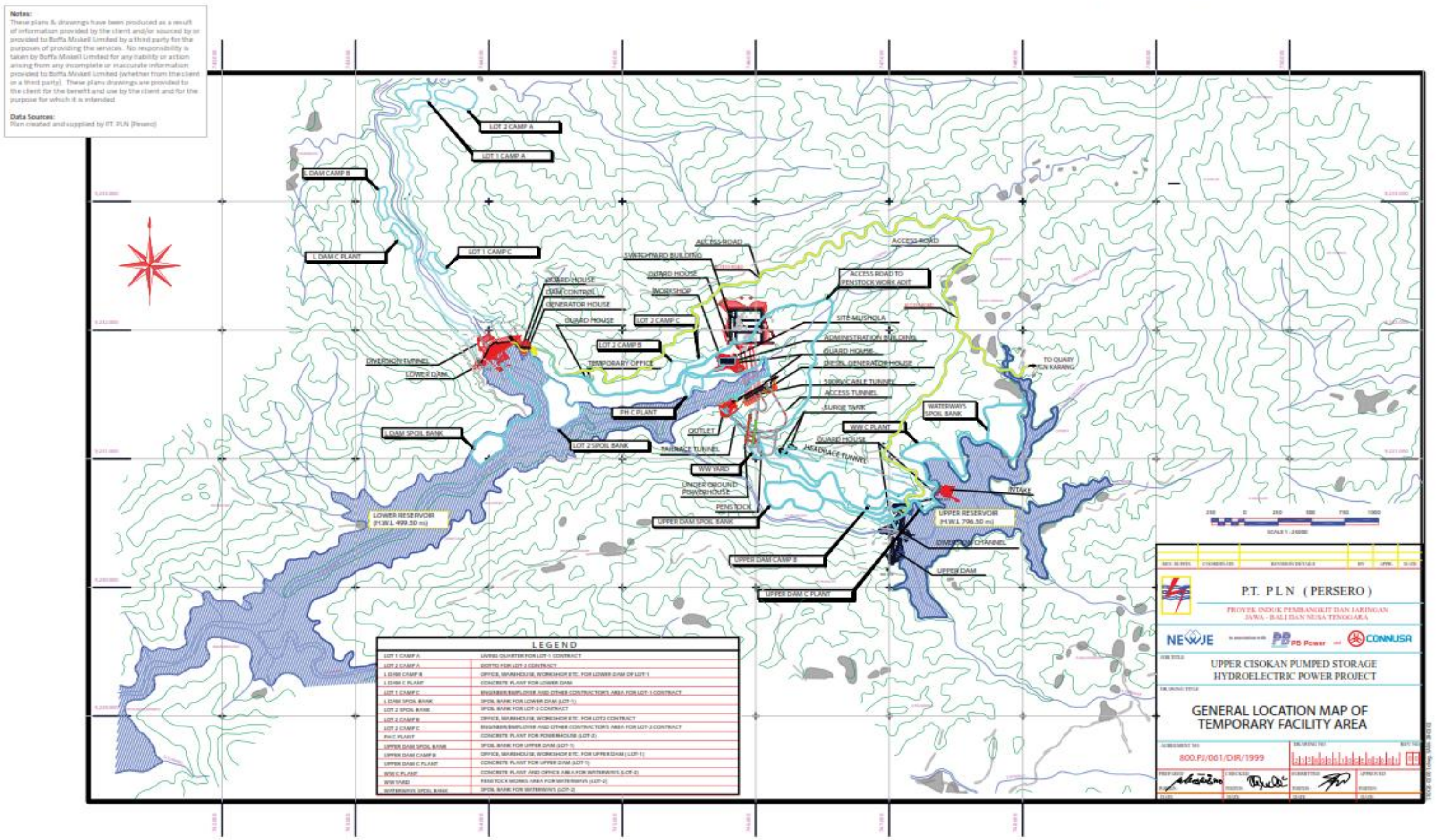


Appendix 2 General Project Layout UCPS



Appendix 3 General Location Map of Temporary Facilities Area

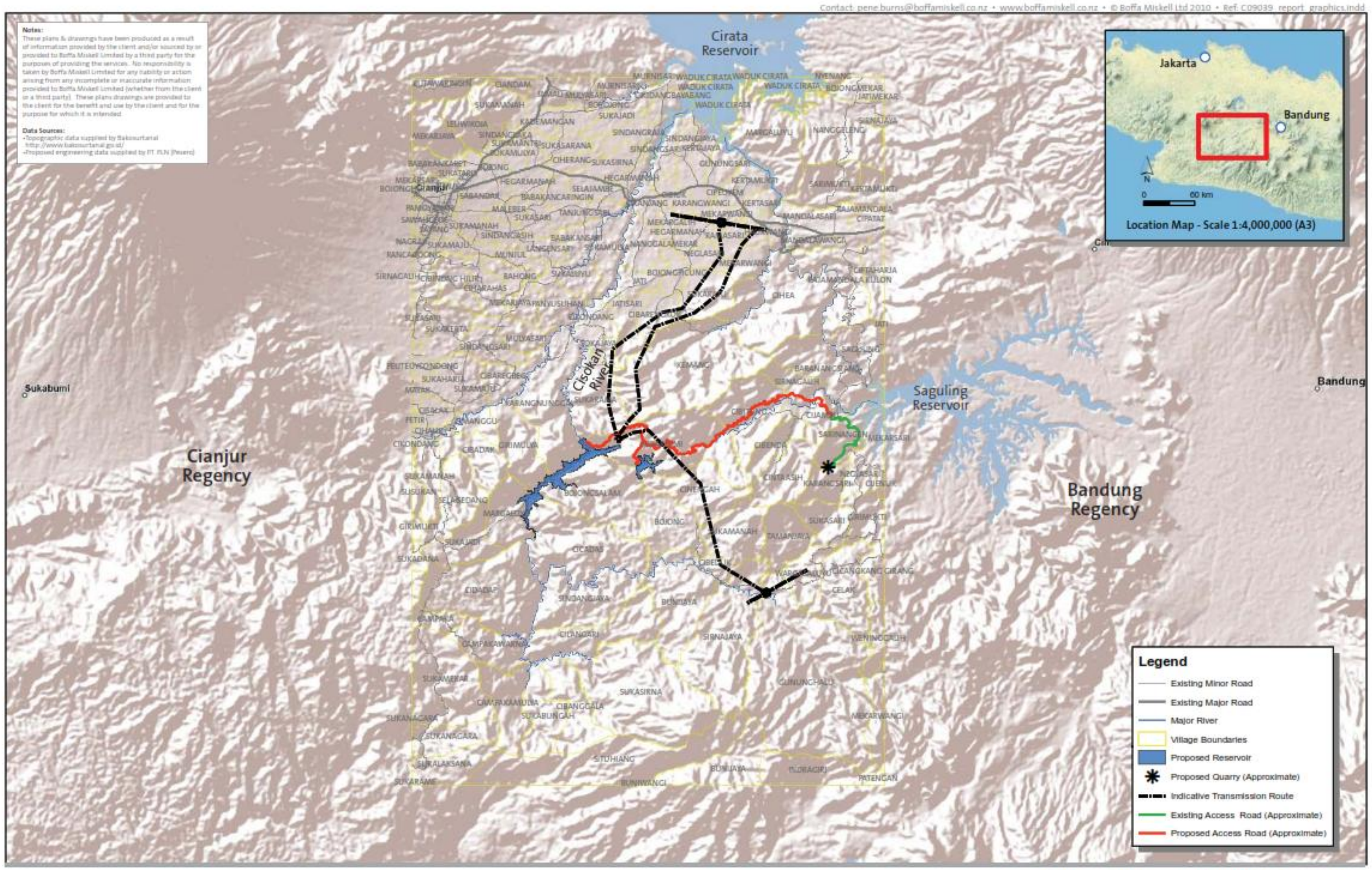
Contact: pene.burns@boffamiskell.co.nz • www.boffamiskell.co.nz • © Boffa Miskell Ltd 2010 • Ref: C09039_report_graphics.indd



Boffa Miskell

UPPER CISOKAN PUMPED STORAGE
Figure 5
Layout of Construction Areas Upper and Lower Reservoirs
22nd March 2010

Appendix 4 Indicative 500 kV Transmission Line Route

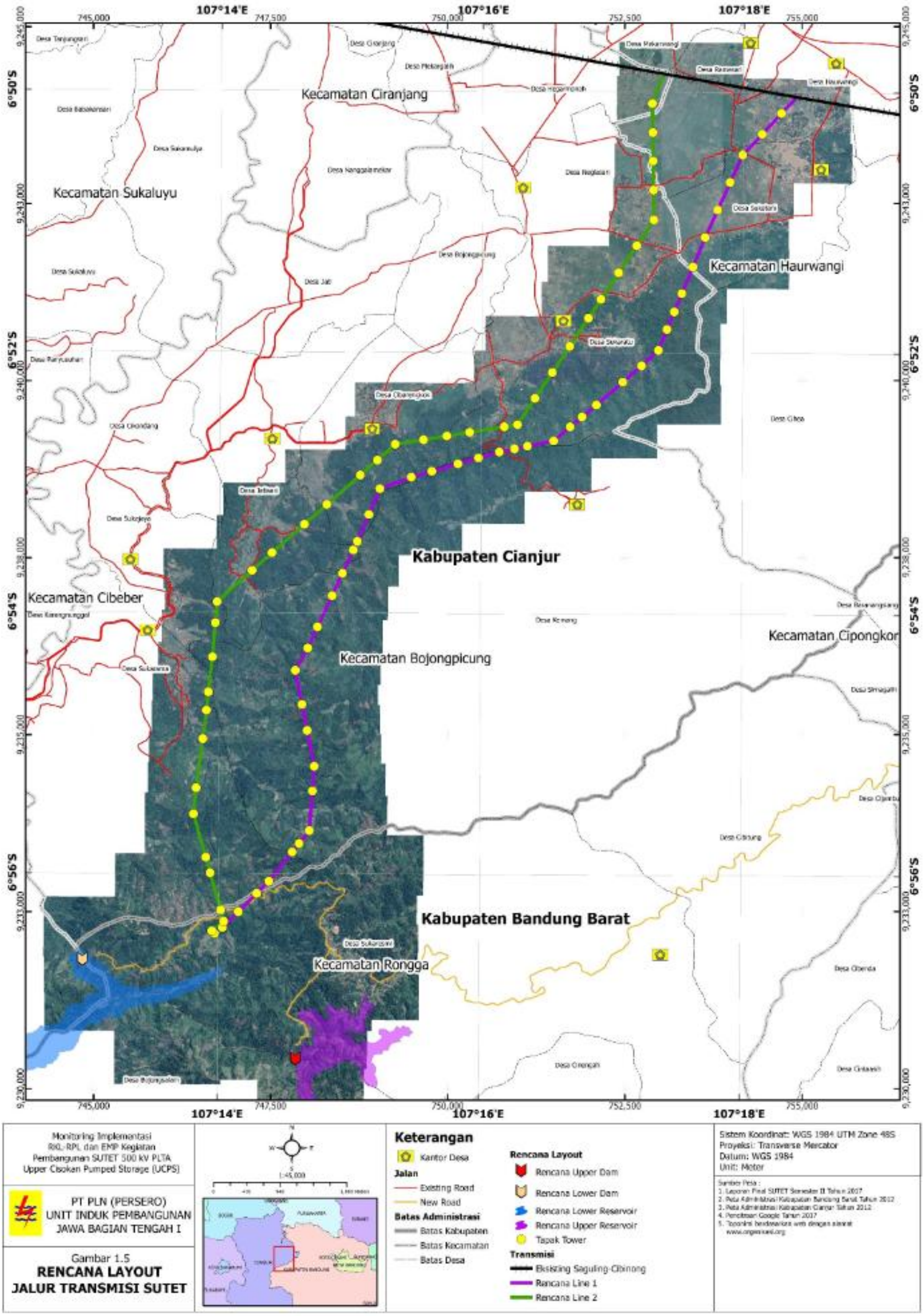


Boffa Miskell

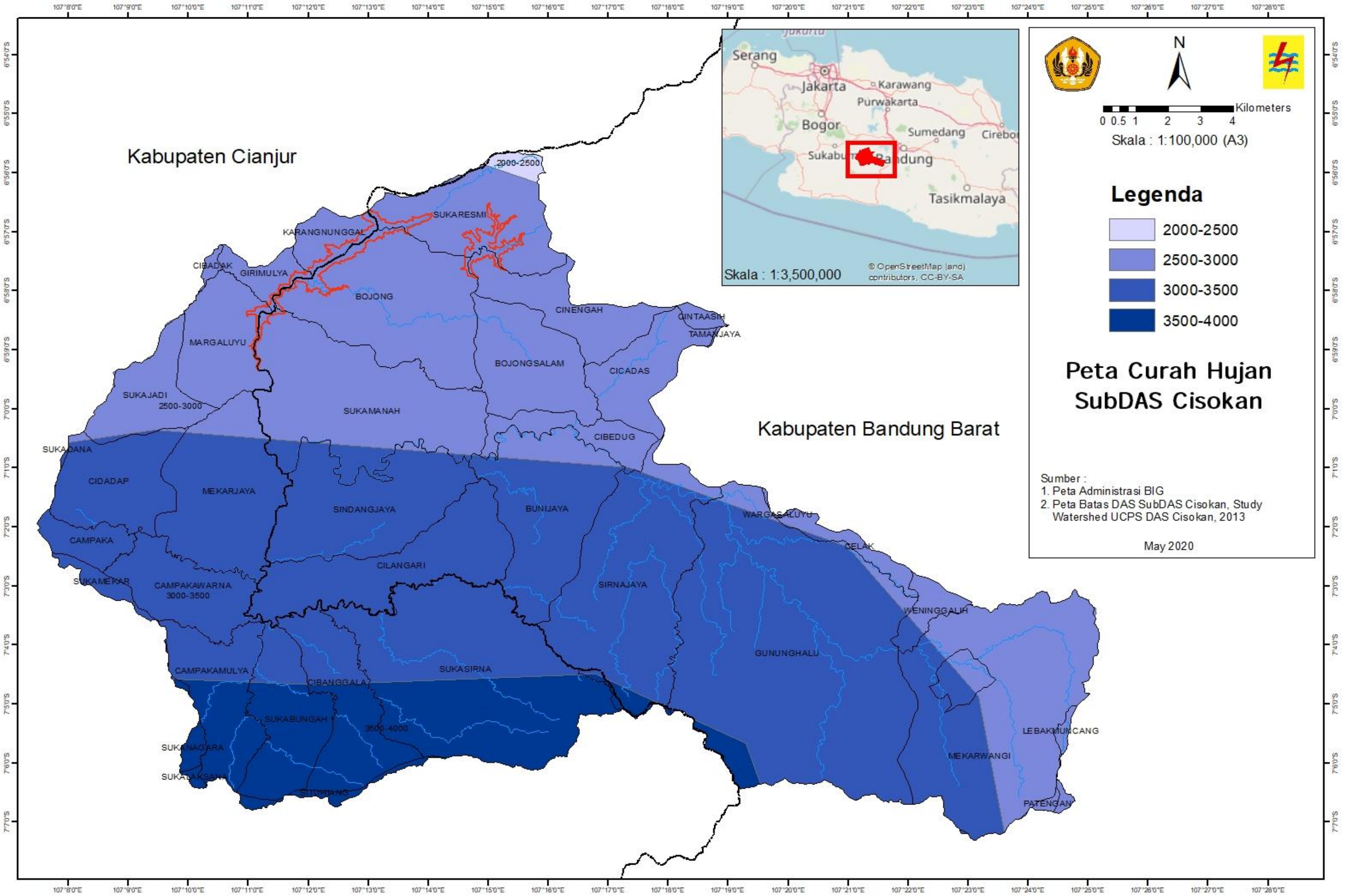
0 4 km
Scale 1:200,000 (A3)

UPPER CISOKAN PUMPED STORAGE
Figure 6
Indicative 500 kV Transmission Line Route
22nd March 2010

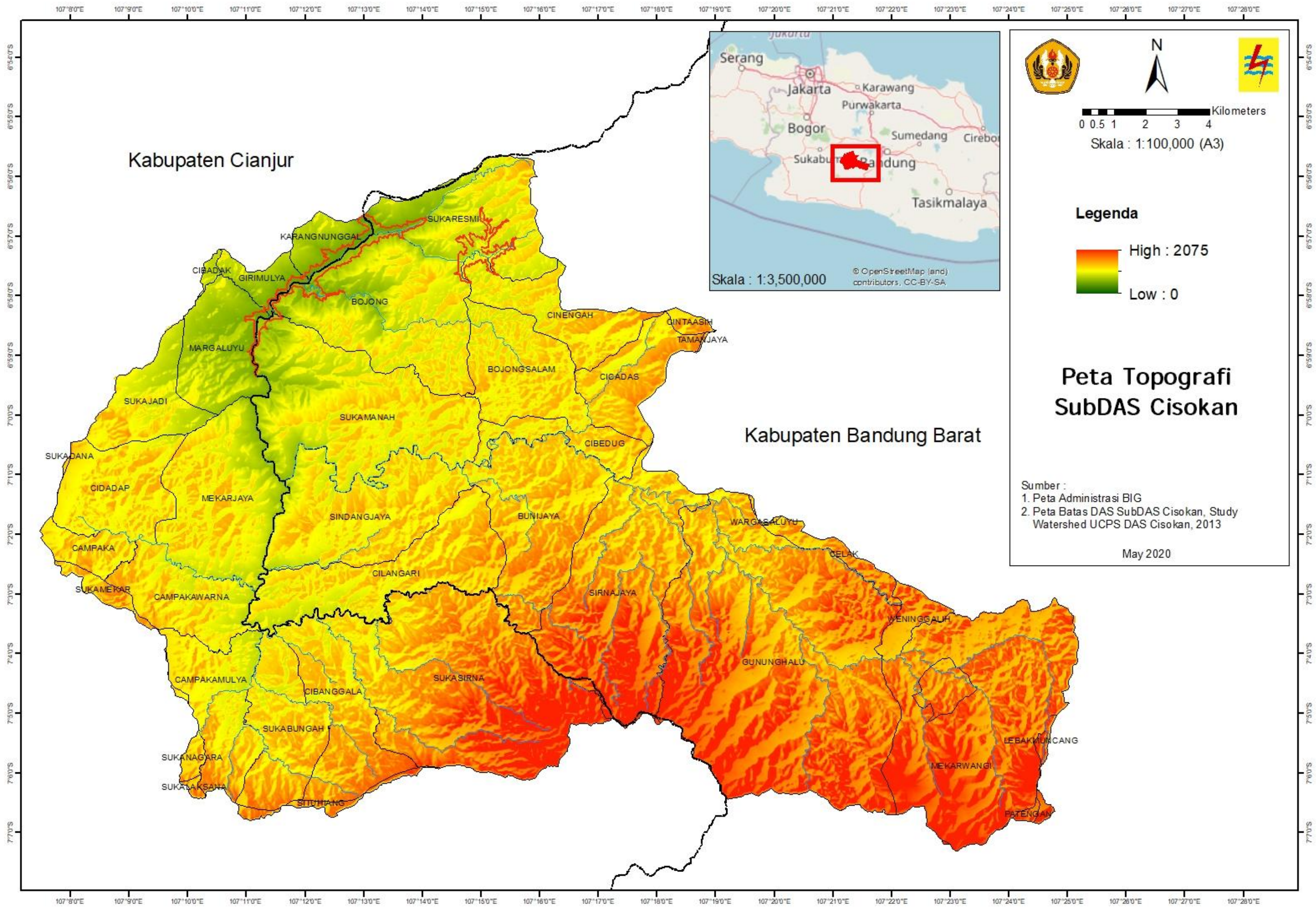
Appendix 5 Map Distribution Location of the UCPS Transmission Line Tower



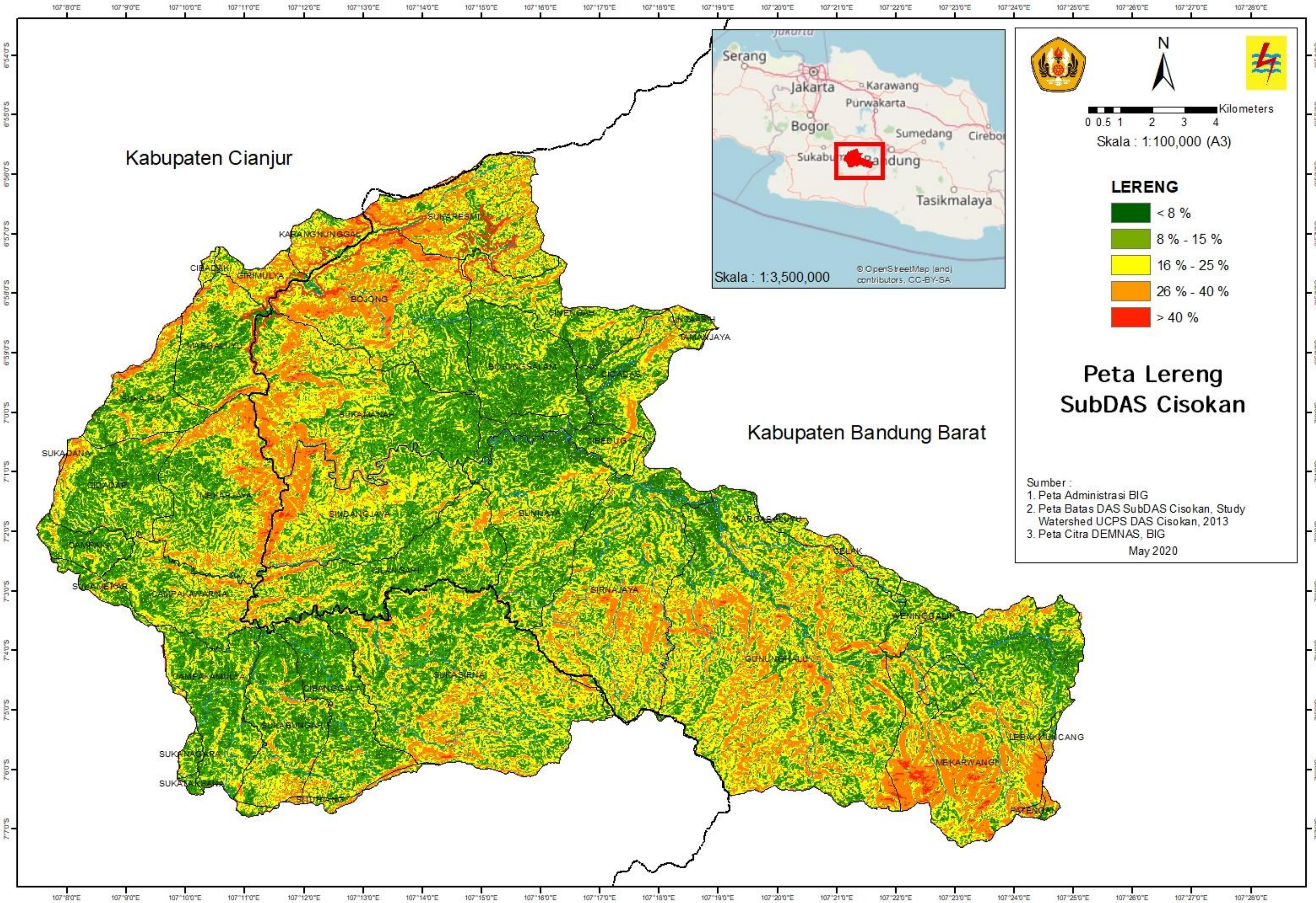
Appendix 6 Cisokan Watershed Rainfall Map



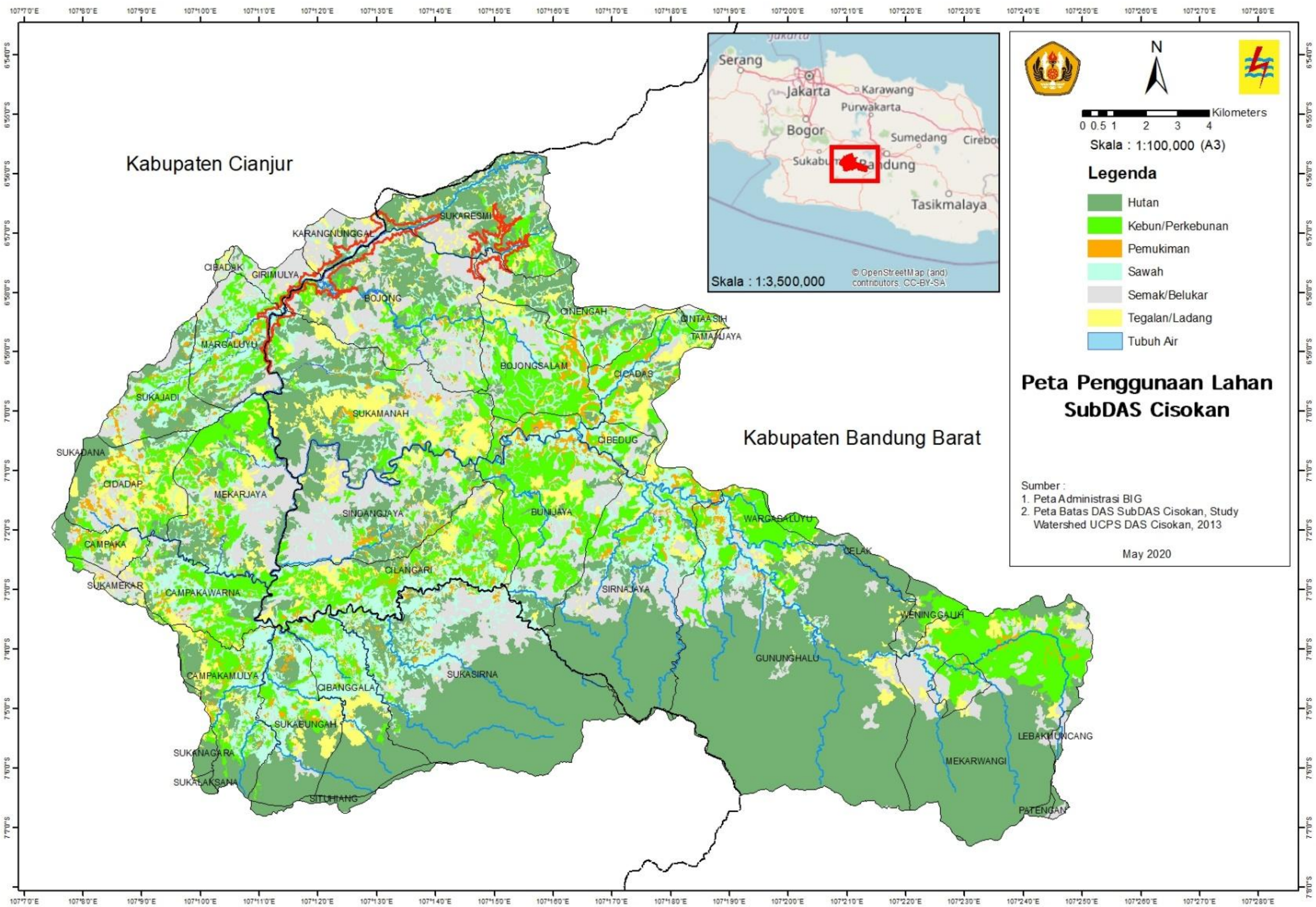
Appendix 7 Cisokan Watershed Topographic Map



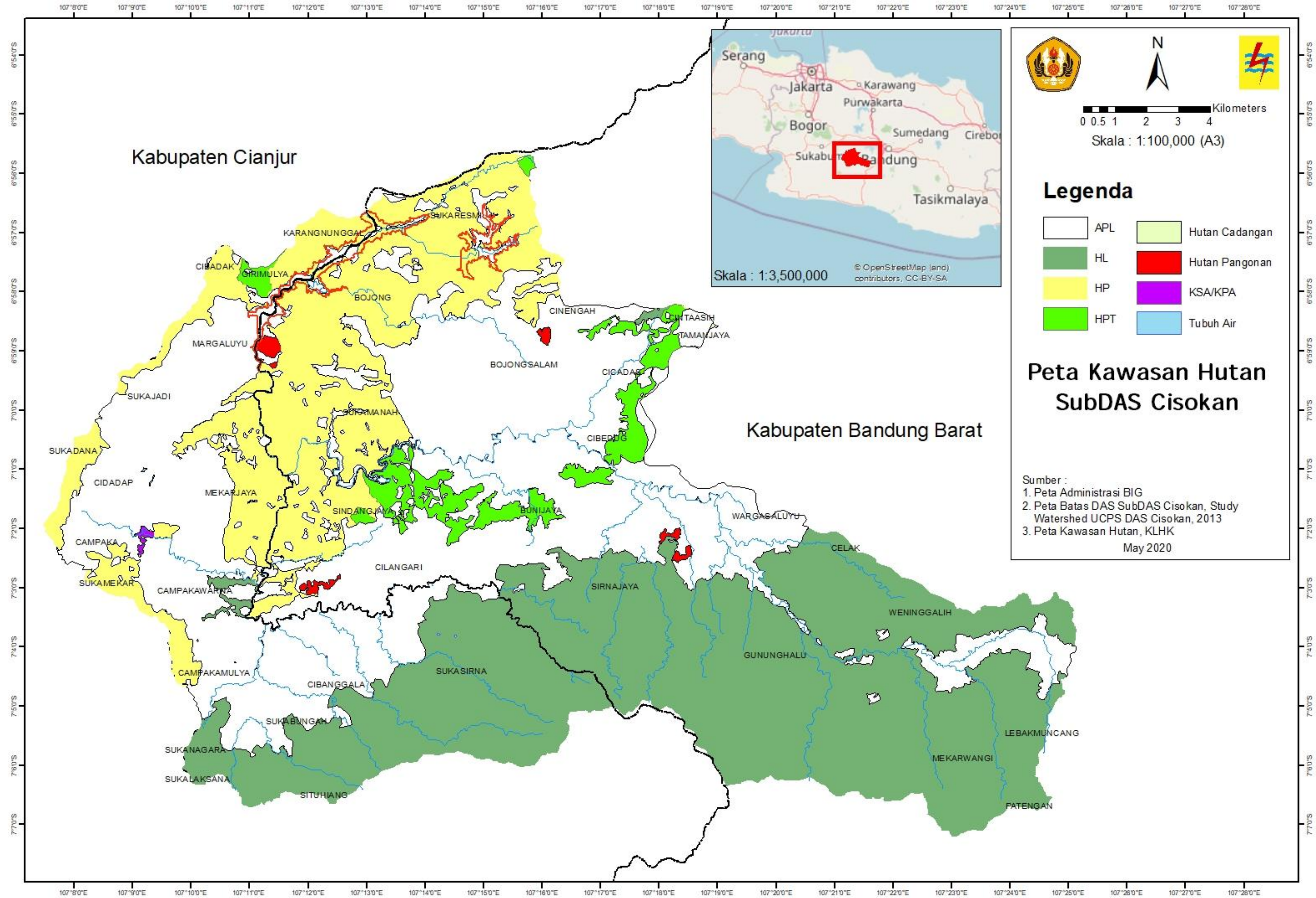
Appendix 8 Cisokan Watershed Slope Map



Appendix 9 Cisokan Watershed Land Use Map



Appendix 10 Cisokan Watershed Forest Area Map



Appendix 11 Water Quality

Table 1. Water Quality in Cilengkong River at 1998 and 2007

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
	PHYSIC										
1	Odor	~									
2	Taste										
3	Turbidity	NTU	10								
4	Temperature	C	-		25.1						
5	Air Temperature	C									
6	Color	PtCo	10								
7	Total Suspended Solids (TSS)	mg/L	40								
8	Total Dissolved Solids (TDS)	mg/L			689						
9	Electrical Conductivity	us/cm	250		1394						
	INORGANIC CHEMICAL										
1	Mercury (Hg)	mg/L			tt						
2	Phospat Dissolved	mg/L	0.01								
3	Amonia (NH3)	mg/L	0.3		<0.02						
4	Nitrogen Total	mg/L									
5	Reactive Phospor Dissolved	mg/L									

No.		Parameter	Unit	1998	2001	2007	2012		2013		2014	
				PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
6		Arsen (As)	mg/L			<0.005						
7		Barium (Ba)	mg/L									
8		Iron (Fe)	mg/L	0.95		0.02						
9		Boron (B)	mg/L									
10		Flourida (F)	mg/L	0.15		0.36						
11		Cadmium (Cd)	mg/L	-								
12		Chlorida (Cl)	mg/L			1						
13		Chlorine (Cl2)	mg/L			0.03						
14		Cobalt (Co)	mg/L									
15		Chromium Valensi 6 (Cr)	mg/L	-		0.2						
16		Mangan (Mn)	mg/L	-		<0.005						
17		Natrium (Alkali) (Na)	mg/L									
18		Nikel (Ni)	mg/L	0.12		<0.007						
19		Nitrat (NO3 - N)	mg/L	-		2.7						
20		Nitrit (NO2 + N)	mg/L	-		0.01						
21		Dissolve Oxygen (DO)	mg/L			5.43						
22		pH	mg/L	7.5		8.33						
23		Selenium (Se)	mg/L			0.01						

No.		Parameter	Unit	1998	2001	2007	2012		2013		2014	
				PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24		Seng (Zn)	mg/L	-		0.2						
25		Sianida (Cn)	mg/L	-		<0.005						
26		Sulfat (SO4)	mg/L	5.01		9.96						
27		Sulfida (H2S)	mg/L			<0.005						
28		Copper (Cu)	mg/L	-		0.06						
29		Lead (Pb)	mg/L	-		<0.01						
30		Calcium (Ca)	mg/L	28.07								
31		Magnesium (Mg)	mg/L	6.1								
32		Alkali/Acidity (HCO3)	mg/L	136.03								
33		Bicarbonat Ion (HCO3-)	mg/L	5.82								
34		Salinity	mg/L	5								
35		Ca Hardness (CaCO3)	mg/L	70								
36		Mg Hardness (CaCO3)	mg/L	25								
37		Kesadahan Total (CaCo3)	mg/L	95								
	ORGANIC CHEMICAL											
1		Fenol	mg/L	0.03								
2		Minyak dan Lemak	mg/L	-								
3		Senyawa Aktif Biru Metilen	mg/L									

No.		Parameter	Unit	1998	2001	2007	2012		2013		2014	
				PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
4		BOD	mg/L	14.2		4						
5		COD	mg/L	40		8.5						
6		KMnO4	mg/L	23.13								
7		Deterjen (MBAS)	mg/L	0.07								
8		Chloropyhll-a	mg/L									
	MICROBIOLOGY											
1		Koliform Tinja	Jml/1000 ml	460		2400						
2		Total Koliform	Jml/1000 ml	2.4x10^3		2400						

Table 2 Water Quality in Cilengkong River at 2015 – 2020

No.	**Parameter**	**Unit**	**2015**		**2016**		**2017**		**2018**		**2019**		**2020**
			Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Mar**
PHYSIC													
1	Odor	~	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste												
3	Turbidity	NTU	6.91	3.3	6.6	32.3	3.08	2.71	23.3				
4	Temperature	C	28	28.7	28.7	25.9	27.1	25.1	25.9	25.8	25.7	26.2	25.7
5	Air Temperature	C	31.4	33	33	27.9	29.4	29.8					
6	Color	PtCo	5	5	5	10	10	5	25				
7	Total Suspended Solids (TSS)	mg/L			21	20.6	19	21		24	210	38	
8	Total Dissolved Solids (TDS)	mg/L	70	70	100	165	130	95	58	132	104	176	68
9	Electrical Conductivity	us/cm	144.9	148.2	150	73.7	264.81	186.98	139.97				130
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L	<0.001	<0.0013	<0.0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L								0.0233	0.0645	<0.0171	
3	Amonia (NH_3)	mg/L	0.11	0.017	0.0198	0.0015	<0.0038	< 0,0018	< 0,0018				
4	Nitrogen Total	mg/L			5	4	3	2.6					
5	Reactive Phospor Dissolved	mg/L			<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0.005	<0.058	<0.05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L											
8	Iron (Fe)	mg/L	<0.046	<0.015	<0.0153	0.0992	<0.168	< 0,1680	< 0,1680				
9	Boron (B)	mg/L								0.01616	0.14603	0.01741	
10	Flourida (F)	mg/L	<0.02	0.27	0.2829	0.1008	0.8487	1.048	<0.1553				
11	Cadmium (Cd)	mg/L								0.05666	0.02147	<0.00928	
12	Chlorida (Cl)	mg/L	22.8		12.76	121.41	68.97	12.85	4.89				
13	Chlorine (Cl2)	mg/L	0.09	0.06	0.09	0.08	0.03	0.05	0.09				
14	Cobalt (Co)	mg/L								0.01485	0.00891	<0.0033	
15	Chromium Valensi 6 (Cr)	mg/L	<0.02	<0.015	<0.0154	<0.0154	0.0083	<0.0083	<0.0083	0.0041	<0.0032	0.0079	
16	Mangan (Mn)	mg/L	0.03	0.02	0.0212	0.0152	0.0842	0.0213	0.00861				
17	Natrium (Alkali) (Na)	mg/L											
18	Nikel (Ni)	mg/L											
19	Nitrat (NO3 - N)	mg/L	1.03	2.99	5.1161	0.7636	1.3296	0.9134	0.3577	0.4524	8.5045	0.6089	
20	Nitrit (NO2 + N)	mg/L	0.018	0.29	0.2944	0.0029	0.0157	<0.0115	0.0131				
21	Dissolve Oxygen (DO)	mg/L	3.8	1.3	1.25	3.6	3.1	5.48	3.97	4.29	4.67	3.61	24
22	pH	mg/L	7.2	8.09	7.562	7.89	7.15	<0.0013	7.29	7.611	7.621	7.49	8.4
23	Selenium (Se)	mg/L	<0.01	<0.018	<0.01797	<0.01797	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	0.24	0.05	0.0511	<0.01852	0.02	<0.01894	0.03444	<0.01894	<0.01894	<0.01894	
25	Sianida (Cn)	mg/L	0.007	<0.024	<0.024	<0.024	0.005	<0.005	<0.005				

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
26	Sulfat (SO4)	mg/L											
27	Sulfida (H2S)	mg/L	0.6001	0.009	0.014	0.0209	<0.0013	0.0565	0.0032^				
28	Copper (Cu)	mg/L	<0.02	<0.029	<0.0295	<0.00527	<0.0092	<0.00819	<0.00819	<0.00819	0.01029	<0.00819	
29	Lead (Pb)	mg/L	<0.003	<0.03	<0.0307	0.03428	0.0538	0.286	<0.01309	0.04918	<0.01039	<0.01039	
30	Calcium (Ca)	mg/L											
31	Magnesium (Mg)	mg/L											
32	Alkali/Acidity (HCO3)	mg/L											
33	Bicarbonat Ion (HCO3-)	mg/L											
34	Salinity	mg/L											
35	Ca Hardness (CaCO3)	mg/L											
36	Mg Hardness (CaCO3)	mg/L											
37	Kesadahan Total (CaCo3)	mg/L	96.6	39.6	60.89	128	121.58	131.84	105.04				
ORGANIC CHEMICAL													
1	Fenol	mg/L											
2	Minyak dan Lemak	mg/L	2	<2.21	<2.21	<2.21	<0.94	<0.94	<0.94				
3	Senyawa Aktif Biru Metilen	mg/L											
4	BOD	mg/L	2.5	42.6	50.1	1.33	11.04	9.57	6.35^	11	19.64	7.33	10.5
5	COD	mg/L	7.77	87.91	90.3112	1.9319	16.9855	23.9922	19.8998^	33.0311	59.693	25.6396	

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Mar**
6	KMnO4	mg/L											
7	Deterjen (MBAS)	mg/L	0.21	0.36	0.3582	0.1202	0.0558	0.1648	<0.0135				
8	Chloropyhll-a	mg/L											
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml	9.3 x 10^3	9	11	240	23	240	46	240	140	110	
2	Total Koliform	Jml/1000 ml	2.4 x 10^4	210	210	460	94	920	170	350	210	220	

Table 3 Water Quality in Cijambu River at 2007 and 2012-2014

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
PHYSIC											
1	Odor	~							**Odorless**		
2	Taste								**Tasteless**		
3	Turbidity	NTU							9.6		
4	Temperature	C			25.1				29.2 - 29.9	26.1	26
5	Air Temperature	C									
6	Color	PtCo							17.5 koloid		
7	Total Suspended Solids (TSS)	mg/L								40	16.5
8	Total Dissolved Solids (TDS)	mg/L			933		284	196	190	326	290
9	Electrical Conductivity	us/cm			1866		296	275	192		
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L			tt		<0.0005	<0.0005	<0,09	<0.0005	<0.0005
2	Phospat Dissolved	mg/L								0.04	0,03
3	Amonia (NH3)	mg/L			0.59		0.03	0.005	0.026		
4	Nitrogen Total	mg/L									
5	Reactive Phospor Dissolved	mg/L									

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
6	Arsen (As)	mg/L			<0.005		<0.005	<0.005	0.0002	<0.001	<0.001
7	Barium (Ba)	mg/L					<0.1	<0.004			
8	Iron (Fe)	mg/L			0.03		<0.06	0.01	1.12	0.1	0.07
9	Boron (B)	mg/L					<0.01	<0.01			
10	Flourida (F)	mg/L			0.17		0.13	0.13	0.39	0.2	0.041
11	Cadmium (Cd)	mg/L					<0.005	<0.005		<0.001	<0.001
12	Chlorida (Cl)	mg/L			3		<0.144	0.26	4.97	6.7	8.171
13	Chlorine (Cl2)	mg/L			0.02		ttd	0.07	<0.01	0	0
14	Cobalt (Co)	mg/L					<0.02	<0.004			
15	Chromium Valensi 6 (Cr)	mg/L			<0.02		<0,01	<0,01			
16	Mangan (Mn)	mg/L			<0.005		<0.02	0.07	<0.006	<0.01	<0.02
17	Natrium (Alkali) (Na)	mg/L					11.9	9.33	7.24		
18	Nikel (Ni)	mg/L			<0.007		<0.02	<0.004			
19	Nitrat (NO3 - N)	mg/L			3.1		0.32	0.26	0.25	0.9	1.287
20	Nitrit (NO2 + N)	mg/L			0.01		0.03	0.02	0.006	0.01	0.001
21	Dissolve Oxygen (DO)	mg/L			3.11		6.3	6.67	5.3	5.2	4.29
22	pH	mg/L			8.33		8.26	8.29	7.86	7.51	8.04
23	Selenium (Se)	mg/L			0.11		<0.002	<0.002	<0.001	0.001	0.002

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24	Seng (Zn)	mg/L			0.29		<0.01	0.02	<0.001	<0.008	<0.008
25	Sianida (Cn)	mg/L			<0.005		<0.005	<0.005	<0.005	<0.05	<0.02
26	Sulfat (SO4)	mg/L			9.52		26.81	43.82		8.7	19.477
27	Sulfida (H2S)	mg/L			0.005		ttd	0.02	<0,01		
28	Copper (Cu)	mg/L			0.03		<0.02	<0.009	<0,001	<0.01	<0.01
29	Lead (Pb)	mg/L			<0.01		<0.01	<0.009	<0,01	<0.003	<0.003
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCo3)	mg/L							149		
ORGANIC CHEMICAL											
1	Fenol	mg/L					<0.001	<0.001		0.5	<0.0003
2	Minyak dan Lemak	mg/L					<0.02	<0.02	1.67	<5	<5
3	Senyawa Aktif Biru Metilen	mg/L					0.03	ttd			

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
4	BOD	mg/L			100		38.2	4	3.22	3.7	6.51
5	COD	mg/L			126.99		67	18	9.71	16	16
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L							0.37	<0.036	<0.036
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml			9		460	930		4.5,10	4.5,10
2	Total Koliform	Jml/1000 ml			9		1100	1500		7.8,10	4.5,10

Table 4 Water Quality in Cijambu River at 2007 and 2015-2020

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
PHYSIC													
1	Odor	~	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste												
3	Turbidity	NTU	15.3	4.24	6.88	74.2	187	3.06	10.5				
4	Temperature	C	28	27.3	27.3	24.5	23.5	27.3	26	25.6	25.8	26.3	25
5	Air Temperature	C	31.5	32.8	32.8	27	25.8	30.9					
6	Color	PtCo	10	5	5	60	15	15	10				
7	Total Suspended Solids (TSS)	mg/L			31	29.8	50	28		12	30	46	
8	Total Dissolved Solids (TDS)	mg/L	180	100	110	105	95	160	78	200	112	180	112
9	Electrical Conductivity	us/cm	376	221.5	400	122.8	188.52	325.01	189.94				185
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L	<0.001	<0.013	<0.0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L								<0.01271	<0.0171	<0.0171	
3	Amonia (NH3)	mg/L	0.12	0.018	0.0193	<0.0005	<0.0038	< 0,0018	< 0,0018				
4	Nitrogen Total	mg/L			5	4	5	1.9					
5	Reactive Phospor Dissolved	mg/L			<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0.005	<0.058	<0.05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L											
8	Iron (Fe)	mg/L	<0.046	<0.015	<0.0153	0.0929	0.8326	< 0,1680	< 0,1680				
9	Boron (B)	mg/L								0.0141	0.14803	<0.00726	
10	Flourida (F)	mg/L	<0.02	0.08	0.0834	0.1722	0.6947	1.0344	<0.1553				
11	Cadmium (Cd)	mg/L								0.02973	0.02131	<0.00928	
12	Chlorida (Cl)	mg/L	23.52		18.22	149.8	75.8	21.08	7.34				
13	Chlorine (Cl2)	mg/L	0.51	0.09	0.19	0.03	0.02	0.04	0.05				
14	Cobalt (Co)	mg/L								0.02417	0.00826	<0.0033	
15	Chromium Valensi 6 (Cr)	mg/L	<0.02	<0.015	<0.0154	<0.0154	<0.0083	0.0177	<0.0083	0.0046	<0.0032	0.0084	
16	Mangan (Mn)	mg/L	0.02	0.026	0.0259	0.035	0.0448	0.0218	0.01725				
17	Natrium (Alkali) (Na)	mg/L											
18	Nikel (Ni)	mg/L											
19	Nitrat (NO3 - N)	mg/L	1.8	3.15	4.6603	6.5982	4.1629	1.5667	0.8756	0.3515	1.6156	0.8524	
20	Nitrit (NO2 + N)	mg/L	0.016	0.13	0.2214	0.305	0.0379	0.035	0.3152				
21	Dissolve Oxygen (DO)	mg/L	3.5	0.95	0.65	2.9	6.7	4.19	3.98	4.22	4.48	3.56	18.4
22	pH	mg/L	7.32	8.04	7.592	7.21	8.41	8.639	7.31	7.421	7.648	7.61	8.3
23	Selenium (Se)	mg/L	<0.01	<0.018	<0.01797	<0.01797	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	<0.008	0.056	0.0566	<0.01852	0.0182	<0.01894	0.10445	<0.01894	<0.01894	0.01894	
25	Sianida (Cn)	mg/L	<0.001	0.026	0.0269	<0.024	0.005	<0.005	<0.005				

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
26	Sulfat (SO4)	mg/L											
27	Sulfida (H2S)	mg/L	0.457	0.015	0.0159	0.0259	0.0156	0.0076	<0.0013				
28	Copper (Cu)	mg/L	<0.02	<0.029	<0.0295	<0.00527	<0.0092	0.01442	<0.00819	0.00916	<0.00819	<0.00819	
29	Lead (Pb)	mg/L	<0.003	<0.03	<0.0307	<0.02495	0.0538	0.455	<0.01039	0.06721	<0.01039	<0.01039	
30	Calcium (Ca)	mg/L											
31	Magnesium (Mg)	mg/L											
32	Alkali/Acidity (HCO3)	mg/L											
33	Bicarbonat Ion (HCO3-)	mg/L											
34	Salinity	mg/L											
35	Ca Hardness (CaCO3)	mg/L											
36	Mg Hardness (CaCO3)	mg/L											
37	Kesadahan Total (CaCo3)	mg/L	195.3	178.2	210	104	110.16	168.92	121.2				
ORGANIC CHEMICAL													
1	Fenol	mg/L											
2	Minyak dan Lemak	mg/L	2	<2.21	<2.21	<2.21	2	<0.94	<0.94				
3	Senyawa Aktif Biru Metilen	mg/L											
4	BOD	mg/L	2.8	48.6	50.63	0.91	9.39	7.88	6.46	2.55	15.28	11.48	4.7
5	COD	mg/L	8.11	85.98	90.9811	1.2912	15.1475	24.3237	19.8998	7.6931	40.2034	39.5694	

No.	Parameter	Unit	2015		2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
6	KMnO4	mg/L											
7	Deterjen (MBAS)	mg/L	<0.01	0.07	0.0739	0.1983	0.0631	0.2379	<0.0135				
8	Chloropyll-a	mg/L											
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml	600	15	21	460	240	79	79	33	140	240	
2	Total Koliform	Jml/1000 ml	2.7 x 10^3	120	460	1100	920	140	170	63	280	350	

Table 5 Water Quality in Upper Cisokan River at 2001, 2007, 2012 - 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
PHYSIC													
1	Odor	~							**Odorless**			**Odorless**	**Odorless**
2	Taste								**Tasteless**				
3	Turbidity	NTU		-					16.1			18	7.68
4	Temperature	C		25	25.2				27.0 - 27.4	26.1	26	28	27.3
5	Air Temperature	C										31.4	33.4
6	Color	PtCo		18					25 koloid			10	5
7	Total Suspended Solids (TSS)	mg/L		216.72						37	37.5		
8	Total Dissolved Solids (TDS)	mg/L		131	197.1		176	140	120	214	306	110	50
9	Electrical Conductivity	us/cm		120	410		165	136	168.3			226	115.1
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L		20.17	0.002		<0.0005	<0.0005	<0.09	0.0072	0.007	<0.001	<0.013
2	Phospat Dissolved	mg/L		0.058						0.004	<0,03		
3	Amonia (NH3)	mg/L		0.052	0.03		0.08	0.006	<0.005	2.2	2.61	0.095	0.013
4	Nitrogen Total	mg/L											
5	Reactive Phospor Dissolved	mg/L											

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
6	Arsen (As)	mg/L		ud	<0.005		<0.005	<0.005	0.0001	<0.001	0.007	<0.005	<0.058
7	Barium (Ba)	mg/L		ud			<0.1	<0.004					
8	Iron (Fe)	mg/L		1.38	0.29		0.46	0.03	1.68	0.6	0.1	<0.046	<0.015
9	Boron (B)	mg/L		0.012			<0.01	<0.01					
10	Flourida (F)	mg/L		ud	0.24		0.13	<0.03	0.18	0.2	0.135	<0.02	0.34
11	Cadmium (Cd)	mg/L		ud			<0.005	<0.002		<0.001	<0.001		
12	Chlorida (Cl)	mg/L		4.57	2		<1.44	<1.44	4.47	2.9	22.109	16.15	
13	Chlorine (Cl2)	mg/L			0.04		ttd	0.07	<0.1	0	0	0.32	0.08
14	Cobalt (Co)	mg/L		ud			<0.02	<0.004					
15	Chromium Valensi 6 (Cr)	mg/L		ud	0.06		<0,01	<0,01	<0.001	<0.001	<0.004	<0.02	<0.015
16	Mangan (Mn)	mg/L		0.165	<0.005		<0.02	<0.003	<0.006	<0.01	<0.02	0.02	0.026
17	Natrium (Alkali) (Na)	mg/L		7.48			7.61	7.43	6.67				
18	Nikel (Ni)	mg/L		ud	<0.007		<0.02	<0.004					
19	Nitrat (NO3 - N)	mg/L		0.255	0.9		0.24	0.53	0.25	0.9	1.039	2.52	2.85
20	Nitrit (NO2 + N)	mg/L		0.002	0.02		<0.01	0.01	<0.004	0.01	0.001	0.039	0.17
21	Dissolve Oxygen (DO)	mg/L		7.41	3.62		6.38	6.91	5.5	4.9	4.79	3.6	1.5
22	pH	mg/L		7.27	8.07		8.31	8.12	7.2	7.6	7.76	7.33	8.14
23	Selenium (Se)	mg/L		ud	0.01		<0.002	<0.002	<0.001	0.001	0.001	<0.01	<0.018

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24	Seng (Zn)	mg/L		0.064	0.27		<0.01	<0.009	<0.001	<0.008	<0.008	<0.008	0.056
25	Sianida (Cn)	mg/L		0.0018	<0.005		<0.005	<0.005	<0.005	0.05	<0.02	<0.01	0.025
26	Sulfat (SO4)	mg/L		7.05	16.32		16.94	12.52		8.7	14.638		
27	Sulfida (H2S)	mg/L		ud	tt		ttd	0.01	<0.01	<0.02		<0.005	0.006
28	Copper (Cu)	mg/L		ud	0.02		<0.02	<0.009	<0.001	<0.01	<0.01	<0.02	<0.029
29	Lead (Pb)	mg/L		ud	<0.01		<0.01	<0.004	<0.01	<0.003	<0.003	<0.003	<0.03
30	Calcium (Ca)	mg/L											
31	Magnesium (Mg)	mg/L											
32	Alkali/Acidity (HCO3)	mg/L											
33	Bicarbonat Ion (HCO3-)	mg/L		3.21									
34	Salinity	mg/L		0									
35	Ca Hardness (CaCO3)	mg/L											
36	Mg Hardness (CaCO3)	mg/L											
37	Kesadahan Total (CaCo3)	mg/L							76			105	324.72
ORGANIC CHEMICAL													
1	Fenol	mg/L		ud			<0.001	<0.001		0.3	<0.0003		
2	Minyak dan Lemak	mg/L		ud			<0.02	<0.2	0.67	<5	<5	1	<2.21
3	Senyawa Aktif Biru Metilen	mg/L					ttd	0.09					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
4	BOD	mg/L		3	5		<2	6	1.8	3.7	6.81	2.8	38.6
5	COD	mg/L		8.67	6.44		<6	23	9.71	16	32	7.64	80.68
6	KMnO4	mg/L											
7	Deterjen (MBAS)	mg/L		ud					0.37	<0.036	<0.036	0.04	0.16
8	Chloropyll-a	mg/L		0.021									
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml			210		23	930		33.1	<1.8,10	1.5 x 10^3	14
2	Total Koliform	Jml/1000 ml			210		43	1500		23.1	<1.8,10	4.3 x 10^3	120

Table 6 Water Quality in Upper Cisokan River at 2016 - 2020

No.	**Parameter**	**Unit**	**2016**		**2017**		**2018**		**2019**		**2020**
			Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Mar**
PHYSIC											
1	Odor	~	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste										
3	Turbidity	NTU	8.23	39.9	245	233	20.1				
4	Temperature	C	27.3	26.6	27.6	25.3	26	25.9	25.8	25.8	28
5	Air Temperature	C	33.4	28.1	30.6	30.6					
6	Color	PtCo	5	25	25	25	10				
7	Total Suspended Solids (TSS)	mg/L	34.7	30.5	34.5	52		1038	26	28	
8	Total Dissolved Solids (TDS)	mg/L	90	65	65	90	43	264	102	88	43
9	Electrical Conductivity	us/cm	120.1	62.9	126.95	179.15	103.47				126
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L	<0.0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L						<0.0171	<0.0171	0.071	
3	Amonia (NH3)	mg/L	0.0166	<0.0005	<0.0038	0,0627	0.0059				
4	Nitrogen Total	mg/L	5	4	4	3.4					
5	Reactive Phospor Dissolved	mg/L	<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0.05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L									
8	Iron (Fe)	mg/L	<0.0153	0.257	0.6905	< 0,1680	< 0,1680				
9	Boron (B)	mg/L						0.05788	0.12425	0.21855	
10	Flourida (F)	mg/L	0.3401	0.1788	0.4905	1.0753	<0.1553				
11	Cadmium (Cd)	mg/L						0.05475	0.01511	<0.00928	
12	Chlorida (Cl)	mg/L	9.4	123.8	66.36	16.45	4.89				
13	Chlorine (Cl2)	mg/L	0.09	0.05	0.03	0.05	0.04				
14	Cobalt (Co)	mg/L						0.0256	0.00689	<0.00330	
15	Chromium Valensi 6 (Cr)	mg/L	<0.0154	<0.0154	<0.0096	0.0083	<0.0083	<0.0032	<0.0032	0.0085	
16	Mangan (Mn)	mg/L	0.0262	0.0163	0.0958	0.141	0.03848				
17	Natrium (Alkali) (Na)	mg/L									
18	Nikel (Ni)	mg/L									
19	Nitrat (NO3 - N)	mg/L	5.1168	2.7818	5.8728	6.132	0.5369	1.012	1.0407	1.3452	
20	Nitrit (NO2 + N)	mg/L	0.1928	0.0054	0.047	0.0446	<0.0115				
21	Dissolve Oxygen (DO)	mg/L	1.5	4.7	3.5	6.75	4.52	4.46	4.95	3.22	16.6
22	pH	mg/L	7.681	7.49	7.29	8.682	7.41	7.611	7.461	7.53	8.3
23	Selenium (Se)	mg/L	<0.01797	<0.01797	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	0.0599	<0.01852	0.0153	<0.01894	0.05738	<0.01894	<0.01894	<0.01894	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
25	Sianida (Cn)	mg/L	<0.024	<0.024	0.005	<0.005	<0.005				
26	Sulfat (SO4)	mg/L									
27	Sulfida (H2S)	mg/L	0.0062	0.0199	0.0256	0.0684	<0.0067^				
28	Copper (Cu)	mg/L	<0.0295	<0.00527	<0.0092	<0.00819	<0.00819	0.0109	<0.00819	<0.00819	
29	Lead (Pb)	mg/L	<0.0307	<0.02495	0.0538	0.0294	<0.01039	0.00692	<0.01039	<0.01039	
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCo3)	mg/L	350.72	120	<0.0538	109.18	141.4				
ORGANIC CHEMICAL											
1	Fenol	mg/L									
2	Minyak dan Lemak	mg/L	<2.21	<2.21	4	<0.94	<0.94				
3	Senyawa Aktif Biru Metilen	mg/L									
4	BOD	mg/L	40.2	3.55	10.49	17.6	3.2	55.4	27.87	3.88	2.7

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	COD	mg/L	83.1149	5.307	16.9242	50.2975	10.3324^	148.1406	74.5209	12.1276	
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L	0.1558	0.158	0.2597	0.1845	<0.0135				
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml	21	240	540	350	33	350	240	170	
2	Total Koliform	Jml/1000 ml	120	460	1600	1600	94	920	540	210	

Table 7 Water Quality in Lower Cisokan River at 2001, 2007, 2012 – 2015

No.	**Parameter**	**Unit**	**1998**	**2001**	**2007**	**2012**		**2013**		**2014**		**2015**	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
PHYSIC													
1	Odor	~							**Odorless**			**Odorless**	**Odorless**
2	Taste								**Tasteless**				
3	Turbidity	NTU							31.7			15.3	4.78
4	Temperature	C		26	25.9				27.2 - 27.7	27.2	26.3	28	27.6
5	Air Temperature	C										31.4	33.4
6	Color	PtCo		18					20 koloid			15	5
7	Total Suspended Solids (TSS)	mg/L		210.44						-	21		
8	Total Dissolved Solids (TDS)	mg/L		140	248		340	796	149	432	204	80	50
9	Electrical Conductivity	us/cm		139	521		169	136	167.4			172	115.7
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L		16.4	0.002		<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.013
2	Phospat Dissolved	mg/L		0.022						0.03	<0,03		
3	Amonia (NH_3)	mg/L		0.054	0.12		0.008	0.02	0.059			0.21	0.166
4	Nitrogen Total	mg/L											
5	Reactive Phospor Dissolved	mg/L											

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
6	Arsen (As)	mg/L		ud	<0.005		<0.005	<0.005	0.0001	<0.001	0.001	<0.005	<0.058
7	Barium (Ba)	mg/L		ud			<0.01	<0.004					
8	Iron (Fe)	mg/L		0.8	0.37		0.19	0.03	1.09	0.7	0.16	0.071	<0.015
9	Boron (B)	mg/L		0.016			<0.01	<0.01					
10	Flourida (F)	mg/L		ud	0.24		0.13	<0.03	<0.02	0.3	0.28	<0.02	0.17
11	Cadmium (Cd)	mg/L		ud			<0.005	<0.002		<0.001	<0.001		
12	Chlorida (Cl)	mg/L		3.81	2		<1.44	<1.44	4.97	3.4	21.147	16.15	16.14
13	Chlorine (Cl2)	mg/L			0.002		ttd	0.07	<0.1	0	0	0.32	0.09
14	Cobalt (Co)	mg/L		ud			<0.02	<0.004					
15	Chromium Valensi 6 (Cr)	mg/L		ud	0.01		<0,01	<0,01	<0.001	<0.004	<0.004	<0.02	<0.015
16	Mangan (Mn)	mg/L		0.132	<0.005		<0.02	0.04	<0.006	0.01	<0,02	0.03	0.026
17	Natrium (Alkali) (Na)	mg/L		8.56			7.6	7.3	6.8				
18	Nikel (Ni)	mg/L		0.007	<0.007		<0.02	<0.004					
19	Nitrat (NO3 - N)	mg/L		0.24	2.2		0.35	0.3	0.353	0.8	1.256	1.4	2.74
20	Nitrit (NO2 + N)	mg/L		0.003	0.02		<0.01	0.01	<0.004	0.003	0.003	0.048	0.155
21	Dissolve Oxygen (DO)	mg/L		5.32	4.52		6.62	6.48	6	4.4	4.19	3.1	1.5
22	pH	mg/L		7.25	8.23		7.38	8.16	7.53	7.23	7.65	7.58	8
23	Selenium (Se)	mg/L		ud	0.01		<0.002	<0.002	<0.001	0.004	0.001	<0.01	<0.018

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24	Seng (Zn)	mg/L		0.039	0.16		<0.01	<0.009	<0.001	<0.008	<0.008	<0.008	0.053
25	Sianida (Cn)	mg/L		0.0018	<0.005		<0.005	<0.005	<0.005	<0.05	<0.02	<0.01	<0.024
26	Sulfat (SO4)	mg/L		6.62	15.83		14.37	16.29		10.5	0.012		
27	Sulfida (H2S)	mg/L		ud	0.005		ttd	0.02	<0.01			<0.005	0.005
28	Copper (Cu)	mg/L		ud	0.06		<0.02	<0.009	<0.001	<0.01	<0.01	<0.02	0.036
29	Lead (Pb)	mg/L		ud	<0.01		<0.01	<0.004	<0.01	<0.003	<0.003	<0.003	<0.03
30	Calcium (Ca)	mg/L											
31	Magnesium (Mg)	mg/L											
32	Alkali/Acidity (HCO3)	mg/L											
33	Bicarbonat Ion (HCO3-)	mg/L		3.06									
34	Salinity	mg/L		0									
35	Ca Hardness (CaCO3)	mg/L											
36	Mg Hardness (CaCO3)	mg/L											
37	Kesadahan Total (CaCo3)	mg/L							100			0.087	285.12
ORGANIC CHEMICAL													
1	Fenol	mg/L		ud			<0.001	<0.001		0.3	0.01		
2	Minyak dan Lemak	mg/L		ud			<0.02	<0.02	1.2	<5	<5	1	<2.21
3	Senyawa Aktif Biru Metilen	mg/L					ttd	ttd					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
4	BOD	mg/L		3.15	5		<2	5	2.46	5.5	6.51	0.071	36.5
5	COD	mg/L		10.19	6		<6	22	9.71	16	32	27.13	84.83
6	KMnO4	mg/L											
7	Deterjen (MBAS)	mg/L		ud					0.44	<0.036	<0.036	0.296	0.2
8	Chloropyll-a	mg/L		0.018									
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml			28		23	2300	≥ 2400	7.8,10	23,10	4.3 x 10^3	15
2	Total Koliform	Jml/1000 ml			28		39	4300	≥ 2400	13,10	33,10	1.5 x 10^4	240

Table 8 Water Quality in Lower Cisokan River at 2016 – 2020

No.	**Parameter**	**Unit**	**2016**		**2017**		**2018**		**2019**		**2020**
			Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Mar**
PHYSIC											
1	Odor	**~**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste										
3	Turbidity	NTU	5.66	61.1	224	258	9.36				
4	Temperature	C	27.6	26.8	27.9	25.2	26.1	25.9	25.9	26.8	28.3
5	Air Temperature	C	33.4	28.1	30.6	31					
6	Color	PtCo	5	40	21	35	5				
7	Total Suspended Solids (TSS)	mg/L	40.6	35.9	36	59		270	13	46	
8	Total Dissolved Solids (TDS)	mg/L	60	70	65	85	64	846	160	648	48
9	Electrical Conductivity	us/cm	115.9	69	130.36	169	155.4				95
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L	<0.0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L						<0.0171	<0.0171	0.1269	
3	Amonia (NH3)	mg/L	0.1699	0.0007	<0.0038	0,0063	<0.0018				
4	Nitrogen Total	mg/L	4	4	4	2.4					
5	Reactive Phospor Dissolved	mg/L	<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0.05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L									
8	Iron (Fe)	mg/L	<0.0153	0.147	0.7687	< 0,1680	< 0,1680				
9	Boron (B)	mg/L						0.03214	0.18822	0.32251	
10	Flourida (F)	mg/L	0.2292	0.0932	0.7575	0.4747	<0.1553				
11	Cadmium (Cd)	mg/L						0.03531	0.03238	<0.00928	
12	Chlorida (Cl)	mg/L	18.34	121.02	61.76	13.36	5.87				
13	Chlorine (Cl2)	mg/L	0.12	0.05	0.02	0.08	0.09				
14	Cobalt (Co)	mg/L						0.01886	0.01349	<0.00330	
15	Chromium Valensi 6 (Cr)	mg/L	<0.0154	<0.0154	0.01	<0.0083	<0.0083	<0.0032	<0.0032	0.0449	
16	Mangan (Mn)	mg/L	0.0259	0.0213	0.0465	0.0134	0.0119				
17	Natrium (Alkali) (Na)	mg/L									
18	Nikel (Ni)	mg/L									
19	Nitrat (NO3 - N)	mg/L	3.2359	3.1884	5.6673	3.7882	0.2449	0.6584	0.9813	1.16124	
20	Nitrit (NO2 + N)	mg/L	0.1669	0.076	0.00367	0.048	<0.0115				
21	Dissolve Oxygen (DO)	mg/L	1.5	4.6	3.2	6.83	4.67	4.49	4.95	3.36	15.5
22	pH	mg/L	7.882	7.61	7.35	8.591	7.56	7.625	7.562	7.84	8.4
23	Selenium (Se)	mg/L	<0.01797	<0.01797	<0.01	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	0.0598	0.413	0.0159	<0.01894	0.02373	<0.01894	<0.01894	<0.01894	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
25	Sianida (Cn)	mg/L	<0.024	<0.024	0.005	<0.005	<0.005				
26	Sulfat (SO4)	mg/L									
27	Sulfida (H2S)	mg/L	0.0055	0.0147	0.0185	0.0217	<0.0013				
28	Copper (Cu)	mg/L	<0.0295	<0.00527	<0.0092	<0.00819	<0.00819	<0.00819	0.01015	<0.00819	
29	Lead (Pb)	mg/L	<0.0307	<0.02495	0.0538	0.0291	<0.01039	0.0564	<0.01039	<0.01039	
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCo3)	mg/L	300.12	68	72.22	125.66	80.8				
ORGANIC CHEMICAL											
1	Fenol	mg/L									
2	Minyak dan Lemak	mg/L	<2.21	<2.21	3	<0.94	<0.94				
3	Senyawa Aktif Biru Metilen	mg/L									
4	BOD	mg/L	38.5	1.43	9.33	15.43	4.57	32.13	6.56	6.59	3

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	COD	mg/L	80.8211	2.3116	15.8214	44.8522	14.5445	83.9029	20.4976	20.5907	
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L	0.2004	0.1202	0.0303	0.1399	<0.0135				
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml	24	240	920	240	49	350	70	170	
2	Total Koliform	Jml/1000 ml	240	1100	1600	1600	110	920	120	210	

Table 9 Water Quality in Upper Cirumamis River at 1998, 2001, 2007, 2012 – 2015

No.	**Parameter**	**Unit**	**1998**	**2001**	**2007**	**2012**		**2013**		**2014**		**2015**	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
PHYSIC													
1	Odor	~							**Odorless**			**Odorless**	**Odorless**
2	Taste								**Tasteless**				
3	Turbidity	NTU	20						8.14			12.5	1.31
4	Temperature	C	25	26	25.1				27 - 27.5	26.2	26.3	28	29.3
5	Air Temperature	C										31.4	34.2
6	Color	PtCo	10	21					17.5 koloid			10	5
7	Total Suspended Solids (TSS)	mg/L	50	458.48						47	36.5		
8	Total Dissolved Solids (TDS)	mg/L		149	767		228	168	209	216	344	220	110
9	Electrical Conductivity	us/cm	200	152	1544		233	188	195			215	222.5
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L		0.57	tt		<0.0005	<0.0005	0.27	<0,0005	<0,0005	<0,001	<0,013
2	Phospat Dissolved	mg/L	0.3	0.073						0.01	<0,03		
3	Amonia (NH3)	mg/L	0.14	0.104	0.18		0.04	0.005	0.033	<0,078	2.4625	0.01	0.098
4	Nitrogen Total	mg/L											
5	Reactive Phospor Dissolved	mg/L											

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
6	Arsen (As)	mg/L		ud	<0.005		<0.005	<0.005	0.0001	<0,001	0.003	<0,005	<0,058
7	Barium (Ba)	mg/L		ud			<0.1	<0.004					
8	Iron (Fe)	mg/L	1.3	2.2	0.005		<0.06	0.02	0.82	0.05	0.03	<0,046	<0,015
9	Boron (B)	mg/L		0.07			<0.01	<0.01					
10	Flourida (F)	mg/L	0.37	ud	0.16		0.13	0.11	0.3	0.2	0.047	<0,02	0.08
11	Cadmium (Cd)	mg/L	-	ud			<0.005	<0.02		<0,001	<0,001		
12	Chlorida (Cl)	mg/L		3.61	2		<0.144	<1.44	3.48	3.4	15.38	12.56	8.32
13	Chlorine (Cl2)	mg/L			<0.01		ttd	0.06	<0,1	0	0	0.01	0.08
14	Cobalt (Co)	mg/L		ud			<0.02	<0.004					
15	Chromium Valensi 6 (Cr)	mg/L	-	ud	<0.02		<0,01	<0,01	<0,001	<0,004	<0,004	<0,02	<0,015
16	Mangan (Mn)	mg/L	-	0.428	0.07		<0.02	0.06	<0,006	<0,01	<0,02	<0,02	<0,019
17	Natrium (Alkali) (Na)	mg/L		12.2			9.54	8.07	5				
18	Nikel (Ni)	mg/L	-	ud	0.007		<0.02	<0.004					
19	Nitrat (NO3 - N)	mg/L	0.08	0.278	0.4		<0.06	0.16	0.046	0.9	1.129	0.12	1.83
20	Nitrit (NO2 + N)	mg/L	0.01	0.004	0.01		<0.01	0.02	<0,004	0.001	0.002	0.02	0.18
21	Dissolve Oxygen (DO)	mg/L		3.34	3.55		6.1	6.65	5	5	4.29	3.8	2.8
22	pH	mg/L	7.4	7.1	8.32		8.25	8.15	7.33	7.52	7.61	7.2	8.4
23	Selenium (Se)	mg/L		ud	0.01		<0.002	<0.002	<0,001	0.004	0.003	<0,01	<0,018

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24	Seng (Zn)	mg/L	-	0.031	0.2		<0.01	0.02	<0,001	<0,008	<0,008	<0,008	0.05
25	Sianida (Cn)	mg/L	-	0.0032	<0.005		<0.005	<0.005	<0,005	<0,05	<0,02	<0,01	<0,024
26	Sulfat (SO4)	mg/L	2.91	1.92	4.27		2.06	9.36		10.5	8.374		
27	Sulfida (H2S)	mg/L		ud	0.01		ttd	0.02	<0,01			<0,005	0.008
28	Copper (Cu)	mg/L	-	ud	0.03		<0.02	<0.009	<0,001	<0,01	<0,01	<0,02	<0,029
29	Lead (Pb)	mg/L	-	ud	<0.01		<0.01	<0.004	<0,01	<0,003	<0,003	<0,003	0.07
30	Calcium (Ca)	mg/L	22.06										
31	Magnesium (Mg)	mg/L	4.88										
32	Alkali/Acidity (HCO3)	mg/L	115.29										
33	Bicarbonat Ion (HCO3-)	mg/L	2.64	4.11									
34	Salinity	mg/L	5	0									
35	Ca Hardness (CaCO3)	mg/L	55										
36	Mg Hardness (CaCO3)	mg/L	20										
37	Kesadahan Total (CaCO3)	mg/L	75						145			198	83.16
ORGANIC CHEMICAL													
1	Fenol	mg/L	0.07	ud			<0.001	<0.001		0.2	<0,0003		
2	Minyak dan Lemak	mg/L	-	ud			<0.02	<0.2	1.2	<5	<5	1	<2,21
3	Senyawa Aktif Biru Metilen	mg/L					0.04	0.07					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
4	BOD	mg/L	2.8	4.11	5		<2	5	1.8	3.9	6.81	1.8	28.6
5	COD	mg/L	40	12.36	8.1		<6	21	2.2	16	32	5.8	70.53
6	KMnO4	mg/L	2.81										
7	Deterjen (MBAS)	mg/L	0.08	ud					0.28	<0,036	<0,036	0.01	0.243
8	Chloropyll-a	mg/L		0.028									
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml	2.4x10^3		2400		240	1500	≥ 2400	4.5,10	49.1	700	23
2	Total Koliform	Jml/1000 ml	460		2400		460	2100	≥ 2400	7.8,10	70.1	2,8x10^3	240

Table 10 Water Quality in Upper Cirumamis River at 2016 – 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
PHYSIC											
1	Odor	~	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste										
3	Turbidity	NTU	2.78	127	516	2.06	9.96				
4	Temperature	C	29.3	25.6	27.4	26.1	25.9	25.6	25.7	27.1	27.2
5	Air Temperature	C	30.4	27.8	29.9	30.7					
6	Color	PtCo	5	35	5	5	10				
7	Total Suspended Solids (TSS)	mg/L	21.5	21.7	31	12		12	12	26	
8	Total Dissolved Solids (TDS)	mg/L	120	90	70	120	72	106	152	926	123
9	Electrical Conductivity	us/cm	240.5	83.3	147.32	225.11	177				260
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L	<0,0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L						<0.01271	<0.0171	0.2705	
3	Amonia (NH3)	mg/L	0.0966	0.0007	<0.0038	< 0,0018	0,0022				
4	Nitrogen Total	mg/L	4	4	5	1.4					
5	Reactive Phospor Dissolved	mg/L	<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0,05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L									
8	Iron (Fe)	mg/L	<0,0153	<0.08832	3.9347	< 0,1680	<0,1680				
9	Boron (B)	mg/L						0.00919	0.19364	<0.00726	
10	Flourida (F)	mg/L	0.0889	0.0982	0.6934	0.1279	<0,1553				
11	Cadmium (Cd)	mg/L						0.02841	0.03	0.03245	
12	Chlorida (Cl)	mg/L	12.44	122.5	60.63	13.88	9.78				
13	Chlorine (Cl2)	mg/L	0.09	0.05	0.03	0.08	0.05				
14	Cobalt (Co)	mg/L						0.01372	0.01278	0.02404	
15	Chromium Valensi 6 (Cr)	mg/L	<0,0154	<0.0154	0.0114	0.0214	<0,0083	<0.0032	<0.0032	<0.0032	
16	Mangan (Mn)	mg/L	<0,0194	0.0512	0.0114	<0.00774	0,02447				
17	Natrium (Alkali) (Na)	mg/L									
18	Nikel (Ni)	mg/L									
19	Nitrat (NO3 - N)	mg/L	3.8211	5.8608	5.946	1.2329	0.4958	0.3467	0.8748	6.4622	
20	Nitrit (NO2 + N)	mg/L	0.1899	0.0127	0.0126	0.0151	0.0238				
21	Dissolve Oxygen (DO)	mg/L	2.5	4.6	3.5	6.51	3.68	4.26	4.46	4.57	17.6
22	pH	mg/L	7.396	7.26	7.34	8.351	7.52	7.395	7.395	7.51	8.1
23	Selenium (Se)	mg/L	<0,01797	<0.01797	<0.01	<0.0013	<0,0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	0.0481	<0.01852	0.0124	<0.01894	0.15429	<0.01894	<0.01894	<0.01894	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
25	Sianida (Cn)	mg/L	<0,024	<0.024	0.005	<0.005	<0.005				
26	Sulfat (SO4)	mg/L									
27	Sulfida (H2S)	mg/L	0.0098	0.0439	0.002	0.0188	<0,0013				
28	Copper (Cu)	mg/L	<0,0295	<0.00527	0.0092	0.00937	<0,00819	<0.00819	<0.00819	0.00845	
29	Lead (Pb)	mg/L	<0,0307	<0.02495	0.0538	0.0358	<0,01039	0.04726	<0,01039	<0.01145	
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCO3)	mg/L	100.22	76	89.73	168.92	137.36				
ORGANIC CHEMICAL											
1	Fenol	mg/L									
2	Minyak dan Lemak	mg/L	<2,21	<2.21	4	<0.94	<0,94				
3	Senyawa Aktif Biru Metilen	mg/L									
4	BOD	mg/L	29.9	4.74	12.6	8.88	2.73	3.57	4.67	26.34	3.9

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	COD	mg/L	80.5311	7.548	20.355	23.7409	8.5874	14.653	14.8851	71.0096	
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L	0.2455	0.1983	0.134	0.09232	<0.0135				
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml	49	460	1700	32	23	110	49	350	
2	Total Koliform	Jml/1000 ml	290	2400	2600	94	70	220	94	920	

Table 11 Water Quality in Lower Cirumamis River at 2001, 2007, 2013 – 2015

No.	**Parameter**	**Unit**	**1998**	**2001**	**2007**	**2012**		**2013**		**2014**		**2015**	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
PHYSIC													
1	Odor	~							**Odorless**			**Odorless**	**Odorless**
2	Taste								**Tasteless**				
3	Turbidity	NTU							7.02			19.2	5.82
4	Temperature	C		26	25.1				29 - 30.2	27.2	26.4	28	26.8
5	Air Temperature	C										31.4	34.2
6	Color	PtCo		26					15 koloid			10	5
7	Total Suspended Solids (TSS)	mg/L		293.44						39	38.5		
8	Total Dissolved Solids (TDS)	mg/L		131	316				143	316	278	280	60
9	Electrical Conductivity	us/cm		122	651				154			572.5	116.5
INORGANIC CHEMICAL													
1	Mercury (Hg)	mg/L		1.2	tt				<0.09	<0.0005	<0.0005	<0,001	<0.013
2	Phospat Dissolved	mg/L		0.087						0.1	<0.03		
3	Amonia (NH3)	mg/L		0.062	0.77				<0.005	<0.078	2.7275	0.24	0.008
4	Nitrogen Total	mg/L											
5	Reactive Phospor Dissolved	mg/L											
6	Arsen (As)	mg/L		ud	<0.005				0.0001	<0.001	0.002	<0,005	<0.058

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
7	Barium (Ba)	mg/L		ud									
8	Iron (Fe)	mg/L		2.6	0.31				0.78	0.1	0.05	0.085	<0.015
9	Boron (B)	mg/L		0.06									
10	Flourida (F)	mg/L		ud	0.06				0.11	0.2	0.352	<0,02	0.33
11	Cadmium (Cd)	mg/L		ud						<0.001	<0.001		
12	Chlorida (Cl)	mg/L		4.67	1.5				3.48	2.9	22.109	37.05	5.14
13	Chlorine (Cl2)	mg/L			0.001				<0.1	0	0	1.04	0.11
14	Cobalt (Co)	mg/L		ud									
15	Chromium Valensi 6 (Cr)	mg/L		ud	0.02				<0.001	<0.004	<0.004	0.069	<0.015
16	Mangan (Mn)	mg/L		0.494	0.06				<0.006	<0.01	<0.02	0.05	<0.019
17	Natrium (Alkali) (Na)	mg/L		24					6.62				
18	Nikel (Ni)	mg/L		ud	0.009								
19	Nitrat (NO3 - N)	mg/L		0.6	3.5				0.063	0.9	1.041	2.01	2.74
20	Nitrit (NO2 + N)	mg/L		0.005	0.02				<0.004	0.01	0.012	0.08	0.08
21	Dissolve Oxygen (DO)	mg/L		6.85	5.54				5.8	4.7	4.79	3.5	1.2
22	pH	mg/L		6.7	8.11				7.4	7.73	8.04	6.99	8.05
23	Selenium (Se)	mg/L		ud	<0.01				<0.001	0.004	0.002	<0,01	<0.018
24	Seng (Zn)	mg/L		0.048	0.18				<0.001	<0.008	<0.008	<0,008	0.065

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
25	Sianida (Cn)	mg/L		0.0027	<0.005				<0.005	<0.05	<0.02	0,01	0.028
26	Sulfat (SO4)	mg/L		2.35	17.38					10.5	9.603		
27	Sulfida (H2S)	mg/L		ud	0.012				<0.01	<0.02	<0.003	<0,005	0.09
28	Copper (Cu)	mg/L		ud	0.01				<0.001	<0.01	<0.01	<0,02	<0.029
29	Lead (Pb)	mg/L		ud	<0.01				<0.01	<0.003	<0.003	<0,003	<0.03
30	Calcium (Ca)	mg/L											
31	Magnesium (Mg)	mg/L											
32	Alkali/Acidity (HCO3)	mg/L											
33	Bicarbonat Ion (HCO3-)	mg/L		2.96									
34	Salinity	mg/L		0									
35	Ca Hardness (CaCO3)	mg/L											
36	Mg Hardness (CaCO3)	mg/L											
37	Kesadahan Total (CaCo3)	mg/L							113			214.2	285.12
ORGANIC CHEMICAL													
1	Fenol	mg/L		ud						0.2	<0.0003		
2	Minyak dan Lemak	mg/L		ud					1	<5	<5	2	<2.21
3	Senyawa Aktif Biru Metilen	mg/L											
4	BOD	mg/L		2.74	5				2.2	4.1	4.47	3.5	32.6

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	COD	mg/L		11.27	8.06				9.71	16	16	10.6	83.71
6	KMnO4	mg/L											
7	Deterjen (MBAS)	mg/L		ud					0.26	<0.036	<0.036	0.07	
8	Chloropyll-a	mg/L		0.033									
MICROBIOLOGY													
1	Koliform Tinja	Jml/1000 ml			28				≥ 2400	17,10	<1.8,10	900	35
2	Total Koliform	Jml/1000 ml			28				≥ 2400	27,10	<1.8,10	3.5 x 10^3	1.1 x 10^3

Table 12 Water Quality in Lower Cirumamis River at 2016 – 2020

No.	**Parameter**	**Unit**	**2016**		**2017**		**2018**		**2019**		**2020**
			Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Mar**
PHYSIC											
1	Odor	**~**	**Odorless**	**Odorless**	**Odorless**	**Odorless**	**Odorless**				
2	Taste										
3	Turbidity	NTU	4.81	112	488	1.8	10.1				
4	Temperature	C	26.8	25.9	28.2	26.3	25.9	25.7	26	27.3	29.7
5	Air Temperature	C	30.4	27.8	29.9	30.3					
6	Color	PtCo	5	25	5	20	10				
7	Total Suspended Solids (TSS)	mg/L	24.2	23.7	32.5	18		21	36	30	
8	Total Dissolved Solids (TDS)	mg/L	80	80	75	115	68	4358	132	756	170
9	Electrical Conductivity	us/cm	120.5	81.8	146.12	226.44	165.86				200
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L	<0.0132	<0.0132	<0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	
2	Phospat Dissolved	mg/L						<0.0171	0.0129	1.5842	
3	Amonia (NH3)	mg/L	0.0076	0.0007	<0.0038	0,0129	<0.0018				
4	Nitrogen Total	mg/L	5	4	6	1.9					
5	Reactive Phospor Dissolved	mg/L	<0,0038	<0,0038							
6	Arsen (As)	mg/L	<0.05797	<0.05797	<0.005	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Barium (Ba)	mg/L									
8	Iron (Fe)	mg/L	<0.0153	0.113	3.9315	< 0,1680	<0,1680				
9	Boron (B)	mg/L						0.42579	0.15878	<0.00726	
10	Flourida (F)	mg/L	0.3366	0.1162	0.8263	1.0471	<0,1553				
11	Cadmium (Cd)	mg/L						0.33866	0.02237	<0.00928	
12	Chlorida (Cl)	mg/L	9.22	148.61	66.82	10.79	4.89				
13	Chlorine (Cl2)	mg/L	0.19	0.03	0.05	0.1	0.09				
14	Cobalt (Co)	mg/L						0.01372	0.0091	0.02483	
15	Chromium Valensi 6 (Cr)	mg/L	<0.0154	<0.0154	0.0108	<0.0083	<0,0083	0.005	<0.0032	0.0054	
16	Mangan (Mn)	mg/L	<0.0194	0.2326	0.0937	0.847	0.01443				
17	Natrium (Alkali) (Na)	mg/L									
18	Nikel (Ni)	mg/L									
19	Nitrat (NO3 - N)	mg/L	4.7366	5.6427	8.3396	1.2092	1.2403	0.8255	1.2931	15.3258	
20	Nitrit (NO2 + N)	mg/L	0.0866	0.0138	0.0416	<0.0115	0.086				
21	Dissolve Oxygen (DO)	mg/L	1	4.6	3.7	6.42	4.08	4.28	4.51	4.68	21.5
22	pH	mg/L	7.832	7.29	7.01	8.426	7.49	7.422	7.486	7.63	8.5
23	Selenium (Se)	mg/L	<0.01797	<0.01797	<0.01	<0.0013	<0,0013	<0.0013	<0.0013	<0.0013	
24	Seng (Zn)	mg/L	0.062	0.0352	0.0182	<0..1894	0.07271	<0.01894	<0.01894	<0.01894	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
25	Sianida (Cn)	mg/L	<0.024	<0.024	0.005	<0.005	<0.005				
26	Sulfat (SO4)	mg/L									
27	Sulfida (H2S)	mg/L	0.0114	0.0325	0.036	0.0191	<0,0013				
28	Copper (Cu)	mg/L	<0.0295	<0.00527	<0.0092	<0.00819	<0,00819	0.14761	<0,00819	0.00845	
29	Lead (Pb)	mg/L	<0.0307	<0.02495	0.0538	0.0254	<0,01039	0.23464	<0,01039	0.01514	
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCo3)	mg/L	299.66	124	86.5	123.6	137.36				
ORGANIC CHEMICAL											
1	Fenol	mg/L									
2	Minyak dan Lemak	mg/L	<2.21	<2.21	2	<0.94	<0.94				
3	Senyawa Aktif Biru Metilen	mg/L									
4	BOD	mg/L	37.4	8.31	9.32	8.55	4.62	10.29	23.05	32.14	9.1

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	COD	mg/L	90.6608	12.1904	15.6979	24.4948	14.7250^	29.7438	73.2758	83.9203	
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L	0.2598	0.0994	0.1114	0.1569	<0.0135				
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml	49	460	1100	23	33	130	350	540	
2	Total Koliform	Jml/1000 ml	2.1 x 10^5	2400	2600	84	110	280	920	920	

Table 13 Water Quality in Bojongsalam River at 1998, 2013 – 2014

No.	**Parameter**	**Unit**	**1998**	**2001**	**2007**	**2012**		**2013**		**2014**	
			PT. PLN	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
PHYSIC											
1	Odor	~									
2	Taste										
3	Turbidity	NTU	5								
4	Temperature	C	25							25.9	26
5	Air Temperature	C									
6	Color	PtCo	30								
7	Total Suspended Solids (TSS)	mg/L	-							45	17
8	Total Dissolved Solids (TDS)	mg/L					244	180		272	269
9	Electrical Conductivity	us/cm	200				262	229			
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L					<0.0005	<0.0005		<0.0005	<0.0005
2	Phospat Dissolved	mg/L	0.04							<0.068	<0.03
3	Amonia (NH3)	mg/L	0.33				0.07	0.002		2.6	2.2275
4	Nitrogen Total	mg/L									
5	Reactive Phospor Dissolved	mg/L									
6	Arsen (As)	mg/L					<0.005	<0.005		<0.001	<0.001

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
7	Barium (Ba)	mg/L					<0.1	<0.004			
8	Iron (Fe)	mg/L	0.39				<0.06	0.02		0.75	0.07
9	Boron (B)	mg/L					<0.01	<0.01			
10	Flourida (F)	mg/L	0.13				0.13	0.05		1.3	0.679
11	Cadmium (Cd)	mg/L	-				<0.005	<0.002		0.003	<0.001
12	Chlorida (Cl)	mg/L					<0.144	<1.44		3.8	16.341
13	Chlorine (Cl2)	mg/L					ttd	0.05		0	0
14	Cobalt (Co)	mg/L					<0.02	<0.02			
15	Chromium Valensi 6 (Cr)	mg/L	-				<0,01	<0,01		<0.004	<0.004
16	Mangan (Mn)	mg/L	-				<0.02	<0.02		0.04	<0.02
17	Natrium (Alkali) (Na)	mg/L					9.75	11.9			
18	Nikel (Ni)	mg/L	-				<0.02	<0.004			
19	Nitrat (NO3 - N)	mg/L	-				<0.06	0.11		0.9	1.039
20	Nitrit (NO2 + N)	mg/L	0.01				<0.01	<0.01		0.1	0.002
21	Dissolve Oxygen (DO)	mg/L					6.48	6.83		5	4.59
22	pH	mg/L	7.6				8.43	8.26		6.82	7.12
23	Selenium (Se)	mg/L					<0.002	<0.002		0.003	0.003
24	Seng (Zn)	mg/L	-				<0.01	0.02		<0.008	<0.008

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
25	Sianida (Cn)	mg/L	-				<0.005	<0.005		0.63	<0.02
26	Sulfat (SO4)	mg/L	3.51				15.19	9.8		8.7	10.214
27	Sulfida (H2S)	mg/L					ttd	0.009		<0.02	<0.003
28	Copper (Cu)	mg/L	-				<0.02	<0.009		<0.01	<0.01
29	Lead (Pb)	mg/L	0.05				<0.01	<0.004		<0.003	<0.003
30	Calcium (Ca)	mg/L	22.06								
31	Magnesium (Mg)	mg/L	6.1								
32	Alkali/Acidity (HCO3)	mg/L	126.88								
33	Bicarbonat Ion (HCO3-)	mg/L	5.82								
34	Salinity	mg/L	5								
35	Ca Hardness (CaCO3)	mg/L	55								
36	Mg Hardness (CaCO3)	mg/L	25								
37	Kesadahan Total (CaCo3)	mg/L	80								
ORGANIC CHEMICAL											
1	Fenol	mg/L	0.05				< 0.001	< 0.001		3.8	<0.0003
2	Minyak dan Lemak	mg/L	-				<0.02	<0.2		<5	<5
3	Senyawa Aktif Biru Metilen	mg/L					ttd	0.05			
4	BOD	mg/L	11.5				<2	4		3.7	6.81

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	COD	mg/L	26				<6	19		32	48
6	KMnO4	mg/L	21.87								
7	Deterjen (MBAS)	mg/L	0.15							<0.036	<0.036
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml	9.3x10^4				9	1500		540,10	280,10
2	Total Koliform	Jml/1000 ml	4.6x10^6				23	2100		>1600.10	920,10

Table 14 Water Quality in Citapos River at 2007

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
PHYSIC											
1	Odor	~									
2	Taste										
3	Turbidity	NTU									
4	Temperature	C			25.1						
5	Air Temperature	C									
6	Color	PtCo									
7	Total Suspended Solids (TSS)	mg/L									
8	Total Dissolved Solids (TDS)	mg/L			597						
9	Electrical Conductivity	us/cm			1210						
INORGANIC CHEMICAL											
1	Mercury (Hg)	mg/L			tt						
2	Phospat Dissolved	mg/L									
3	Amonia (NH3)	mg/L			0.55						
4	Nitrogen Total	mg/L									
5	Reactive Phospor Dissolved	mg/L									
6	Arsen (As)	mg/L			<0.005						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
7	Barium (Ba)	mg/L									
8	Iron (Fe)	mg/L			0.76						
9	Boron (B)	mg/L									
10	Flourida (F)	mg/L			0.03						
11	Cadmium (Cd)	mg/L									
12	Chlorida (Cl)	mg/L			3.5						
13	Chlorine (Cl2)	mg/L			0.002						
14	Cobalt (Co)	mg/L									
15	Chromium Valensi 6 (Cr)	mg/L			0.01						
16	Mangan (Mn)	mg/L			0.34						
17	Natrium (Alkali) (Na)	mg/L									
18	Nikel (Ni)	mg/L			0.008						
19	Nitrat (NO3 - N)	mg/L			2.2						
20	Nitrit (NO2 + N)	mg/L			0.03						
21	Dissolve Oxygen (DO)	mg/L			3.22						
22	pH	mg/L			8.28						
23	Selenium (Se)	mg/L			0.05						
24	Seng (Zn)	mg/L			0.27						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
25	Sianida (Cn)	mg/L			<0.005						
26	Sulfat (SO4)	mg/L			6.53						
27	Sulfida (H2S)	mg/L			0.04						
28	Copper (Cu)	mg/L			0.14						
29	Lead (Pb)	mg/L			<0.01						
30	Calcium (Ca)	mg/L									
31	Magnesium (Mg)	mg/L									
32	Alkali/Acidity (HCO3)	mg/L									
33	Bicarbonat Ion (HCO3-)	mg/L									
34	Salinity	mg/L									
35	Ca Hardness (CaCO3)	mg/L									
36	Mg Hardness (CaCO3)	mg/L									
37	Kesadahan Total (CaCo3)	mg/L									
ORGANIC CHEMICAL											
1	Fenol	mg/L									
2	Minyak dan Lemak	mg/L									
3	Senyawa Aktif Biru Metilen	mg/L									
4	BOD	mg/L			40						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	COD	mg/L			56.04						
6	KMnO4	mg/L									
7	Deterjen (MBAS)	mg/L									
8	Chloropyll-a	mg/L									
MICROBIOLOGY											
1	Koliform Tinja	Jml/1000 ml			460						
2	Total Koliform	Jml/1000 ml			460						

Appendix 12 Climate, Air Quality, Noise and Vibration

Table 15 Climate, Air Quality, Noise and Vibration in Sarinagen-Karangsari Village at 2007 and 2011 - 2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C								23	30	25.6-33.1
2	Humidity (RH)	%								90	83	47-76
3	Air Pressure	mmHg								693	693	
4	Wind Direction									E	E	W
5	Wind Speed	Km/Hour								1.4	5.5	0.4-1.3
6	Weather									Cloudy	Bright	Bright
Noise Level												
1	Daytime Noise (Ls)	dB			54.3					55.13	63.05	56.8
2	Night Noise (Lm)	dB			42.3					59.44	59.54	56.7
3	Day and Night Noise (Lsm)	dB				48.3	46.67	63.3		57.07	62.16	56.8
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3				73.93	239.64	26		45	21.9	
2	Nitrogen Dioksida (NO2)	ug/m3			<4							21.56
3	Sulfur Dioksida (SO2)	ug/m3			392.21							15.53

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
4	Oksidan (O2)	ug/m3										16.59
5	Debu (TSP)	ug/m3			73.93							60.62
6	Timah Hitam (Pb)	ug/m3			<0.01							0.012
7	Karbon Monoksida (CO)	ug/m3			140.4							406.46
8	Hidrokarbon (HC)	ug/m3			tt							17.99
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
9	25	10^-6 m										
10	31.5	10^-6 m										
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	4	mm/sec										
2	5	mm/sec										
3	6.3	mm/sec										
4	8	mm/sec										
5	10	mm/sec										
6	12.5	mm/sec										
7	16	mm/sec										
8	20	mm/sec										
9	25	mm/sec										
10	31.5	mm/sec										
11	40	mm/sec										
12	50	mm/sec										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Vibration Frequency												
1	Accelerate	mm/sec										0.1
2	Velocity	mm/sec										0.6
Tingkat Getaran												
1	Gunung Karang Desa Sarinagen	mm/sec										

Table 16 Climate, Air Quality, Noise and Vibration in Sarinagen-Karangsari Village at 2014 - 2019

No.	**Parameter**	**Unit**	**2014**		**2015**		**2016**		**2017**		**2018**		**2019**	
			Sem 1	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
Climatology Data														
1	Temperature	°C	25.7	36.5	32.1	34.37	-	-	32.52	30.83	31.33	31.32	30.35	31.45
2	Humidity (RH)	%	86.8	45.8	56.33	48.15	-	-	58.4	56.62	52.97	55.77	57.17	54.88
3	Air Pressure	mmHg	761.62	761.49	694.43	698.18	-	-	693.6	697.05	694.95	696.68	696.503	694.88
4	Wind Direction		W	N	W	W	-	-	E	E	E	W	E	E
5	Wind Speed	Km/Hour	0.2	0.8	1.21	3.03	-	-	1.18	0.75	1.6	3.95	0.88	3.03
6	Weather		Bright	Bright			-	-						
Noise Level														
1	Daytime Noise (Ls)	dB	54.5	59.7	49.15	40.8	40.22	54.6	51.78	42.55	36.7	43.6	45.66	53.65
2	Night Noise (Lm)	dB	46.8	51.4										
3	Day and Night Noise (Lsm)	dB	48.8	55.8										
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3	<20	<20	< 10	< 10	-	-	<2.24	<8.1	<8,10	<8,10	<8,10	<8.10

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
3	Sulfur Dioksida (SO2)	ug/m3	<20	<20	< 17,15	< 17,15	-	-	6.53	8.51	<6,65	38.2	39.09	12.97
4	Oksidan (O2)	ug/m3	<10	<10	< 15,61	< 15,61	-	-	3.16	17.45	8.76	18.04	18.99	<0.74
5	Debu (TSP)	ug/m3	35.2	22.9	79	60.7	-	-	46.7	54.7	99	121.4	129.88	78.7
6	Timah Hitam (Pb)	ug/m3	<0.5	<0.5	0.02	0.01	-	-	0.01	0,01	0.03	0.04	0.04	0.04
7	Karbon Monoksida (CO)	ug/m3	<1000	<1000	< 1,145	< 1,145	-	-	<1.145	<1.145	<1.145	<1,145	<1,145	<1.145
8	Hidrokarbon (HC)	ug/m3	<100	<100	160	5.2	-	-	4.1	10.2				
9	PM10	ug/m3							30.8	48.6				
10	PM2.5	ug/m3							48.7	39.1				
11	Amoniak (NH3)	ppm									0.0042	0.0075	0.0066	0.006
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	<0.0002
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m	62.922	0.05										
2	5	10^-6 m	69.563	0.0647										
3	6.3	10^-6 m	79.428	0.0842										
4	8	10^-6 m	41.151	0.1173										
5	10	10^-6 m	27.644	0.2117										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
6	12.5	10^-6 m	17.711	0.5356										
7	16	10^-6 m	15.63	0.5356										
8	20	10^-6 m	12.507	0.737										
9	25	10^-6 m	2.627	0.625										
10	31.5	10^-6 m	1.049	0.3698										
11	40	10^-6 m	0.528	0.1303										
12	50	10^-6 m	0.243	0.1711										
13	63	10^-6 m	0.106	0.0122										
Vibration Frequency (Peak) Hz														
1	4	mm/sec	1.581	0.002										
2	5	mm/sec	2.184	0.0021										
3	6.3	mm/sec	3.142	0.0021										
4	8	mm/sec	2.067	0.0023										
5	10	mm/sec	1.736	0.0034										
6	12.5	mm/sec	1.39	0.0068										
7	16	mm/sec	1.571	0.0073										
8	20	mm/sec	1.571	0.005										
9	25	mm/sec	0.412	0.0024										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
10	31.5	mm/sec	0.207	0.0014										
11	40	mm/sec	0.133	0.0005										
12	50	mm/sec	0.076	0.0005										
Vibration Frequency														
1	Accelerate	mm/sec												
2	Velocity	mm/sec												
Tingkat Getaran														
1	Gunung Karang Desa Sarinagen	mm/sec			0.045	0.1	0.7	0.06	0.15	0.3	0.3	0.1	0.1	0.2

Table 17 Climate, Air Quality, Noise and Vibration in Al Barqun Sarinagen Village at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			65.5							
2	Night Noise (Lm)	dB			51.2							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			200.14							
4	Oksidan (O2)	ug/m3										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3			69.78							
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			200.54							
8	Hidrokarbon (HC)	ug/m3			tt							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
10	31.5	10^-6 m										
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	4	mm/sec										
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										
Vibration Frequency (Peak) Hz												

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
1	Desa Sarinangen	mm/sec										

Table 18 Climate, Air Quality, Noise and Vibration in Al Barqun Sarinagen Village at 2016 - 2019

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C					30.65	26.75	32.95	31.28	31.57	31.6	31.3	32.45
2	Humidity (RH)	%					62.37	61.57	56.4	55.83	52.65	54.72	59.05	53.82
3	Air Pressure	mmHg					701.63	679.58	697.8	700.73	697.73	699.68	697.95	699.98
4	Wind Direction						W	W	E	S	E	W	E	E
5	Wind Speed	Km/Hour					0.69	0.63	1.15	1.37	1.18	3.2	0.87	1.62
6	Weather													
Noise Level														
1	Daytime Noise (Ls)	dB					60.88	61.67	53.95	51.54	55.85	50.8	50.65	52.6
2	Night Noise (Lm)	dB												
3	Day and Night Noise (Lsm)	dB												
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3					< 10	<10	<2.24	<8.1	<8,10	<8,10	<8,10	12.66

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
3	Sulfur Dioksida (SO2)	ug/m3					< 17,15	<17.15	41	18,42	<6,65	40.14	38.56	21.34
4	Oksidan (O2)	ug/m3					< 15,61	<15.61	8.801	13.55	9.73	22.54	18.99	45.69
5	Debu (TSP)	ug/m3					80.3	27.9	49.6	91.8	108.8	159.2	121.88	77.4
6	Timah Hitam (Pb)	ug/m3					0.01	0.05	0.01	0.03	0.03	0.04	0.04	0.04
7	Karbon Monoksida (CO)	ug/m3					< 1,145	<1.145	<1.145	<1.145	2,668	<1,145	<1,145	2.095
8	Hidrokarbon (HC)	ug/m3					5.6	5.1	3.6	14.15				
9	PM10	ug/m3					10.8	10.2	30.8	81.2				
10	PM2.5	ug/m3					12.4	12.4	48.7	54.4				
11	Amoniak (NH3)	ppm									0.0038	0.0067	0.0056	0.0105
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	0.0004
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
5	10	10^-6 m												
6	12.5	10^-6 m												
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												
10	31.5	10^-6 m												
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	4	mm/sec												
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
8	25	mm/sec												
9	31.5	mm/sec												
10	40	mm/sec												
11	50	mm/sec												
Vibration Frequency (Peak) Hz														
1	Desa Sarinangen	mm/sec					0.4	0.07	0.1	0.5	0.2	0.1	0.2	0.1

Table 19 Climate, Air Quality, Noise and Vibration in Cimega School, Cipongkor at 2015

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C			32.6	34.47								
2	Humidity (RH)	%			56.33	49.38								
3	Air Pressure	mmHg			693.9	702.08								
4	Wind Direction				W	E								
5	Wind Speed	Km/Hour			1.43	3.12								
6	Weather													
Noise Level														
1	Daytime Noise (Ls)	dB			46.89	60.1								
2	Night Noise (Lm)	dB												
3	Day and Night Noise (Lsm)	dB												
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3			< 10	< 10								
3	Sulfur Dioksida (SO2)	ug/m3			< 17,15	< 17,15								
4	Oksidan (O2)	ug/m3			< 15,61	< 15,61								

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3			73	101.6								
6	Timah Hitam (Pb)	ug/m3			0.05	0.01								
7	Karbon Monoksida (CO)	ug/m3			< 1,145	< 1,145								
8	Hidrokarbon (HC)	ug/m3			4.8	2.8								
9	PM10	ug/m3												
10	PM2,5	ug/m3												
11	Amoniak (NH3)	ppm												
12	Hidrogen Sulfida (H2S)	ppm												
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												
5	10	10^-6 m												
6	12.5	10^-6 m												
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
10	31.5	10^-6 m												
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	4	mm/sec												
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												
8	25	mm/sec												
9	31.5	mm/sec												
10	40	mm/sec												
11	50	mm/sec												
Noise Level (Smt 1 2015)														

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
1	*SDN Cimega*	dBA			46.89	60.1								
Vibration Frequency (Smt 1 2015)														
1	*SDN Cimega*	dBA			0.045	0.2								

Table 20 Climate, Air Quality, Noise and Vibration in Cipari Junction at 2017, 2011-2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem 2
Climatology Data														
1	Temperature	°C								24	28			
2	Humidity (RH)	%								81	69			
3	Air Pressure	mmHg								693	693			
4	Wind Direction									N	S			
5	Wind Speed	Km/Hour								1.8	1.1			
6	Weather									Cloudy	Cloudy			
Noise Level														
1	Daytime Noise (Ls)	dB			73.5					66.54	61.84			
2	Night Noise (Lm)	dB			50.2					60.08	62.76			
3	Day and Night Noise (Lsm)	dB				61.85	60.42	51.6		64.36	62.17			
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3				63.71	144.25	<230		129.7	61.3			
2	Nitrogen Dioksida (NO2)	ug/m3			<4									
3	Sulfur Dioksida (SO2)	ug/m3			278.64									
4	Oksidan (O2)	ug/m3												

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem 2
5	Debu (TSP)	ug/m3			63.71									
6	Timah Hitam (Pb)	ug/m3			<0.01									
7	Karbon Monoksida (CO)	ug/m3			397.8									
8	Hidrokarbon (HC)	ug/m3			tt									
9	PM10	ug/m3												
10	PM2,5	ug/m3												
11	Amoniak (NH3)	ppm			<0.1									
12	Hidrogen Sulfida (H2S)	ppm			<0.005									
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												
5	10	10^-6 m												
6	12.5	10^-6 m												
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem 2
10	31.5	10^-6 m												
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												
8	25	mm/sec												
9	31.5	mm/sec												
10	40	mm/sec												
11	50	mm/sec												
Vibration Frequency														
1	Accelerate	mm/sec												

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem 2
2	Velocity	mm/sec												
Vibration Frequency (Smt 1 2015)														
1	*Access Road*	mm/sec												
Vibration Frequency (Peak) Hz														
1	Cipari Junction	mm/sec												

Table 21 Climate, Air Quality, Noise and Vibration in Cipari Junction at 2015-2019

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C			31.1	35	30.42	26.52	33.28	30.77	31.1	30.17	30.17	32.8
2	Humidity (RH)	%			59.41	41.83	65.45	77.45	56.27	54.28	52.78	56.48	57.2	50.75
3	Air Pressure	mmHg			694.43	701.26	699.9	698.1	696.98	700.66	698.1	702.61	701.03	699.23
4	Wind Direction				W	W	W	W	S	S	E	W	E	SE
5	Wind Speed	Km/Hour			1.1	2.87	1.8	0.98	0.98	1.13	1.57	0.6	0.77	2,65
6	Weather													
Noise Level														
1	Daytime Noise (Ls)	dB			47.86	65.9	40.22	59.05	53.15	44.72	45.85	63.15	63.6	57.95
2	Night Noise (Lm)	dB												
3	Day and Night Noise (Lsm)	dB												
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3			< 10	< 10	< 10	<10	<2.24	<8.1	<8,10	12.29	11.78	11.48

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
3	Sulfur Dioksida (SO2)	ug/m3			< 17,15	< 17,15	< 17,15	<17.15	<2.24	13.61	<6,65	41.37	24.89	19.7
4	Oksidan (O2)	ug/m3			< 15,61	< 15,61	< 15,61	<15.61	18.06	12.48	13.38	20.44	9.95	37.29
5	Debu (TSP)	ug/m3			81	117.8	72.5	25.6	62.5	80.7	95.2	205.8	121.44	68.9
6	Timah Hitam (Pb)	ug/m3			0.02	0.05	0.01	0.05	0.02	0.02	0.03	0.06	0.03	0.04
7	Karbon Monoksida (CO)	ug/m3			< 1,145	< 1,145	< 1,145	<1.145	<1.145	<1.145	<1.145	3.435	3.435	1.718
8	Hidrokarbon (HC)	ug/m3			3.5	8.6	8.5	5.1	4.1	10.8				
9	PM10	ug/m3					58.7	30.3	41.3	71.3				
10	PM2,5	ug/m3					62.3	3.25	55.7	41.6				
11	Amoniak (NH3)	ppm									0.0046	0.0091	0.0044	0.0093
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	0.0003
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												
5	10	10^-6 m												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
6	12.5	10^-6 m												
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												
10	31.5	10^-6 m												
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												
8	25	mm/sec												
9	31.5	mm/sec												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
10	40	mm/sec												
11	50	mm/sec												
Vibration Frequency														
1	Accelerate	mm/sec												
2	Velocity	mm/sec												
Vibration Frequency														
1	*Access Road*	mm/sec			0.09	0.3	0.7							
Vibration Frequency (Peak) Hz														
1	Cipari Junction	mm/sec						0.09	0.25	0.3	0.3	0.2	0.2	0.2

Table 22 Climate, Air Quality, Noise and Vibration in Cijambu Village at 1998, 2001, 2007, 2012 - 2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C								24	20	26.0-33.0
2	Humidity (RH)	%								81	89	48 - 76
3	Air Pressure	mmHg								692	692	
4	Wind Direction									W	W	W
5	Wind Speed	Km/Hour								2.1	1.3	0.33-1.35
6	Weather									Bright	Cloudy	Bright
Noise Level												
1	Daytime Noise (Ls)	dB	36	36	69.5					60.1	69.27	55.8
2	Night Noise (Lm)	dB	33	33	50.2					57.47	73.39	55.2
3	Day and Night Noise (Lsm)	dB				59.85				59.33	71.11	55.8
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3				69.07				141	23.5	
2	Nitrogen Dioksida (NO2)	ug/m3			<4							14.89
3	Sulfur Dioksida (SO2)	ug/m3			331.67							16.23

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
4	Oksidan (O2)	ug/m3										15.46
5	Debu (TSP)	ug/m3			69.07							52.14
6	Timah Hitam (Pb)	ug/m3			<0.01							0.01
7	Karbon Monoksida (CO)	ug/m3			304.41							421.42
8	Hidrokarbon (HC)	ug/m3			tt							171.81
9	PM10	ug/m3										
10	PM2,5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
9	25	10^-6 m										
10	31.5	10^-6 m										
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	4	mm/sec										
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Noise Level (Smt 1 2015)												
1	Pemukiman dkt *power house*	dBA										
Vibration Frequency (Smt 1 2015)												
1	pemukiman dkt *power house*	dBA										

Table 23 Climate, Air Quality, Noise and Vibration in Cijambu Village at 2014

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C	31.2	36										
2	Humidity (RH)	%	59.4	45.8										
3	Air Pressure	mmHg	760.86	761.49										
4	Wind Direction		E	E										
5	Wind Speed	Km/Hour	1.1	2.8										
6	Weather		Bright	Cloudy										
Noise Level														
1	Daytime Noise (Ls)	dB	52	70.4										
2	Night Noise (Lm)	dB	51.7	62.4										
3	Day and Night Noise (Lsm)	dB	47.9	65.1										
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3	37.24	34.9										
3	Sulfur Dioksida (SO2)	ug/m3	<20	<20										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
4	Oksidan (O2)	ug/m3	13,04	19.7										
5	Debu (TSP)	ug/m3	10,1	56.2										
6	Timah Hitam (Pb)	ug/m3	<0.5	<0.5										
7	Karbon Monoksida (CO)	ug/m3	<1000	<1000										
8	Hidrokarbon (HC)	ug/m3	<100	<100										
9	PM10	ug/m3												
10	PM2,5	ug/m3												
11	Amoniak (NH3)	ppm												
12	Hidrogen Sulfida (H2S)	ppm												
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m	38.1	0.1167										
2	5	10^-6 m	34.16	0.1415										
3	6.3	10^-6 m	17.42	0.2071										
4	8	10^-6 m	6.31	0.3534										
5	10	10^-6 m	2.43	0.7628										
6	12.5	10^-6 m	1.2	1.3451										
7	16	10^-6 m	0.59	1.9799										
8	20	10^-6 m	0.35	2.6811										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
9	25	10^-6 m	0.21	3.6365										
10	31.5	10^-6 m	0.13	2.0183										
11	40	10^-6 m	0.07	0.9302										
12	50	10^-6 m	0.03	0.8097										
13	63	10^-6 m	0	0.0653										
Vibration Frequency (Peak) Hz														
1	4	mm/sec	0.35	**0.0046**										
1	5	mm/sec	0.18	0.0045										
2	6.3	mm/sec	0.1	0.0052										
3	8	mm/sec	0.06	0.007										
4	10	mm/sec	0.04	0.0121										
5	12.5	mm/sec	0.03	0.0171										
6	16	mm/sec	0.02	0.0197										
7	20	mm/sec	0.02	0.0213										
8	25	mm/sec	0.01	0.0232										
9	31.5	mm/sec	0	0.0102										
10	40	mm/sec	0	0.0037										
11	50	mm/sec	0	0.0026										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Noise Level (Smt 1 2015)														
1	Pemukiman dkt *power house*	dBA												
Vibration Frequency (Smt 1 2015)														
1	pemukiman dkt *power house*	dBA												

Table 24 Climate, Air Quality, Noise and Vibration in Sukaresmi Village at 1998, 2001, 2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										26.7-29.6
2	Humidity (RH)	%										60 - 67
3	Air Pressure	mmHg										
4	Wind Direction											E
5	Wind Speed	Km/Hour										0.2 - 1.4
6	Weather											Clouded
Noise Level												
1	Daytime Noise (Ls)	dB	45	45								52.8
2	Night Noise (Lm)	dB	42.3	42.3								54.8
3	Day and Night Noise (Lsm)	dB										50.5
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3										21.8
3	Sulfur Dioksida (SO2)	ug/m3										14.66
4	Oksidan (O2)	ug/m3										15.67

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3										86.79
6	Timah Hitam (Pb)	ug/m3										0.018
7	Karbon Monoksida (CO)	ug/m3										428.3
8	Hidrokarbon (HC)	ug/m3										16.35
9	PM10	ug/m3										
10	PM2,5	ug/m3										
11	Amoniak (NH3)	ppm										
12	Hidrogen Sulfida (H2S)	ppm										
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
10	31.5	10^-6 m										
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	4	mm/sec										
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										
Vibration Frequency												

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
1	Accelerate	mm/sec										0.1
2	Velocity	mm/sec										0.3
Vibration Frequency (Smt 1 2015)												
1	*Access Road*	dBA										
Vibration Frequency (Peak) Hz												
1	Desa Sukaresmi	mm/sec										

Table 25 Climate, Air Quality, Noise and Vibration in Sukaresmi Village at 2014-2019

No.	**Parameter**	**Unit**	**2014**		**2015**		**2016**		**2017**		**2018**		**2019**	
			Sem 1	**Sem2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
Climatology Data														
1	Temperature	°C	28.8	35.4	30.15	34.77	31.1	27.45	29.93	30.15	29.2	30.9	30.45	32.78
2	Humidity (RH)	%	66.5	33.6	60.3	48.53	54.55	77.45	49.9	55.23	66.88	54.48	57.33	53.23
3	Air Pressure	mmHg	761.37	752.35	691.2	690.3	689.7	698.1	690.45	690.68	691.35	698.1	697.75	696.68
4	Wind Direction		E	S	W	E	W	W	W	W	E	W	E	E
5	Wind Speed	Km/Hour	0.3	1.7	0.48	3.52	2.64	0.83	2.62	0.78	0.83	0.88	0.72	1.73
6	Weather		Bright	Bright										
Noise Level														
1	Daytime Noise (Ls)	dB	55.3	49.5	43.98	43.18	55.55	57.43	50.13	44.26	42.35	52.1	47.25	60.7
2	Night Noise (Lm)	dB	48.1	41										
3	Day and Night Noise (Lsm)	dB	47.6	45.9										
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3	<20	23.5	< 10	< 10	< 10	<10	<2.24	3.96	<8,10	<8,10	<8,10	<8.10

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
3	Sulfur Dioksida (SO2)	ug/m3	<20	<20	< 17,15	< 17,15	< 17,15	18.46	<2.24	12.01	<6,65	36.95	28.88	18.03
4	Oksidan (O2)	ug/m3	<10	19.6	< 15,61	< 15,61	< 15,61	<15.61	6.91	7.7	12.75	26.61	18.88	23.67
5	Debu (TSP)	ug/m3	14.4	41.4	65	256.3	138.8	26.8	52.1	114.9	100.1	241.4	154.66	92.6
6	Timah Hitam (Pb)	ug/m3	<0.5	<0.5	0.01	0.01	0.04	0.04	0.01	0.03	0.03	0.05	0.04	0.04
7	Karbon Monoksida (CO)	ug/m3	<1000	<1000	< 1,145	< 1,145	< 1,145	<1.145	<1.145	<1.145	<1.145	2.862	2.862	<1.145
8	Hidrokarbon (HC)	ug/m3	<100	<100	3.8	2.5	4.5	4.2	8.9	15.3				
9	PM10	ug/m3						67	71.5	112.1				
10	PM2,5	ug/m3						90.3	90.2	74.4				
11	Amoniak (NH3)	ppm									0.0043	0.0078	0.0066	0.0076
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	<0.0002
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m	27.631	0.0241										
2	5	10^-6 m	22.306	0.0341										
3	6.3	10^-6 m	17.46	0.0598										
4	8	10^-6 m	11.66	0.0591										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	**Sem2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
5	10	10^-6 m	6.926	0.0787										
6	12.5	10^-6 m	5.303	0.1278										
7	16	10^-6 m	2.704	0.1717										
8	20	10^-6 m	1.41	0.1939										
9	25	10^-6 m	1.023	0.2101										
10	31.5	10^-6 m	0.676	0.1775										
11	40	10^-6 m	0.475	0.1419										
12	50	10^-6 m	0.258	0.1272										
13	63	10^-6 m	0	0.0224										
Vibration Frequency (Peak) Hz														
1	4	mm/sec	0.694	0.001										
1	5	mm/sec	0.7	0.0011										
2	6.3	mm/sec	0.691	0.0015										
3	8	mm/sec	0.586	0.0012										
4	10	mm/sec	0.435	0.0013										
5	12.5	mm/sec	0.416	0.0016										
6	16	mm/sec	0.272	0.0017										
7	20	mm/sec	0.177	0.0015										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
8	25	mm/sec	0.161	0.0013										
9	31.5	mm/sec	0.134	0.0009										
10	40	mm/sec	0.119	0.0006										
11	50	mm/sec	0.081	0.0004										
Vibration Frequency														
1	Accelerate	mm/sec												
2	Velocity	mm/sec												
Vibration Frequency (Smt 1 2015)														
1	*Access Road*	dBA			0.045	0.4	0.5							
Vibration Frequency (Peak) Hz														
1	Desa Sukaresmi	mm/sec						0.08	0.15	0.5	0.2	0.2	0.1	0.1

Table 26 Climate, Air Quality, Noise and Vibration in Sukaresmi Resettlement at 2018-2019

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C									32.05	29.48	29.67	32.48
2	Humidity (RH)	%									52.37	57.52	61.21	54.63
3	Air Pressure	mmHg									706.51	698.1	708.38	695.78
4	Wind Direction										E	W	E	E
5	Wind Speed	Km/Hour									1.3	0.67	0.63	1.27
6	Weather													
Noise Level														
1	Daytime Noise (Ls)	dB									42.05	48.6	50.22	38.45
2	Night Noise (Lm)	dB												
3	Day and Night Noise (Lsm)	dB												
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3									<8,10	<8,10	<8,10	<8.10
3	Sulfur Dioksida (SO2)	ug/m3									<6,65	32.89	26.66	11.32
4	Oksidan (O2)	ug/m3									12.28	15.51	11.98	16.5

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3									108.7	104.6	94.05	92.6
6	Timah Hitam (Pb)	ug/m3									0.03	0.03	0.02	0.03
7	Karbon Monoksida (CO)	ug/m3									<1.145	1.178	<1.145	<1.145
8	Hidrokarbon (HC)	ug/m3												
9	PM10	ug/m3												
10	PM2,5	ug/m3												
11	Amoniak (NH3)	ppm												
12	Hidrogen Sulfida (H2S)	ppm												
11	Amoniak (NH3)	ppm									0.0046	0.0062	0.0034	0.0056
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	<0.0002
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												
5	10	10^-6 m												
6	12.5	10^-6 m												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												
10	31.5	10^-6 m												
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	4	mm/sec												
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												
8	25	mm/sec												
9	31.5	mm/sec												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem2	Sem 1	Sem2
10	40	mm/sec												
11	50	mm/sec												
Vibration Frequency														
1	Accelerate	mm/sec												
2	Velocity	mm/sec												
Vibration Frequency (Smt 1 2015)														
1	*Access Road*	dBA												
Vibration Frequency (Peak) Hz														
1	Desa Sukaresmi	mm/sec									0.3	0.1	0.1	0.1

Table 27 Climate, Air Quality, Noise and Vibration in Bojong Salam Village at 2013 - 2016

No.	Parameter	Unit	2013	2014		2015		2016	
			Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data									
1	Temperature	°C	28.8-30.1	35.2	39.4	33.15	32.83	28.59	26.2
2	Humidity (RH)	%	55-68	51.2	38.5	55.53	51.4	65.12	79.62
3	Air Pressure	mmHg		763.14	757.17	693.45	694.43	696.15	695.55
4	Wind Direction		E	S	W	W	W	W	W
5	Wind Speed	Km/Hour	0.2 - 1.4	0.2	1.5	1.21	2.07	0.35	0.72
6	Weather		Cloudy	Cloudy	Bright				
Noise Level									
1	Daytime Noise (Ls)	dB	50.3	50.9	67.8	42.52	39	43.88	54.72
2	Night Noise (Lm)	dB	49.9	46	61				
3	Day and Night Noise (Lsm)	dB	52.6	47.5	63.4				
Air Quality									
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3							
2	Nitrogen Dioksida (NO2)	ug/m3	21.34	<20	23.7	< 10	< 10	< 10	<10
3	Sulfur Dioksida (SO2)	ug/m3	13.69	<20	<20	< 17,15	< 17,15	< 17,15	<17.15
4	Oksidan (O2)	ug/m3	17	<10	21.6	< 15,61	< 15,61	< 15,61	<15.61

No.	Parameter	Unit	2013	2014		2015		2016	
			Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3	93.06	23.5	49.8	59	71.1	80.3	26.8
6	Timah Hitam (Pb)	ug/m3	0.016	<0.5	<0.5	0.02	0.05	0.01	0.05
7	Karbon Monoksida (CO)	ug/m3	416.2	<1000	<1000	< 1,145	< 1,145	< 1,145	<1.145
8	Hidrokarbon (HC)	ug/m3	15.75	<100	<100	2.5	8.6	6.6	6.1
9	PM10	ug/m3							65.4
10	PM2.5	ug/m3							65.7
11	Amoniak (NH3)	ppm							
12	Hidrogen Sulfida (H2S)	ppm							
Vibration Frequency (Mikron) Hz									
1	4	10^-6 m		22.568	0.1864				
2	5	10^-6 m		21.582	0.2349				
3	6.3	10^-6 m		18.487	0.544				
4	8	10^-6 m		12.567	1.039				
5	10	10^-6 m		6.695	1.3067				
6	12.5	10^-6 m		4.584	1.6183				
7	16	10^-6 m		1.555	1.8506				
8	20	10^-6 m		0.824	1.5957				
9	25	10^-6 m		0.536	1.312				

No.	Parameter	Unit	2013	2014		2015		2016	
			Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
10	31.5	10^-6 m		0.347	0.9236				
11	40	10^-6 m		0.259	0.6278				
12	50	10^-6 m		0.089	0.4484				
13	63	10^-6 m		0	0.0029				
Vibration Frequency (Peak) Hz									
1	4	mm/sec		0.567	0.0074				
1	5	mm/sec		0.678	0.0075				
2	6.3	mm/sec		0.731	0.0138				
3	8	mm/sec		0.631	0.0207				
4	10	mm/sec		0.42	0.0208				
5	12.5	mm/sec		0.36	0.0206				
6	16	mm/sec		0.156	0.0184				
7	20	mm/sec		0.104	0.0127				
8	25	mm/sec		0.084	0.0084				
9	31.5	mm/sec		0.069	0.0047				
10	40	mm/sec		0.065	0.0025				
11	50	mm/sec		0.028	0.0014				
Vibration Frequency									

No.	Parameter	Unit	2013	2014		2015		2016	
			Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
1	Accelerate	mm/sec	0.1						
2	Velocity	mm/sec	0.5						
Vibration Frequency (Peak) Hz									
1	Bojongsalam	mm/sec				0.045	0.1	0.9	0.07

Table 28 Climate, Air Quality, Noise and Vibration in Cibima Village at 1998, 2007, 2012 – 2013

No.	**Parameter**	**Unit**	**1998**	**2001**	**2007**		**2011**		**2012**		**2013**	
			PT. PLN	**PT. PLN**	**NewJec**	**AMDAL**	**AMDAL**		**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
Climatology Data												
1	Temperature	°C								23	28	26.8-30.0
2	Humidity (RH)	%								90	83	61 - 70
3	Air Pressure	mmHg								754	754	
4	Wind Direction									S	S	E
5	Wind Speed	Km/Hour								1.6	2.6	0.2 - 1.4
6	Weather									Cloudy	Cloudy	Cloudy
Noise Level												
1	Daytime Noise (Ls)	dB	36.5		49.28					56.95	69.53	50.8
2	Night Noise (Lm)	dB	32.5		45.52					49.76	59.7	49.9
3	Day and Night Noise (Lsm)	dB				47.4				55.58	67.99	50.6
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3				36.02				67.5	30.4	
2	Nitrogen Dioksida (NO2)	ug/m3			<4							23.44
3	Sulfur Dioksida (SO2)	ug/m3			210.67							14.67
4	Oksidan (O2)	ug/m3										15.81
5	Debu (TSP)	ug/m3			54.69							91.33

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							0.018
7	Karbon Monoksida (CO)	ug/m3			302.61							431.8
8	Hidrokarbon (HC)	ug/m3			tt							15.85
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	4	mm/sec										
2	5	mm/sec										
3	6.3	mm/sec										
4	8	mm/sec										
5	10	mm/sec										
6	12.5	mm/sec										
7	16	mm/sec										
8	20	mm/sec										
9	25	mm/sec										
10	31.5	mm/sec										
11	40	mm/sec										
12	50	mm/sec										
Vibration Frequency												
1	Accelerate	mm/sec										0.1

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
2	Velocity	mm/sec										0.4
Vibration Frequency (Peak) Hz												
1	Desa Cibima	mm/sec										

Table 29 Climate, Air Quality, Noise and Vibration in Cibima Village at 2014 – 2019

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C	25.1	32	31.66	33.88	-	-	28.53	28.77	31.3	30.4	30.7	31.89
2	Humidity (RH)	%	82.1	48.4	58.33	49.95	-	-	56.68	56.82	52.92	54.77	58.65	55.5
3	Air Pressure	mmHg	760.1	760.47	692.7	693.38	-	-	693.53	690	695.25	697.88	688.88	696.15
4	Wind Direction		W	W	W	W	-	-	W	W	E	W	E	E
5	Wind Speed	Km/Hour	0.3	1.8	0.81	2.55	-	-	2.28	0.88	1.05	0.6	2.33	1.07
6	Weather		Bright	Cloudy			-	-						
Noise Level														
1	Daytime Noise (Ls)	dB	48.3	62.6	40.92	47.8	49.55	53.28	52.63	46.41	39	50.1	52.91	39.05
2	Night Noise (Lm)	dB	45.1	54.8										
3	Day and Night Noise (Lsm)	dB	42.2	60.7										
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3	<20	26.4	<10	< 10	-	-	<2.24	<8.1	<8,10	<8,10	<8,10	<8.10
3	Sulfur Dioksida (SO2)	ug/m3	<20	<20	<17.15	< 17,15	-	-	5.43	7.82	7.06	34.78	22.89	14.64
4	Oksidan (O2)	ug/m3	<10	17	<15.61	< 15,61	-	-	10.64	21.89	11.7	16.52	11.56	15.12
5	Debu (TSP)	ug/m3	33.3	34.1	61	91.3	-	-	68.9	59.6	89	98.7	61.22	94.6

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
6	Timah Hitam (Pb)	ug/m3	<0.5	<0.5	0.02	0.02	-	-	0.02	0.02	0.03	0.03	0.02	0.03
7	Karbon Monoksida (CO)	ug/m3	<1000	<1000	<1.145	< 1,145	-	-	<1.145	<1.145	<1.145	<1,145	<1,145	<1.145
8	Hidrokarbon (HC)	ug/m3	<100	<100	4.2	6.6	-	-	5.4	7.9				
9	PM10	ug/m3							25.6	40.7				
10	PM2.5	ug/m3							40.3	30.6				
11	Amoniak (NH3)	ppm									0.0051	0.0061	0.0037	0.0066
12	Hidrogen Sulfida (H2S)	ppm									<0.0002	<0.0002	<0.0002	<0.0002
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m	1.013	0.0634										
2	5	10^-6 m	9.473	0.0882										
3	6.3	10^-6 m	12.615	0.1374										
4	8	10^-6 m	10.608	0.1984										
5	10	10^-6 m	4.485	0.3017										
6	12.5	10^-6 m	3.295	0.3722										
7	16	10^-6 m	3.441	0.4117										
8	20	10^-6 m	1.001	0.3525										
9	25	10^-6 m	0.61	0.3305										
10	31.5	10^-6 m	0.678	0.303										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m	0.422	0.2473										
12	50	10^-6 m	0.128	0.2328										
13	63	10^-6 m	0	0.0637										
Vibration Frequency (Peak) Hz														
1	4	mm/sec	0.252	0.0025										
2	5	mm/sec	0.297	0.0028										
3	6.3	mm/sec	0.499	0.0035										
4	8	mm/sec	0.533	0.004										
5	10	mm/sec	0.282	0.0048										
6	12.5	mm/sec	0.259	0.0047										
7	16	mm/sec	0.346	0.0041										
8	20	mm/sec	0.126	0.0028										
9	25	mm/sec	0.096	0.0021										
10	31.5	mm/sec	0.134	0.0015										
11	40	mm/sec	0.106	0.001										
12	50	mm/sec	0.04	0.0007										
Vibration Frequency														
1	Accelerate	mm/sec												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
2	Velocity	mm/sec												
Vibration Frequency (Peak) Hz														
1	Desa Cibima	mm/sec			0.045	0.1	0.5	0.06	0.29	0.4	0.2	0.1	0.1	0.1

Table 30 Climate, Air Quality, Noise and Vibration in Karang Nunggal Village at 1998 and 2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										26.1-31.2
2	Humidity (RH)	%										48 - 78
3	Air Pressure	mmHg										
4	Wind Direction											W
5	Wind Speed	Km/Hour										0.2 - 1.26
6	Weather											Bright
Noise Level												
1	Daytime Noise (Ls)	dB	43.2									47.6
2	Night Noise (Lm)	dB	40.5									46.7
3	Day and Night Noise (Lsm)	dB										48.2
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3										16.13
3	Sulfur Dioksida (SO2)	ug/m3										10.99
4	Oksidan (O2)	ug/m3										27.76

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
5	Debu (TSP)	ug/m3										56.74
6	Timah Hitam (Pb)	ug/m3										<0.0001
7	Karbon Monoksida (CO)	ug/m3										462.8
8	Hidrokarbon (HC)	ug/m3										12.31
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm										
12	Hidrogen Sulfida (H2S)	ppm										
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										

No.	Parameter	Unit	1998 PT. PLN	2001 PT. PLN	2007 NewJec	2007 AMDAL	2011 AMDAL	2011	2012 Sem 1	2012 Sem2	2013 Sem 1	2013 Sem2
10	31.5	10^-6 m										
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										
Vibration Frequency												
1	Accelerate	mm/sec										0.1

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
2	Velocity	mm/sec										0.3
Tingkat Getaran												
1	Desa Karangnunggal	mm/sec										

Tabel Climate, Air Quality, Noise and Vibration in Karang Nunggal Village at 2016 - 2017

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Climatology Data														
1	Temperature	°C					32	28.52	29.85	29.83				
2	Humidity (RH)	%					59.19	84.2	52.07	54.87				
3	Air Pressure	mmHg					723.39	723.24	723.24	726.16				
4	Wind Direction						W	W	W	E				
5	Wind Speed	Km/Hour					0.8	1.08	0.58	0.77				
6	Weather													
Noise Level														
1	Daytime Noise (Ls)	dB					45.38	53.97	50.42	42.22				
2	Night Noise (Lm)	dB												
3	Day and Night Noise (Lsm)	dB												
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3					<10	<10	<2.24	<8.1				
3	Sulfur Dioksida (SO2)	ug/m3					<17.15	17.6	<2.24	13.8				
4	Oksidan (O2)	ug/m3					<15.61	235	6.99	12				
5	Debu (TSP)	ug/m3					103	28.7	75.9	55.6				

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3					0.05	0.05	0.03	0.02				
7	Karbon Monoksida (CO)	ug/m3					<1.145	<1.145	<1.145	<1.145				
8	Hidrokarbon (HC)	ug/m3					10.6	8.6	7.4	8				
9	PM10	ug/m3					90.8	80.5	80.2	41.3				
10	PM2.5	ug/m3					96.5	81.9	87.5	30.7				
11	Amoniak (NH3)	ppm												
12	Hidrogen Sulfida (H2S)	ppm												
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m												
2	5	10^-6 m												
3	6.3	10^-6 m												
4	8	10^-6 m												
5	10	10^-6 m												
6	12.5	10^-6 m												
7	16	10^-6 m												
8	20	10^-6 m												
9	25	10^-6 m												
10	31.5	10^-6 m												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m												
12	50	10^-6 m												
13	63	10^-6 m												
Vibration Frequency (Peak) Hz														
1	5	mm/sec												
2	6.3	mm/sec												
3	8	mm/sec												
4	10	mm/sec												
5	12.5	mm/sec												
6	16	mm/sec												
7	20	mm/sec												
8	25	mm/sec												
9	31.5	mm/sec												
10	40	mm/sec												
11	50	mm/sec												
Vibration Frequency														
1	Accelerate	mm/sec												
2	Velocity	mm/sec												

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Tingkat Getaran														
1	Desa Karangnunggal	mm/sec					0.6	0.06	0.14	0.5				

Table 32 Climate, Air Quality, Noise and Vibration in Cibitung Village at 2013

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C									20	
2	Humidity (RH)	%									89	
3	Air Pressure	mmHg									692	
4	Wind Direction										W	
5	Wind Speed	Km/Hour									1.3	
6	Weather										Cloudy	
Noise Level												
1	Daytime Noise (Ls)	dB										
2	Night Noise (Lm)	dB										
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3									23.5	
2	Nitrogen Dioksida (NO2)	ug/m3										
3	Sulfur Dioksida (SO2)	ug/m3										
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3										
7	Karbon Monoksida (CO)	ug/m3										
8	Hidrokarbon (HC)	ug/m3										
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm										
12	Hidrogen Sulfida (H2S)	ppm										
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Table 33 Climate, Air Quality, Noise and Vibration in Sukarama Village at 2014-2016

No.	**Parameter**	**Unit**	**2014**		**2015**		**2016**		**2017**		**2018**		**2019**	
			Sem 1	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**	**Sem 1**	**Sem2**
Climatology Data														
1	Temperature	°C	28.8	35.8	30.5	33.07								
2	Humidity (RH)	%	71.8	52.8	58.51	51.8								
3	Air Pressure	mmHg	759.09	768.6	723.24	690.53								
4	Wind Direction		S	W	W	E								
5	Wind Speed	Km/Hour	0.1	1.2	0.95	1.67								
6	Weather		Bright	Cloudy										
Noise Level														
1	Daytime Noise (Ls)	dB	54.1	61.3										
2	Night Noise (Lm)	dB	48	59.7										
3	Day and Night Noise (Lsm)	dB	49.6	60										
Air Quality														
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3												
2	Nitrogen Dioksida (NO2)	ug/m3	<20	<20	< 10	< 10								
3	Sulfur Dioksida (SO2)	ug/m3	<20	<20	< 17,15	< 17,15								
4	Oksidan (O2)	ug/m3	<10	13.4	< 15,61	< 15,61								
5	Debu (TSP)	ug/m3	11.9	39.7	40.3	68.8								

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3	<0.5	<0.5	0.01	0.05								
7	Karbon Monoksida (CO)	ug/m3	<1000	<1000	< 1,145	< 1,145								
8	Hidrokarbon (HC)	ug/m3	<100	<100	2.4	8.6								
9	PM10	ug/m3												
10	PM2,5	ug/m3												
11	Amoniak (NH3)	ppm												
12	Hidrogen Sulfida (H2S)	ppm												
Vibration Frequency (Mikron) Hz														
1	4	10^-6 m	11.373	0.015										
2	5	10^-6 m	46.477	0.0161										
3	6.3	10^-6 m	48.524	0.0197										
4	8	10^-6 m	40.518	0.0281										
5	10	10^-6 m	28.763	0.0407										
6	12.5	10^-6 m	10.912	0.0728										
7	16	10^-6 m	24.681	0.1038										
8	20	10^-6 m	3.061	0.1741										
9	25	10^-6 m	1.838	0.2828										
10	31.5	10^-6 m	1.44	0.3649										

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m	1.73	0.433										
12	50	10^-6 m	0.208	0.4486										
13	63	10^-6 m	0.062	0.1446										
Vibration Frequency (Peak) Hz														
1	4	mm/sec	0.286	**0.0006**										
1	5	mm/sec	1.459	0.0005										
2	6.3	mm/sec	1.92	0.0005										
3	8	mm/sec	2.036	0.0006										
4	10	mm/sec	1.806	0.0006										
5	12.5	mm/sec	0.857	0.0009										
6	16	mm/sec	2.48	0.001										
7	20	mm/sec	0.385	0.0014										
8	25	mm/sec	0.289	0.0018										
9	31.5	mm/sec	0.285	0.0018										
10	40	mm/sec	0.435	0.0017										
11	50	mm/sec	0.065	0.0014										
Noise Level (Smt 1 2015)														
1	Pemukiman dkt *up dam*	dBA			43.84	39.3								

No.	Parameter	Unit	2014		2015		2016		2017		2018		2019	
			Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2	Sem 1	Sem2
Vibration Frequency (Smt 1 2015)														
1	Pemukiman dkt *up dam*	dBA			0.3	0.1								

Table 34 Climate, Air Quality, Noise and Vibration in Upper Reservoir at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			54.8							
2	Night Noise (Lm)	dB			44.65							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			121.62							
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3			83.16							

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			304.41							
8	Hidrokarbon (HC)	ug/m3			tt							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Table 35 Climate, Air Quality, Noise and Vibration in Power House at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			53.54							
2	Night Noise (Lm)	dB			42.53							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			121.37							
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3			36.02							

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			304.41							
8	Hidrokarbon (HC)	ug/m3			tt							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Table 36 Climate, Air Quality, Noise and Vibration in Lower Reservoir at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			54.65							
2	Night Noise (Lm)	dB			45.65							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			141.37							
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3			44.91							

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			204.45							
8	Hidrokarbon (HC)	ug/m3			tt							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Table 37 Climate, Air Quality, Noise and Vibration in Bojong Picung Street at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			65.5							
2	Night Noise (Lm)	dB			51.2							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			200.14							
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3			69.78							

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			200.54							
8	Hidrokarbon (HC)	ug/m3			ud							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Table 38 Climate, Air Quality, Noise and Vibration in Sukmajaya Village (Gunung Halu) at 2007

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
Climatology Data												
1	Temperature	°C										
2	Humidity (RH)	%										
3	Air Pressure	mmHg										
4	Wind Direction											
5	Wind Speed	Km/Hour										
6	Weather											
Noise Level												
1	Daytime Noise (Ls)	dB			69.5							
2	Night Noise (Lm)	dB			50.2							
3	Day and Night Noise (Lsm)	dB										
Air Quality												
1	Partikel (TSP) SNI 19-7119.3-2005	ug/m3										
2	Nitrogen Dioksida (NO2)	ug/m3			<4							
3	Sulfur Dioksida (SO2)	ug/m3			331.67							
4	Oksidan (O2)	ug/m3										
5	Debu (TSP)	ug/m3			69.07							

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
6	Timah Hitam (Pb)	ug/m3			<0.01							
7	Karbon Monoksida (CO)	ug/m3			304.41							
8	Hidrokarbon (HC)	ug/m3			ud							
9	PM10	ug/m3										
10	PM2.5	ug/m3										
11	Amoniak (NH3)	ppm			<0.1							
12	Hidrogen Sulfida (H2S)	ppm			<0.005							
Vibration Frequency (Mikron) Hz												
1	4	10^-6 m										
2	5	10^-6 m										
3	6.3	10^-6 m										
4	8	10^-6 m										
5	10	10^-6 m										
6	12.5	10^-6 m										
7	16	10^-6 m										
8	20	10^-6 m										
9	25	10^-6 m										
10	31.5	10^-6 m										

No.	Parameter	Unit	1998	2001	2007		2011		2012		2013	
			PT. PLN	PT. PLN	NewJec	AMDAL	AMDAL		Sem 1	Sem2	Sem 1	Sem2
11	40	10^-6 m										
12	50	10^-6 m										
13	63	10^-6 m										
Vibration Frequency (Peak) Hz												
1	5	mm/sec										
2	6.3	mm/sec										
3	8	mm/sec										
4	10	mm/sec										
5	12.5	mm/sec										
6	16	mm/sec										
7	20	mm/sec										
8	25	mm/sec										
9	31.5	mm/sec										
10	40	mm/sec										
11	50	mm/sec										

Appendix 13 Biodiversity

Table 39 Fish in Quarry Area at 1998, 2001 and 2007

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	Scientific Name	PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*									
2	Baung	*Mystus sp.*									
3	Bogo	*Chana sp.*		√							
4	Genggehek	*Mystacoleucus sp.*			√						
5	Hampal	*Hampala sp.*			√						
6	Kobogeurang	*Mystus sp.*									
7	Kehkel	*Glypthothorax sp.*			√						
8	Lalawak	*Barbonymus sp.*									
9	Lele	*Clarias sp.*	√	√*							
10	Nila	*Osteochilus sp.*									
11	Parai	*Puntius sp.*									
12	Tagih	*Mystus sp.*									
13	Mas	*Cyrpinus carpio*		√*							
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*	√	√							
17	Mujair	*Oreochromis mossambica*									
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*									
27	Julung-Julung	*Dermogenys pusilus*									
28	Lais	*Lais hexamena*									
29	Lempuk	*Callichrous bimaculatus*									
30	Tawes	*Puntius javanicus*									
31	Impun		√	√							
32	Careh	*Chryptoterus sp*		√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 40 Fish in Cijambu River at 2001, 2007, 2013 – 2014

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	Scientific Name	PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*							-		
2	Baung	*Mystus sp.*							-		
3	Bogo	*Chana sp.*		√					√		
4	Genggehek	*Mystacoleucus sp.*			√				-		
5	Hampal	*Hampala sp.*			√				-	√	
6	Kobogeurang	*Mystus sp.*							-	√	
7	Kehkel	*Glypthothorax sp.*			√				√		
8	Lalawak	*Barbonymus sp.*							-	√	
9	Lele	*Clarias sp.*		√*					√	√	
10	Nila	*Osteochilus sp.*							√	√	
11	Parai	*Puntius sp.*							√		
12	Tagih	*Mystus sp.*							-	√	
13	Mas	*Cyrpinus carpio*		√*						√	
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*		√						√	
17	Mujair	*Oreochromis mossambica*								√	
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*								√	
27	Julung-Julung	*Dermogenys pusilus*								√	
28	Lais	*Lais hexamena*								√	
29	Lempuk	*Callichrous bimaculatus*								√	
30	Tawes	*Puntius javanicus*								√	
31	Impun			√							
32	Careh	*Chryptoterus sp*		√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 41 Fish in Cijambu Riber at 2015 - 2019

No.	Organisme	2015	2016	2017	2018	2019

	Local Name	Scientific Name	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*										
2	Baung	*Mystus sp.*										
3	Bogo	*Chana sp.*	√	√	√	√						
4	Genggehek	*Mystacoleucus sp.*					√	√	√	√	√	√
5	Hampal	*Hampala sp.*										
6	Kobogeurang	*Mystus sp.*										
7	Kehkel	*Glypthothorax sp.*					√	√	√	√	√	√
8	Lalawak	*Barbonymus sp.*										
9	Lele	*Clarias sp.*	√	√	√	√	√	√	√	√	√	√
10	Nila	*Osteochilus sp.*	√	√	√	√	√	√	√	√	√	√
11	Parai	*Puntius sp.*					√	√	√	√	√	√
12	Tagih	*Mystus sp.*										
13	Mas	*Cyrpinus carpio*	√	√	√	√	√	√	√	√	√	√
14	Senggal		√	√	√	√	√	√	√	√	√	√
15	Hurang						√	√	√	√	√	√
16	Benteur	*Puntius binotatus*	√	√	√	√	√	√	√	√	√	√
17	Mujair	*Oreochromis mossambica*	√	√	√	√	√	√	√	√	√	√
18	Kancra						√	√	√	√	√	√
19	Sapu-sapu		√	√	√	√						
20	Sepat		√	√	√	√						
21	Betok		√	√	√	√						
22	Bungkreung/Gendol		√	√	√	√						
23	Kepiting		√	√	√	√						
24	Udang		√	√	√	√						
25	Remis		√	√	√	√						
26	Gabus	*Chana striatus*										
27	Julung-Julung	*Dermogenys pusilus*										
28	Lais	*Lais hexamena*										
29	Lempuk	*Callichrous bimaculatus*										
30	Tawes	*Puntius javanicus*										
31	Impun											
32	Careh	*Chryptoterus sp*										
33	Tilapia											
34	Nilem											

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 42 Fish in Upper Cisokan River at 1998, 2001, 2007, 2013 – 2014

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	Scientific Name	PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2

1	Balar	*Barbonymus sp.*							√		
2	Baung	*Mystus sp.*							√		
3	Bogo	*Chana sp.*	√	√					√		
4	Genggehek	*Mystacoleucus sp.*			√				√		
5	Hampal	*Hampala sp.*			√				√	√	
6	Kobogeurang	*Mystus sp.*							√	√	
7	Kehkel	*Glypthothorax sp.*			√				-		
8	Lalawak	*Barbonymus sp.*							√	√	
9	Lele	*Clarias sp.*	√	√*					√	√	
10	Nila	*Osteochilus sp.*							√	√	
11	Parai	*Puntius sp.*							√		
12	Tagih	*Mystus sp.*							√	√	
13	Mas	*Cyrpinus carpio*		√*						√	
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*	√	√						√	
17	Mujair	*Oreochromis mossambica*	√							√	
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*								√	
27	Julung-Julung	*Dermogenys pusilus*								√	
28	Lais	*Lais hexamena*								√	
29	Lempuk	*Callichrous bimaculatus*								√	
30	Tawes	*Puntius javanicus*								√	
31	Impun		√	√							
32	Careh	*Chryptoterus sp*	√	√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 43 Fish in Upper Cisokan River at 2015 - 2019

No.	Organisme		2015		2016		2017		2018		2019	
	Local Name	Scientific Name	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*										
2	Baung	*Mystus sp.*										
3	Bogo	*Chana sp.*	√	√	√	√						

4	Genggehek	*Mystacoleucus sp.*					√	√	√	√	√	√
5	Hampal	*Hampala sp.*										
6	Kobogeurang	*Mystus sp.*										
7	Kehkel	*Glypthothorax sp.*					√	√	√	√	√	√
8	Lalawak	*Barbonymus sp.*										
9	Lele	*Clarias sp.*	√	√	√	√	√	√	√	√	√	√
10	Nila	*Osteochilus sp.*	√	√	√	√	√	√	√	√	√	√
11	Parai	*Puntius sp.*					√	√	√	√	√	√
12	Tagih	*Mystus sp.*										
13	Mas	*Cyrpinus carpio*	√	√	√	√	√	√	√	√	√	√
14	Senggal		√	√	√	√	√	√	√	√	√	√
15	Hurang						√	√	√	√	√	√
16	Benteur	*Puntius binotatus*	√	√	√	√	√	√	√	√	√	√
17	Mujair	*Oreochromis mossambica*	√	√	√	√	√	√	√	√	√	√
18	Kancra						√	√	√	√	√	√
19	Sapu-sapu		√	√	√	√						
20	Sepat		√	√	√	√						
21	Betok		√	√	√	√						
22	Bungkreung/Gendol		√	√	√	√						
23	Kepiting		√	√	√	√						
24	Udang		√	√	√	√						
25	Remis		√	√	√	√						
26	Gabus	*Chana striatus*										
27	Julung-Julung	*Dermogenys pusilus*										
28	Lais	*Lais hexamena*										
29	Lempuk	*Callichrous bimaculatus*										
30	Tawes	*Puntius javanicus*										
31	Impun											
32	Careh	*Chryptoterus sp*										
33	Tilapia											
34	Nilem											

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 44 Fish in Lower Cisokan River at 1998, 2001, 2007, 2013 – 2014

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	Scientific Name	PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*							√		
2	Baung	*Mystus sp.*							√		
3	Bogo	*Chana sp.*	√	√					√		
4	Genggehek	*Mystacoleucus sp.*			√				√		
5	Hampal	*Hampala sp.*			√				√	√	
6	Kobogeurang	*Mystus sp.*							√	√	
7	Kehkel	*Glypthothorax sp.*			√				-		
8	Lalawak	*Barbonymus sp.*							√	√	
9	Lele	*Clarias sp.*	√	√*					√	√	
10	Nila	*Osteochilus sp.*							√	√	
11	Parai	*Puntius sp.*							√		
12	Tagih	*Mystus sp.*							√	√	
13	Mas	*Cyrpinus carpio*		√*						√	
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*	√	√						√	
17	Mujair	*Oreochromis mossambica*	√							√	
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*								√	
27	Julung-Julung	*Dermogenys pusilus*								√	
28	Lais	*Lais hexamena*								√	
29	Lempuk	*Callichrous bimaculatus*								√	
30	Tawes	*Puntius javanicus*								√	
31	Impun		√	√							
32	Careh	*Chryptoterus sp*	√	√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :
√* Cultivated (Ponds)
√ Natural Habitat (Rivers)

Table 45 Fish in Lower Cisokan River at 2015 – 2019

No.	Organisme	2015	2016	2017	2018	2019

	Local Name	Scientific Name	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*										
2	Baung	*Mystus sp.*										
3	Bogo	*Chana sp.*	√	√	√	√						
4	Genggehek	*Mystacoleucus sp.*					√	√	√	√	√	√
5	Hampal	*Hampala sp.*										
6	Kobogeurang	*Mystus sp.*										
7	Kehkel	*Glypthothorax sp.*					√	√	√	√	√	√
8	Lalawak	*Barbonymus sp.*										
9	Lele	*Clarias sp.*	√	√	√	√	√	√	√	√	√	√
10	Nila	*Osteochilus sp.*	√	√	√	√	√	√	√	√	√	√
11	Parai	*Puntius sp.*					√	√	√	√	√	√
12	Tagih	*Mystus sp.*										
13	Mas	*Cyrpinus carpio*	√	√	√	√	√	√	√	√	√	√
14	Senggal		√	√	√	√	√	√	√	√	√	√
15	Hurang						√	√	√	√	√	√
16	Benteur	*Puntius binotatus*	√	√	√	√	√	√	√	√	√	√
17	Mujair	*Oreochromis mossambica*	√	√	√	√	√	√	√	√	√	√
18	Kancra						√	√	√	√	√	√
19	Sapu-sapu		√	√	√	√						
20	Sepat		√	√	√	√						
21	Betok		√	√	√	√						
22	Bungkreung/Gendol		√	√	√	√						
23	Kepiting		√	√	√	√						
24	Udang		√	√	√	√						
25	Remis		√	√	√	√						
26	Gabus	*Chana striatus*										
27	Julung-Julung	*Dermogenys pusilus*										
28	Lais	*Lais hexamena*										
29	Lempuk	*Callichrous bimaculatus*										
30	Tawes	*Puntius javanicus*										
31	Impun											
32	Careh	*Chryptoterus sp*										
33	Tilapia											
34	Nilem											

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 46 Fish in Upper Cirumamis River at 1998, 2001, 2007, 2013 – 2014

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	Scientific Name	PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2

1	Balar	*Barbonymus sp.*							-		
2	Baung	*Mystus sp.*							-		
3	Bogo	*Chana sp.*	√	√					√		
4	Genggehek	*Mystacoleucus sp.*			√				-		
5	Hampal	*Hampala sp.*			√				-	√	
6	Kobogeurang	*Mystus sp.*							-	√	
7	Kehkel	*Glypthothorax sp.*			√				-		
8	Lalawak	*Barbonymus sp.*							-	√	
9	Lele	*Clarias sp.*	√	√*					√	√	
10	Nila	*Osteochilus sp.*							√	√	
11	Parai	*Puntius sp.*							√		
12	Tagih	*Mystus sp.*							-	√	
13	Mas	*Cyrpinus carpio*		√*						√	
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*	√	√						√	
17	Mujair	*Oreochromis mossambica*	√							√	
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*								√	
27	Julung-Julung	*Dermogenys pusilus*								√	
28	Lais	*Lais hexamena*								√	
29	Lempuk	*Callichrous bimaculatus*								√	
30	Tawes	*Puntius javanicus*								√	
31	Impun		√	√							
32	Careh	*Chryptoterus sp*		√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :
√* Cultivated (Ponds)
√ Natural Habitat (Rivers)

Table 47 Fish in Upper Cirumamis River at 2015 – 2019

No.	Organisme		2015		2016		2017		2018		2019	
	Local Name	**Scientific Name**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
1	Balar	*Barbonymus sp.*										
2	Baung	*Mystus sp.*										
3	Bogo	*Chana sp.*	√	√	√	√						

4	Genggehek	*Mystacoleucus sp.*					√	√	√	√	√	√
5	Hampal	*Hampala sp.*										
6	Kobogeurang	*Mystus sp.*										
7	Kehkel	*Glypthothorax sp.*					√	√	√	√	√	√
8	Lalawak	*Barbonymus sp.*										
9	Lele	*Clarias sp.*	√	√	√	√	√	√	√	√	√	√
10	Nila	*Osteochilus sp.*	√	√	√	√	√	√	√	√	√	√
11	Parai	*Puntius sp.*					√	√	√	√	√	√
12	Tagih	*Mystus sp.*										
13	Mas	*Cyrpinus carpio*	√	√	√	√	√	√	√	√	√	√
14	Senggal		√	√	√	√	√	√	√	√	√	√
15	Hurang						√	√	√	√	√	√
16	Benteur	*Puntius binotatus*	√	√	√	√	√	√	√	√	√	√
17	Mujair	*Oreochromis mossambica*	√	√	√	√	√	√	√	√	√	√
18	Kancra						√	√	√	√	√	√
19	Sapu-sapu		√	√	√	√						
20	Sepat		√	√	√	√						
21	Betok		√	√	√	√						
22	Bungkreung/Gendol		√	√	√	√						
23	Kepiting		√	√	√	√						
24	Udang		√	√	√	√						
25	Remis		√	√	√	√						
26	Gabus	*Chana striatus*										
27	Julung-Julung	*Dermogenys pusilus*										
28	Lais	*Lais hexamena*										
29	Lempuk	*Callichrous bimaculatus*										
30	Tawes	*Puntius javanicus*										
31	Impun											
32	Careh	*Chryptoterus sp*										
33	Tilapia											
34	Nilem											

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 48 Fish in Lower Cirumamis River at 1998, 2001, 2007, 2013 – 2014

No.	Organisme		1998	2001	2007	2012		2013		2014	
	Local Name	**Scientific Name**	**PT. PLN**	**PT. PLN**	**NewJec**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
1	Balar	*Barbonymus sp.*							-		
2	Baung	*Mystus sp.*							-		
3	Bogo	*Chana sp.*	√	√					√		
4	Genggehek	*Mystacoleucus sp.*			√				-		

5	Hampal	*Hampala sp.*			√				-	√	
6	Kobogeurang	*Mystus sp.*							-	√	
7	Kehkel	*Glypthothorax sp.*			√				-		
8	Lalawak	*Barbonymus sp.*							-	√	
9	Lele	*Clarias sp.*	√	√*					√	√	
10	Nila	*Osteochilus sp.*							√	√	
11	Parai	*Puntius sp.*							√		
12	Tagih	*Mystus sp.*							-	√	
13	Mas	*Cyrpinus carpio*		√*						√	
14	Senggal										
15	Hurang										
16	Benteur	*Puntius binotatus*	√	√						√	
17	Mujair	*Oreochromis mossambica*	√							√	
18	Kancra										
19	Sapu-sapu										
20	Sepat										
21	Betok										
22	Bungkreung/Gendol										
23	Kepiting										
24	Udang										
25	Remis										
26	Gabus	*Chana striatus*								√	
27	Julung-Julung	*Dermogenys pusilus*								√	
28	Lais	*Lais hexamena*								√	
29	Lempuk	*Callichrous bimaculatus*								√	
30	Tawes	*Puntius javanicus*								√	
31	Impun		√	√							
32	Careh	*Chryptoterus sp*		√							
33	Tilapia			√*							
34	Nilem			√							

For 2001 :
√* Cultivated (Ponds)
√ Natural Habitat (Rivers)

Table 49 Fish in Lower Cirumamis River at 2015 – 2019

No.	Organisme		2015		2016		2017		2018		2019	
	Local Name	Scientific Name	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Balar	*Barbonymus sp.*										
2	Baung	*Mystus sp.*										
3	Bogo	*Chana sp.*	√	√	√	√						
4	Genggehek	*Mystacoleucus sp.*					√	√	√	√	√	√
5	Hampal	*Hampala sp.*										
6	Kobogeurang	*Mystus sp.*										

7	Kehkel	*Glypthothorax sp.*					√	√	√	√	√	√
8	Lalawak	*Barbonymus sp.*										
9	Lele	*Clarias sp.*	√	√	√	√	√	√	√	√	√	√
10	Nila	*Osteochilus sp.*	√	√	√	√	√	√	√	√	√	√
11	Parai	*Puntius sp.*					√	√	√	√	√	√
12	Tagih	*Mystus sp.*										
13	Mas	*Cyrpinus carpio*	√	√	√	√	√	√	√	√	√	√
14	Senggal		√	√	√	√	√	√	√	√	√	√
15	Hurang						√	√	√	√	√	√
16	Benteur	*Puntius binotatus*	√	√	√	√	√	√	√	√	√	√
17	Mujair	*Oreochromis mossambica*	√	√	√	√	√	√	√	√	√	√
18	Kancra						√	√	√	√	√	√
19	Sapu-sapu		√	√	√	√						
20	Sepat		√	√	√	√						
21	Betok		√	√	√	√						
22	Bungkreung/Gendol		√	√	√	√						
23	Kepiting		√	√	√	√						
24	Udang		√	√	√	√						
25	Remis		√	√	√	√						
26	Gabus	*Chana striatus*										
27	Julung-Julung	*Dermogenys pusilus*										
28	Lais	*Lais hexamena*										
29	Lempuk	*Callichrous bimaculatus*										
30	Tawes	*Puntius javanicus*										
31	Impun											
32	Careh	*Chryptoterus sp*										
33	Tilapia											
34	Nilem											

For 2001 :

√* Cultivated (Ponds)

√ Natural Habitat (Rivers)

Table 50 Aquatic Biota in Cilengkong River at 1998, 2007 and 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachellomonas sp.												
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.												
8	Microcrcys sp.												
9	Eunotia sp												
10	stephanodiscus sp												
11	Chroococcus sp												
12	Lyngbya sp												
13	Gomphosphaeria sp.												
14	Microcystis sp												
15	calanus sp.												
16	pleurothaenium sp											-	
17	zygogonium											30	
18	chlamydomonan sp											-	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				-							-	
25	Chlorella sp												200
26	Coscinodiscus sp												-
27	Cyclotella sp												20
28	Hemidiscus sp												-
29	Oocystis sp												10
30	Protococcus sp												-
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
	Bacillariophyceae												
1	Closterium sp.												
	Chyanopyta												
1	Aphanocapsa sp												
2	Merismopedia sp												
3	Oscilatoria sp.				700								
4	Oscillatoria sp1												
5	Oscillatoria sp2												
6	zygnema sp												
7	Anabaena sp												
8	Sprulina												
	Chrysophyta												
1	Amphora sp												-
2	Achanthes sp1												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2												
4	Cocconeis sp				50							-	
5	Chymbella sp											-	-
6	Coscinodicus sp1												
7	Coscinodicus sp2												
8	Diatoma sp											-	
9	Diatoma vulgaris												
10	Fragilaria sp.												
11	Fragillaria sp1												
12	Fragillaria sp2												
13	Fragilaria copucina											30	
14	Frustulia sp												
15	Gomphonema sp											-	
16	Navicula sp				**50**							-	20
17	Navicula sp1												
18	Navicula sp2												
19	Navicula sp3												
20	Navicula sp4												
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma												
24	Nitzschia sp											-	20
25	Nitzschia sp1												
26	Nitzschia sp2												
27	Nitzchia palea												
28	Pinnularia sp											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1												
30	Pinnularia sp2												
31	Pleurosigma sp1												
32	Pleurosigma sp2												
33	Pleurosigma sp3												
34	Surirela sp												
35	Surirella sp1												
36	Surirella sp2												
37	Surirella sp3												
38	Surirella elegans											60	
39	Synedra sp.											-	-
40	Synedro ulna											-	
41	Cladophora sp.											-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											30	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.											1170	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				-								
53	Vaucheria sp				-								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											-	
58	Melosira moniliformis												
59	Phormodium sp.											-	50
60	Rhizosolenia sp.												
61	Spirogyra												
62	Stigonema sp												
63	Tablelaria flocculosa											-	
64	Thallasionema sp.												
65	Aulacoseria sp.												
	Chlorophyta												
1	Closterium sp											-	-
2	Closterium sp1												
3	Closterium sp2												
4	Closterium setaceum												
5	Coelastrum sp												
6	Cosmarium sp												
7	Euastrum sp												
8	Pediastrum simplex												
9	Pediastrum duplex												
10	Pediastrum sp											30	
11	Pediastrum sp1												
12	Pediastrum sp2												
13	Pleototanium sp												
14	Scenedesmus sp											-	-

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1												
16	Scenedesmus sp2												
17	Scenedesmus sp3												
18	Scenedesmus guadricouda												
19	Scenedesmus ellipsoideus												
20	Scenedesmus ermotus												
21	Scenedesmus longispina												
22	Scenedesmus dimorphus												
23	Scenedesmus ecuminatus												
24	Tetmemorius sp												
	Euglenophyta												
1	Euglena acus												
2	Euglena sp												
3	phacus ionicauda												
4	phacus undulatus												
5	phacus sp												
6	Audouinella sp												
	Perifiton												
1	Total Perifiton												
2	ID Simpson												
	Pyhtoplankton Sum												
1	Total Phytoplankton											1350	420
2	ID Simpson											0.215	0.695
3	ID Shannon Wienner												1.4723
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)												
6	Jumlah Taxa												
7	Indeks Diversitas												
8	Shanon-Waeaver												
9	H-max												
10	Equitabilitas												
	ZOOPLANKTON												
	Mollusca												
1	Larva Molusca												
	Artropoda												
	Crustaceae												
1	Larva kepiting												
2	Larva udang												
	Branciopoda												
1	Branciopoda sp												
	Copepoda												
1	Cyelops sp											-	20
	Protozoa												
	Dinophyceae												
1	Peridinium sp												
	Ciliata												
1	Colpoda sp												-
2	Didinium sp												
3	Glaucoma sp												
4	Lionclus sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp												
6	Vorticella sp.												
7	Paramaecium sp.				-							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											-	
	Rhizopoda												
1	Arcella Sp											50	10
2	Arcella discoides												
3	Arcella viilgaris												
4	Amoeba sp												
5	Centropyxis sp.											90	
6	Centropyxis acureata												
7	Spirozona sp.												
8	Diffugia sp											60	
9	Panagrolaimus sp.												
10	Euglypha sp											-	
11	Euglypha sp1												
12	Euglypha sp2												
	Flagellata												
1	Anisonema												
2	Peranema sp												
	Trochelmintes												
	Rotifera												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp												
2	Brachionus sp.												
3	Keratella sp.												
4	Copepoda												
Rotatoria													
1	Licone sp												
2	Monostyla sp											30	
3	Epistylis sp											60	
4	Loxofillum sp											-	
5	Chilodonella sp											-	
6	Ichtydium sp											-	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.												
11	Phylodina sp.											-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											30	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp												
23	Macrostella sp.												
24	Nauplii											-	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											-	
28	Spirostomum sp.											30	
29	Cephalodella sp.											-	-
30	Bursaria sp.											-	
31	Psilotricha sp.											30	
32	Platyas sp												
33	Rhabdolaimus sp.												
34	Diaptomus sp.												
35	Tintinnopsis sp.												10
36	Rotifera sp												
37	Sacamoeba sp												
Zooplankton Sum													
1	Jumlah Individu/L											360	40
2	Jumlah Taxa												
3	Indeks Diversitas												
4	Shanon-Waeaver												
5	H-max												
6	Equitabilitas												
7	Indeks Dominansi Simpson (C)											0.847	0.652
8	Indeks Dominansi Shanon Wienner												1.2424
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
	Plankton Sum												
1	Jumlah Individu/L				800							1710	460
2	Jumlah Taxa				3								
3	Indeks Diversitas												
4	Shanon-Waeaver												
5	H-max												
6	Equitabilitas												
7	Indeks Dominansi Simpson (C)				0.23							0.317	0.257
8	Indeks Dominansi Shanon Wienner				0.46								1.7301
9	Indeks Kemerataan (E)												0.722
10	Indeks Diversitas Simpson plankton												0.7429
	BENTHOS												
1	Baetis sp.												
2	Tiara sp.												
3	Hydrophyceae sp.												
4	Planaria sp												
5	Enalagma sp												
6	Helobdella sp												
7	Sulcospira sp.												-
8	Anadara sp											-	
9	Bursa sp											5	
10	Cerithideopsilla sp.											-	
11	Conus sp											-	
12	Corbicula sp											5	
13	Littorina sp											-	
14	Tellina sp											5	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											-	
16	Trochus sp.											5	
17	Tubifex sp												
18	Wattebledia sp												
	Bivalia												
1	Carbicula javanica												
2	Plisbryoconcaha exilis												
	Grastropoda												
1	Lymnaea sp												-
2	Physa sp.												
3	Goniobasis livescen												
4	Campeloma sp.												
5	Pomacea canaliculata												
6	Parathelpusa sp.												
7	Ena sp												
8	Pila ampullacea sp												
9	Melanoides sp												3
	Arthropoda												
	Insecta												
	Diptera												
1	Chironomiae												
2	Diptera (sp 1 larva)												
3	Diptera (sp 1 pupa)												
4	Diptera (sp 2 pupa)												
5	Diptera (sp 3 pupa)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Coleopetra													
1	Elimiade												
2	Coleopatra sp 1												
3	Coleopatra sp 2												
Annelida													
Olygochaeta													
1	Olygochaeta sp												
2	Olygochaeta sp1												
3	Olygochaeta sp2												
Nemathelminthes													
1	Nematoda sp												
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp												
6	Tarebia sp.												
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
Benthos Sum													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2											20	3
2	ID Shannon & wienner benthos											1.386	0
3	Jumlah Individu/L												
4	Jumlah Taxa												
5	Indeks Diversitas												
6	Shanon-Waeaver												
7	H-max												
8	Equitabilitas												
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
MACROINVERTEBRATE													
1	Acreneuria sp.				-								
2	Berosus sp.				-								
3	Campolema sp.				-								
4	Cerithidae sp.				-								
5	Gonidae sp.				-								
6	Heisoma sp.				-								
7	Lymnaea sp.				-								-
8	Pleurocera sp.				-								
9	Pteronarcys sp.				-								
10	Stenelmis sp.				-								
11	Steronema sp.				-								
12	Tarebia sp.				1								
13	Thrassis pansus				1								
MACROINVERTEBRATE SUM													
1	Number of Species				2								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				2								
3	Index Shannon-Wienner				0.69								
4	Index Simpson				0.5								

Table 51 Aquatic Biota in Cilengkong River at 2016 - 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachellomonas sp.									-	
2	Tolypothrix sp.									30	
3	Actinastrum sp.									-	
4	Bacteriastrum sp.									-	
5	Ceratium sp.									-	
6	Craticula sp.										
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									-	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
22	rhopadolia										
23	hyalotheca sp										
24	tribonema sp									-	
25	Chlorella sp										
26	Coscinodiscus sp				-						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		60								
32	Polycystis sp.		30								
33	Rivularia sp.		30								
Bacillariophyceae											
1	Closterium sp.										
Chyanopyta											
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.		30		30	60	60	180	330	60	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		60								
8	Sprulina										
Chrysophyta											
1	Amphora sp					30	30	30	-		
2	Achanthes sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Achanthes sp2										
4	Cocconeis sp										
5	Chymbella sp		120	90	-	60	60	30	60	30	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			330		90	90	30	-		
9	Diatoma vulgaris		30								
10	Fragilaria sp.		120	60		30	30	30	120	-	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				-						
14	Frustulia sp										
15	Gomphonema sp		30	90		30	30	30	30		
16	Navicula sp			180	-	30	30	60	120	30	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		30								
22	Navicula cryptocephala		60								
23	Nitzschia sigma										
24	Nitzschia sp			180	60	90	90	60	30	-	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea		60								
28	Pinnularia sp					-	-	-	30		
29	Pinnularia sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
30	Pinnularia sp2										
31	Pleurosigma sp1										
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				40	30	30	30	30		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				-					90	
40	Synedro ulna										
41	Cladophora sp.			60	-	30	30	-	-	-	
42	Gyrosigma sp		90	60	-	60	60	60	60	30	
43	Gyrosigma sp (Perifiton)		-								
44	Lemanea sp.			90	-	30	30	90	90	-	
45	Lyngbya sp.			-	40	-	-	-	-	-	
46	Microspora sp		180	90	-	90	90	120	60	-	
47	Mougeotia sp.		270	240		120	120	30	30		
48	Oedogonium sp		-	180		-	-				
49	Stanieria sp.			180	300	360	360	180	360	90	
50	Stauroneis sp		210	90		90	90				
51	Stigeoclonium sp		60	30		30	30	30			
52	Ulothrix sp		-	-		-	-				
53	Vaucheria sp										
54	Chaetophora sp.				-						
55	Chamaesiphon sp.				-						
56	Licmophora sp.				-						

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
57	Melosira sp.				40						
58	Melosira moniliformis		30								
59	Phormodium sp.				60	30	30	-	-	30	
60	Rhizosolenia sp.				-						
61	Spirogyra				-					30	
62	Stigonema sp				-						
63	Tablelaria flocculosa				-			30			
64	Thallasionema sp.							-	-		
65	Aulacoseria sp.		-			-	-				
	Chlorophyta										
1	Closterium sp				50	-	-	-	-	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				-						
9	Pediastrum duplex										
10	Pediastrum sp					-	-	-	-	-	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							60	30		
15	Scenedesmus sp1										
16	Scenedesmus sp2										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
Euglenophyta											
1	Euglena acus										
2	Euglena sp		180	150		60	30	30	120	-	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		-	-		-	-	-	-	-	
6	Audouinella sp		180								
Perifiton											
1	Total Perifiton		510								
2	ID Simpson		0.948								
Pyhtoplankton Sum											
1	Total Phytoplankton		1410	2100	620	1350	1350	1110	1380	420	
2	ID Simpson		0.872	0.916	0.726	0.891	0.891	0.91	0.85	0.857	
3	ID Shannon Wienner						2.605	2.64	2.2		
4	Indeks Kemerataan (E)							0.91	0.84	0.94	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.07	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Shanon-Waeaver										
9	H-max										
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		120	90	40	30	30	30	30		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				30					-	
7	Paramaecium sp.									-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Plumatella sp.									-	
9	Polychaeta sp.									-	
10	Macrothrix sp.										
11	Cyprya sp.										
Rhizopoda											
1	Arcella Sp			-	-	30	30	30	60	-	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							-	-	30	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
Flagellata											
1	Anisonema										
2	Peranema sp									-	
Trochelmintes											
Rotifera											
1	Asphlanca sp		-								
2	Brachionus sp.		60	30	-	30	30	30	30		
3	Keratella sp.										
4	Copepoda										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
	Rotatoria										
1	Licone sp										
2	Monostyla sp				-					-	
3	Epistylis sp									-	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									-	
8	Acanthocyclops sp.		180	150		90	90	30	-		
9	Chydorus sp.		90	60		-	-				
10	Notholca sp.		90	120	40	60	60	30	30	60	
11	Phylodina sp.		-	-		30	30	-	-	30	
12	Thermocyclops sp		30	30							
13	Bryocamptus sp				-						
14	C. aculeata				-						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				40						
19	Cypridiopsis sp				-						
20	Horaella sp				-						
21	Leucosolenia sp				-						
22	Microstella sp				-						
23	Macrostella sp.									-	
24	Nauplii				40			30	30	-	
25	Boomina sp.										
26	Plamatella sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
27	Moina sp.									-	
28	Spirostomum sp.										
29	Cephalodella sp.							-			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				-						
33	Rhabdolaimus sp.				-						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				-						
37	Sacamoeba sp				-					-	
	Zooplankton Sum										
1	Jumlah Individu/L		570	480	190	270	270	180	180	120	
2	Jumlah Taxa										
3	Indeks Diversitas									1.04	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.792	0.781	0.798	0.082	0.79	0.86	0.78	0.938	
8	Indeks Dominansi Shanon Wienner						1.433	1.79	1.56		
9	Indeks Kemerataan (E)							1	0.97	0.95	
	Plankton Sum										
1	Jumlah Individu/L		1980	2580	810	1620	1620	1290	1560	540	
2	Jumlah Taxa										
3	Indeks Diversitas									2.37	
4	Shanon-Waeaver										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.918	0.063	0.172	0.082	0.082		0.88	0.895	
8	Indeks Dominansi Shanon Wienner			2.908	2.209	2.901	2.897	2.93	2.49		
9	Indeks Kemerataan (E)			0.941	0.861	0.901	0.912	0.92	0.84	0.95	
10	Indeks Diversitas Simpson plankton			0.937	0.828	0.918	0.918	0.93			
BENTHOS											
1	Baetis sp.									5	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp		10								
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		-							20	
18	Wattebledia sp		10								
Bivalia											

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
1	Carbicula javanica										
2	Plisbryoconcaha exilis										
	Grastropoda										
1	Lymnaea sp									-	
2	Physa sp.									-	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		10	10	10	10	10	10	10	-	
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae									20	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
	Coleopetra										
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
1	Olygochaeta sp										
2	Olygochaeta sp1										
3	Olygochaeta sp2										
Nemathelminthes											
1	Nematoda sp										
2	Bellamya sp		10	10	10	5	5	5	5		
3	Bythinia sp		-	-		-	-	-			
4	Operculina sp.		5	5							
5	Pomacea sp		5	5		5	5	5	5		
6	Tarebia sp.			5	-	5	5	5	-	-	
7	Nereis sp.			-		-	-	-	5		
8	Lumbriculus sp.							30	20		
9	Balanus				-						
10	Cellanea sp				-						
11	Cheritidae sp				-						
12	Gafrarium sp				-						
13	Nassarium sp				-						
14	Placamen sp.				-						
Benthos Sum											
1	Total mikrozoobenthos ; /m2		50	35	20	25	25	55	45	45	
2	ID Shannon & wienner benthos		1.748	1.55	0.693	1.332	1.332	1.29	1.43		
3	Jumlah Individu/L										
4	Jumlah Taxa										
5	Indeks Diversitas									0.965	
6	Shanon-Waeaver										
7	H-max										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.224	0.5	0.28	0.72	0.36	0.28	0.41	
10	Indeks Kemerataan (E)			0.963	1	0.961	0.961	0.8	0.89	0.88	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 52 Aquatic Biota in Cijambu River 2007, 2012 – 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachelomonas sp.								33				
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.								3				
8	Microcrcys sp.								-				
9	Eunotia sp										15		
10	stephanodiscus sp										-		
11	Chroococcus sp										15		
12	Lyngbya sp										-		
13	Gomphosphaeria sp.										15		
14	Microcystis sp										45		
15	calanus sp.										15		
16	pleurothaenium sp											-	
17	zygogonium											1	
18	chlamydomonan sp											-	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				200							-	
25	Chlorella sp												150
26	Coscinodiscus sp												-
27	Cyclotella sp												30
28	Hemidiscus sp												10
29	Oocystis sp												-
30	Protococcus sp												10
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
Bacillariophyceae													
1	Closterium sp.										45		
Chyanopyta													
1	Aphanocapsa sp						-						
2	Merismopedia sp						-						
3	Oscilatoria sp.				100					70	45	-	80
4	Oscillatoria sp1						1	-					
5	Oscillatoria sp2						-						
6	zygnema sp									80	-		
7	Anabaena sp							-					
8	Sprulina							1					
Chrysophyta													
1	Amphora sp						1						-
2	Achanthes sp1							-					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2							-					
4	Cocconeis sp				-		1					-	
5	Chymbella sp						5	1				-	-
6	Coscinodicus sp1						5						
7	Coscinodicus sp2						1						
8	Diatoma sp						-	2				-	
9	Diatoma vulgaris												
10	Fragilaria sp.								99		-		
11	Fragillaria sp1						3	7					
12	Fragillaria sp2						-	5					
13	Fragilaria copucina											1	
14	Frustulia sp						1	-					
15	Gomphonema sp						2	-		40	-	-	
16	Navicula sp				50				-	20	15	-	10
17	Navicula sp1						2	2					
18	Navicula sp2						3	1					
19	Navicula sp3						1	-					
20	Navicula sp4						-						
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma						2	5					
24	Nitzschia sp							3			-	-	20
25	Nitzschia sp1						5						
26	Nitzschia sp2						-						
27	Nitzchia palea												
28	Pinnularia sp							1				-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1						1						
30	Pinnularia sp2						1						
31	Pleurosigma sp1						1	1					
32	Pleurosigma sp2						2	-					
33	Pleurosigma sp3						-						
34	Surirela sp								66				
35	Surirella sp1						1	2					
36	Surirella sp2						-	3					
37	Surirella sp3						-	-					
38	Surirella elegans											-	
39	Synedra sp.								-			-	20
40	Synedro ulna											-	
41	Cladophora sp.											-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											1	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.								297			39	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				-						-		
53	Vaucheria sp				-								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											-	
58	Melosira moniliformis												
59	Phormodium sp.								-			-	30
60	Rhizosolenia sp.												
61	Spirogyra								-	90	75		
62	Stigonema sp												
63	Tablelaria flocculosa								33			-	
64	Thallasionema sp.												
65	Aulacoseria sp.												
Chlorophyta													
1	Closterium sp						1		66	70	-	-	-
2	Closterium sp1							-					
3	Closterium sp2							-					
4	Closterium setaceum								-				
5	Coelastrum sp						-						
6	Cosmarium sp						3	-					
7	Euastrum sp						1						
8	Pediastrum simplex							2	-				
9	Pediastrum duplex						1	1					
10	Pediastrum sp							1				1	
11	Pediastrum sp1						-						
12	Pediastrum sp2						-						
13	Pleototanium sp						-						
14	Scenedesmus sp											-	-

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1							2					
16	Scenedesmus sp2							1					
17	Scenedesmus sp3							-					
18	Scenedesmus guadricouda						1						
19	Scenedesmus ellipsoideus						-						
20	Scenedesmus ermotus						-						
21	Scenedesmus longispina						1						
22	Scenedesmus dimorphus						-						
23	Scenedesmus ecuminatus						-						
24	Tetmemorius sp						-						
	Euglenophyta												
1	Euglena acus							1					
2	Euglena sp						1	1				-	
3	phacus ionicauda							-					
4	phacus undulatus							-					
5	phacus sp							-					
6	Audouinella sp												
	Perifiton												
1	Total Perifiton												
2	ID Simpson												
	Pyhtoplankton Sum												
1	Total Phytoplankton								627			43	360
2	ID Simpson								0.72			0.175	0.7546
3	ID Shannon Wienner												1.7329
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)						48	45					
6	Jumlah Taxa						26	21					
7	Indeks Diversitas						4.3239	4.0587					
8	Shanon-Waeaver						-	-					
9	H-max						4.7004	4.3923					
10	Equitabilitas						0.9199	0.924					
	ZOOPLANKTON												
	Mollusca												
1	Larva Molusca									-			
	Artropoda												
	Crustaceae												
1	Larva kepiting									70			
2	Larva udang									-	-		
	Branciopoda												
1	Branciopoda sp						1						
	Copepoda												
1	Cyelops sp						-	1			-	1	-
	Protozoa												
	Dinophyceae												
1	Peridinium sp									-			
	Ciliata												
1	Colpoda sp						4	2					-
2	Didinium sp						3						
3	Glaucoma sp						3	4					
4	Lionclus sp						2						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp						3						
6	Vorticella sp.							1					
7	Paramaecium sp.				-							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											2	
	Rhizopoda												
1	Arcella Sp								66			-	40
2	Arcella discoides						2	3					
3	Arcella viilgaris						-	-					
4	Amoeba sp						2						
5	Centropyxis sp.								-			1	
6	Centropyxis acureata						1	-					
7	Spirozona sp.								-				
8	Diffugia sp						1	1				-	
9	Panagrolaimus sp.											-	
10	Euglypha sp							-				-	
11	Euglypha sp1						1						
12	Euglypha sp2						1						
	Flagellata												
1	Anisonema							1					
2	Peranema sp						-	-					
	Trochelmintes												
	Rotifera												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									-	15		
2	Brachionus sp.									-	-		
3	Keratella sp										-		
4	Copepoda									110	-		
Rotatoria													
1	Licone sp							-					
2	Monostyla sp						-	-	-				
3	Epistylis sp											-	
4	Loxofillum sp											1	
5	Chilodonella sp											1	
6	Ichtydium sp											-	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.						-	2	-			-	
11	Phylodina sp.							5	-			-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											3	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp												
23	Macrostella sp.												
24	Nauplii											-	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											1	
28	Spirostomum sp.											-	
29	Cephalodella sp.											-	-
30	Bursaria sp.											-	
31	Psilotricha sp.											-	
32	Platyas sp												
33	Rhabdolaimus sp.								-				-
34	Diaptomus sp.								-		-		
35	Tintinnopsis sp.												-
36	Rotifera sp												
37	Sacamoeba sp												
	Zooplankton Sum												
1	Jumlah Individu/L						24	19	66			10	40
2	Jumlah Taxa						12	8					
3	Indeks Diversitas						3.4055	2.7539					
4	Shanon-Waeaver						-	-					
5	H-max						3.585	3					
6	Equitabilitas						0.9499	0.918					
7	Indeks Dominansi Simpson (C)								0			0.82	0
8	Indeks Dominansi Shanon Wienner												0
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Plankton Sum													
1	Jumlah Individu/L				350				693	550	435	53	400
2	Jumlah Taxa				3					8	9		
3	Indeks Diversitas												
4	Shanon-Waeaver												
5	H-max									2.097	2.197		
6	Equitabilitas									0.99	0.765		
7	Indeks Dominansi Simpson (C)				0.63				0.76		-	0.4507	0.209
8	Indeks Dominansi Shanon Wienner				0.96					1.997	1.68		1.8847
9	Indeks Kemerataan (E)												0.819
10	Indeks Diversitas Simpson plankton												0.7912
BENTHOS													
1	Baetis sp.												
2	Tiara sp.												
3	Hydrophyceae sp.												
4	Planaria sp												
5	Enalagma sp												
6	Helobdella sp												
7	Sulcospira sp.												
8	Anadara sp											5	
9	Bursa sp											-	
10	Cerithideopsilla sp.											5	
11	Conus sp											5	
12	Corbicula sp											-	
13	Littorina sp											-	
14	Tellina sp											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											-	
16	Trochus sp.											5	
17	Tubifex sp												
18	Wattebledia sp												
	Bivalia												
1	Carbicula javanica									25	25		
2	Plisbryoconcaha exilis										-		
	Grastropoda												
1	Lymnaea sp									-	-		3
2	Physa sp.												
3	Goniobasis livescen									50	25		
4	Campeloma sp.									-	-		
5	Pomacea canaliculata									50	50		
6	Parathelpusa sp.									25	25		
7	Ena sp										75		
8	Pila ampullacea sp										-		
9	Melanoides sp						-						-
	Arthropoda												
	Insecta												
	Diptera												
1	Chironomiae						-	2					
2	Diptera (sp 1 larva)							1					
3	Diptera (sp 1 pupa)						2						
4	Diptera (sp 2 pupa)						1	1					
5	Diptera (sp 3 pupa)							-					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Coleopetra													
1	Elimiade						-	-					
2	Coleopatra sp 1						1						
3	Coleopatra sp 2						-						
Annelida													
Olygochaeta													
1	Olygochaeta sp						-						
2	Olygochaeta sp1							2					
3	Olygochaeta sp2							-					
Nemathelminthes													
1	Nematoda sp						2	5					
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp												
6	Tarebia sp.												
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
Benthos Sum													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2								36	150	200	20	3
2	ID Shannon & wienner benthos								1.543			1.386	0
3	Jumlah Individu/L ; individu/sampel						6	12					
4	Jumlah Taxa						4	6		4	5		
5	Indeks Diversitas						1.918	2.2834		1.33	1.494		
6	Shanon-Waeaver						-	-					
7	H-max						2	2.585		1.386	1.609		
8	Equitabilitas						0.959	0.8833		0.961	0.928		
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
MACROINVERTEBRATE													
1	Acreneuria sp.				-								
2	Berosus sp.				1								
3	Campolema sp.				-								
4	Cerithidae sp.				-								
5	Gonidae sp.				-								
6	Heisoma sp.				-								
7	Lymnaea sp.				-								-
8	Pleurocera sp.				-								
9	Pteronarcys sp.				-								
10	Stenelmis sp.				1								
11	Steronema sp.				1								
12	Tarebia sp.				-								
13	Thrassis pansus				1								
MACROINVERTEBRATE SUM													
1	Number of Species				4								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				4								
3	Index Shannon-Wienner				1.39								
4	Index Simpson				0.75								

Table 53 Aquatic Biota in Cijambu River 2016 – 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.									-	
2	Tolypothrix sp.									-	
3	Actinastrum sp.									-	
4	Bacteriastrum sp.									-	
5	Ceratium sp.									-	
6	Craticula sp.		90								
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									-	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
22	rhopadolia										
23	hyalotheca sp										
24	tribonema sp									30	
25	Chlorella sp										
26	Coscinodiscus sp				-						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		60								
32	Polycystis sp.		30								
33	Rivularia sp.		-								
	Bacillariophyceae										
1	Closterium sp.										
	Chyanopyta										
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.		30		60	60	60	210	420	60	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		30								
8	Sprulina										
	Chrysophyta										
1	Amphora sp					-	-	-	-		
2	Achanthes sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Achanthes sp2										
4	Cocconeis sp										
5	Chymbella sp		60	60	60	30	30	60	30	30	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			180		90	90	60	-		
9	Diatoma vulgaris		60								
10	Fragilaria sp.		150	60		30	30	90	120	30	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				30						
14	Frustulia sp										
15	Gomphonema sp		30	60		30	30	30			
16	Navicula sp			210	30	60	60	90	150	60	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		-								
22	Navicula cryptocephala		60								
23	Nitzschia sigma										
24	Nitzschia sp			210	-	120	120	30	30	30	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea		90								
28	Pinnularia sp					-	-	-	-		
29	Pinnularia sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
30	Pinnularia sp2										
31	Pleurosigma sp1										
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				-	30	30	30	30		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				30					30	
40	Synedro ulna										
41	Cladophora sp.			60	30	30	30	30	30	-	
42	Gyrosigma sp		120	60	-	60	60	60	60	66	
43	Gyrosigma sp (Perifiton)		60								
44	Lemanea sp.			30	40	30	30	60	90	60	
45	Lyngbya sp.			60	-	30	30	30	30	-	
46	Microspora sp		60	30	-	30	30	90	60	-	
47	Mougeotia sp.		-	-		-	-	-	-		
48	Oedogonium sp		60	60		-	-				
49	Stanieria sp.			90	210	270	270	180	420	120	
50	Stauroneis sp		90	90		90	90				
51	Stigeoclonium sp		-	-		-	-	-			
52	Ulothrix sp		60	180		120	120				
53	Vaucheria sp										
54	Chaetophora sp.				40						
55	Chamaesiphon sp.				-						
56	Licmophora sp.				-						

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
57	Melosira sp.				-						
58	Melosira moniliformis		30								
59	Phormodium sp.				40	30	30	30	30	120	
60	Rhizosolenia sp.				-						
61	Spirogyra				-					60	
62	Stigonema sp				-						
63	Tablelaria flocculosa				30			-			
64	Thallasionema sp.							60	30		
65	Aulacoseria sp.		150			-	-				
Chlorophyta											
1	Closterium sp				-	-	-	30	30	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				-						
9	Pediastrum duplex										
10	Pediastrum sp					30	30	30	-	-	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							60	30		
15	Scenedesmus sp1										
16	Scenedesmus sp2										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
	Euglenophyta										
1	Euglena acus										
2	Euglena sp		120	120		60	60	30	30	-	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		180			120	120	30	-	-	
6	Audouinella sp		90								
	Perifiton										
1	Total Perifiton		690								
2	ID Simpson		0.949								
	Pyhtoplankton Sum										
1	Total Phytoplankton		1020	1770	600	1350	1350	1320	1620	696	
2	ID Simpson		0.875	0.919	0.832	0.915	0.915	0.93	0.84	0.893	
3	ID Shannon Wienner						2.728	2.82	2.26		
4	Indeks Kemerataan (E)							0.93	0.8	0.95	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.35	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Shanon-Waeaver										
9	H-max										
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		-	-	-	-	30	-	30		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				-					-	
7	Paramaecium sp.									30	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Plumatella sp.									30	
9	Polychaeta sp.									30	
10	Macrothrix sp.										
11	Cyprya sp.										
	Rhizopoda										
1	Arcella Sp				40	30	30	30	30	-	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							30	30	90	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
	Flagellata										
1	Anisonema										
2	Peranema sp									-	
	Trochelmintes										
	Rotifera										
1	Asphlanca sp		60								
2	Brachionus sp.				-	30	30	30	30		
3	Keratella sp										
4	Copepoda										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
	Rotatoria										
1	Licone sp										
2	Monostyla sp				40					-	
3	Epistylis sp									0	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									30	
8	Acanthocyclops sp.		120	90		90	90	30	-		
9	Chydorus sp.		30	30		30	30				
10	Notholca sp.		30	30	40	30	30	30	30	60	
11	Phylodina sp.		-	-		-	-	-	-	90	
12	Thermocyclops sp		60	30							
13	Bryocamptus sp				-						
14	C. aculeata				-						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				-						
19	Cypridiopsis sp				40						
20	Horaella sp				-						
21	Leucosolenia sp				-						
22	Microstella sp				40						
23	Macrostella sp.									-	
24	Nauplii				-			60	60	-	
25	Boomina sp.										
26	Plamatella sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
27	Moina sp.									60	
28	Spirostomum sp.										
29	Cephalodella sp.							-			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				-						
33	Rhabdolaimus sp.				-						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				30						
37	Sacamoeba sp				-					0	
Zooplankton Sum											
1	Jumlah Individu/L		330	240	230	210	210	210	210	420	
2	Jumlah Taxa										
3	Indeks Diversitas									1.97	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.777	0.781	0.832	0.735	0.735	0.9	0.82	0.918	
8	Indeks Dominansi Shanon Wienner						1.753	1.75	1.75		
9	Indeks Kemerataan (E)							0.98	0.98	0.86	
Plankton Sum											
1	Jumlah Individu/L		1350	2010	830	1560	1560	1530	1830	1116	
2	Jumlah Taxa										
3	Indeks Diversitas									2.87	
4	Shanon-Waeaver										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.916	0.066	0.1	0.069	0.069		0.87	0.938	
8	Indeks Dominansi Shanon Wienner			2.899	2.617	2.954	2.992	3	2.55		
9	Indeks Kemerataan (E)			0.924	0.924	0.918	0.918	0.93	0.81	0.93	
10	Indeks Diversitas Simpson plankton			0.934	0.899	0.931	0.931	0.94			
BENTHOS											
1	Baetis sp.									-	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp										
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		-							30	
18	Wattebledia sp		5								
Bivalia											

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
1	Carbicula javanica										
2	Plisbryoconcaha exilis										
Grastropoda											
1	Lymnaea sp									-	
2	Physa sp.									5	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		10	15	10	15	15	20	20	-	
Arthropoda											
Insecta											
Diptera											
1	Chironomiae									5	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
Coleopetra											
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
Annelida											
Olygochaeta											

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
1	Olygochaeta sp										
2	Olygochaeta sp1										
3	Olygochaeta sp2										
	Nemathelminthes										
1	Nematoda sp										
2	Bellamya sp		10	5	10	5	5	5	5		
3	Bythinia sp		-	-		-	-	-			
4	Operculina sp.		5	5							
5	Pomacea sp		5	5		5	5	5	5		
6	Tarebia sp.			10	-	10	10	10	-	-	
7	Nereis sp.			-		5	5	5	5		
8	Lumbriculus sp.							30	10		
9	Balanus				-						
10	Cellanea sp				-						
11	Cheritidae sp				-						
12	Gafrarium sp				-						
13	Nassarium sp				-						
14	Placamen sp.				-						
	Benthos Sum										
1	Total mikrozoobenthos ; /m2		45	40	20	40	40	75	45	40	
2	ID Shannon & wienner benthos		1.491	1.494	0.693	1.494	1.494	1.53	1.43		
3	Jumlah Individu/L ; individu/sampel										
4	Jumlah Taxa										
5	Indeks Diversitas									0.736	
6	Shanon-Waeaver										
7	H-max										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.25	0.5	0.25	0.75	0.26	0.28	0.59	
10	Indeks Kemerataan (E)			0.928	1	0.928	0.928	0.85	0.89	1	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 54 Aquatic Biota in Upper Cisokan River at 2001, 2007, 2012 - 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachelomonas sp.								66				
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.								-				
8	Microcrcys sp.								-				
9	Eunotia sp										-		
10	stephanodiscus sp										30		
11	Chroococcus sp										-		
12	Lyngbya sp										-		
13	Gomphosphaeria sp.										-		
14	Microcystis sp										-		
15	calanus sp.										-		
16	pleurothaenium sp											-	
17	zygogonium											-	
18	chlamydomonan sp											-	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				-							-	
25	Chlorella sp												50
26	Coscinodiscus sp												10
27	Cyclotella sp												10
28	Hemidiscus sp												-
29	Oocystis sp												-
30	Protococcus sp												10
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
	Bacillariophyceae												
1	Closterium sp.										30		
	Chyanopyta												
1	Aphanocapsa sp						-						
2	Merismopedia sp						-						
3	Oscilatoria sp.				50					-	45	-	90
4	Oscillatoria sp1						4	-					
5	Oscillatoria sp2						-						
6	zygnema sp									-	-		
7	Anabaena sp							-					
8	Sprulina							-					
	Chrysophyta												
1	Amphora sp						-						10
2	Achanthes sp1							1					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2							1					
4	Cocconeis sp				-		-					-	
5	Chymbella sp						5	5	-			2	20
6	Coscinodicus sp1						-						
7	Coscinodicus sp2						-						
8	Diatoma sp						-	2				-	
9	Diatoma vulgaris												
10	Fragilaria sp.								132		-		
11	Fragillaria sp1						19	28					
12	Fragillaria sp2						14	21					
13	Fragilaria copucina											1	
14	Frustulia sp						-	-					
15	Gomphonema sp						4	2		-	-	-	
16	Navicula sp				100				-	20	-	1	
17	Navicula sp1						4	3					
18	Navicula sp2						-	2					
19	Navicula sp3						3	-					
20	Navicula sp4						-						
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma						3	8					
24	Nitzschia sp							6			-	-	20
25	Nitzschia sp1						7						
26	Nitzschia sp2						3						
27	Nitzchia palea												
28	Pinnularia sp							1				1	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1						-						
30	Pinnularia sp2						-						
31	Pleurosigma sp1						3	2					
32	Pleurosigma sp2						-	-					
33	Pleurosigma sp3						1						
34	Surirela sp								99				
35	Surirella sp1						4	10					
36	Surirella sp2						3	12					
37	Surirella sp3						1	2					
38	Surirella elegans											2	
39	Synedra sp.								-			-	10
40	Synedro ulna						1	5				-	
41	Cladophora sp.								-			-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											1	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.								561			147	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				-						-		
53	Vaucheria sp				50								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											-	
58	Melosira moniliformis												
59	Phormodium sp.								-			11	10
60	Rhizosolenia sp.												
61	Spirogyra								33	50	165		
62	Stigonema sp												
63	Tablelaria flocculosa								33			-	
64	Thallasionema sp.												
65	Aulacoseria sp.												
	Chlorophyta												
1	Closterium sp						-		-	-	60	-	10
2	Closterium sp1							-					
3	Closterium sp2							2					
4	Closterium setaceum								-				
5	Coelastrum sp						1						
6	Cosmarium sp						-	1					
7	Euastrum sp						1						
8	Pediastrum simplex							-	-				
9	Pediastrum duplex						3	-					
10	Pediastrum sp							-				-	
11	Pediastrum sp1						1						
12	Pediastrum sp2						2						
13	Pleototanium sp						1						
14	Scenedesmus sp											-	20

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1							-					
16	Scenedesmus sp2							-					
17	Scenedesmus sp3							-					
18	Scenedesmus guadricouda						6						
19	Scenedesmus ellipsoideus						1						
20	Scenedesmus ermotus						1						
21	Scenedesmus longispina						2						
22	Scenedesmus dimorphus						2						
23	Scenedesmus ecuminatus						-						
24	Tetmemorius sp						-						
	Euglenophyta												
1	Euglena acus							-					
2	Euglena sp						-	-				-	
3	phacus ionicauda							1					
4	phacus undulatus							2					
5	phacus sp							-					
6	Audouinella sp												
	Perifiton												
1	Total Perifiton												
2	ID Simpson												
	Pyhtoplankton Sum												
1	Total Phytoplankton								924			166	370
2	ID Simpson								0.59			0.215	0.8692
3	ID Shannon Wienner												2.26
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)						100	118					
6	Jumlah Taxa						27	22					
7	Indeks Diversitas						4.1693	3.617					
8	Shanon-Waeaver						-	-					
9	H-max						4.7549	4.4594					
10	Equitabilitas						0.8768	0.8111					
	ZOOPLANKTON												
	Mollusca												
1	Larva Molusca									-			
	Artropoda												
	Crustaceae												
1	Larva kepiting									50			
2	Larva udang									40			
	Branciopoda												
1	Branciopoda sp						-						
	Copepoda												
1	Cyelops sp						1	-			-	-	10
	Protozoa												
	Dinophyceae												
1	Peridinium sp									-			
	Ciliata												
1	Colpoda sp						5	5					20
2	Didinium sp						4						
3	Glaucoma sp						5	2					
4	Lionclus sp						-						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp						2						
6	Vorticella sp.							-					
7	Paramaecium sp.				-							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											-	
	Rhizopoda												
1	Arcella Sp								66			1	10
2	Arcella discoides						2	12					
3	Arcella viilgaris						-	2					
4	Amoeba sp						-						
5	Centropyxis sp.								-			3	
6	Centropyxis acureata						1	2					
7	Spirozona sp.								-				
8	Diffugia sp						1	2				2	
9	Panagrolaimus sp.											-	
10	Euglypha sp							2				-	
11	Euglypha sp1						1						
12	Euglypha sp2						2						
	Flagellata												
1	Anisonema							-					
2	Peranema sp						2	-					
	Trochelmintes												
	Rotifera												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									-			
2	Brachionus sp.									30			
3	Keratella sp												
4	Copepoda									-			
	Rotatoria												
1	Licone sp							-					
2	Monostyla sp						1	3				1	
3	Epistylis sp											2	
4	Loxofillum sp											-	
5	Chilodonella sp											-	
6	Ichtydium sp											-	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.						-	2	-			-	
11	Phylodina sp.							2	-			-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											1	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp												
23	Macrostella sp.												
24	Nauplii											-	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											-	
28	Spirostomum sp.											1	
29	Cephalodella sp.											-	10
30	Bursaria sp.											-	
31	Psilotricha sp.											1	
32	Platyas sp												
33	Rhabdolaimus sp.								-				-
34	Diaptomus sp.								-		30		
35	Tintinnopsis sp.												-
36	Rotifera sp												
37	Sacamoeba sp												
Zooplankton Sum													
1	Jumlah Individu/L						15	34	66			12	50
2	Jumlah Taxa						11	10					
3	Indeks Diversitas						3.1528	2.9278					
4	Shanon-Waeaver						-	-					
5	H-max						3.4594	3.3219					
6	Equitabilitas						0.9114	0.8814					
7	Indeks Dominansi Simpson (C)								0			0.847	0.72
8	Indeks Dominansi Shanon Wienner												1.3322
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Plankton Sum													
1	Jumlah Individu/L				200				990	190	450	178	420
2	Jumlah Taxa				3					5	8		
3	Indeks Diversitas												
4	Shanon-Waeaver										-		
5	H-max									1.609	2.079		
6	Equitabilitas									0.969	0.859		
7	Indeks Dominansi Simpson (C)				0.63				0.64			0.3169	0.105
8	Indeks Dominansi Shanon Wienner				1.04					1.559	1.786		2.5145
9	Indeks Kemerataan (E)												0.888
10	Indeks Diversitas Simpson plankton												0.8946
BENTHOS													
1	Baetis sp.								30				
2	Tiara sp.								-				
3	Hydrophyceae sp.								3				
4	Planaria sp								-				
5	Enalagma sp								3				
6	Helobdella sp								3				
7	Sulcospira sp.								-				-
8	Anadara sp											-	
9	Bursa sp											5	
10	Cerithideopsilla sp.											-	
11	Conus sp											-	
12	Corbicula sp											5	
13	Littorina sp											5	
14	Tellina sp											5	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											5	
16	Trochus sp.											-	
17	Tubifex sp												
18	Wattebledia sp												
Bivalia													
1	Carbicula javanica									25	25		
2	Plisbryoconcaha exilis										-		
Grastropoda													
1	Lymnaea sp									75	75		3
2	Physa sp.												
3	Goniobasis livescen									25	25		
4	Campeloma sp.									-	-		
5	Pomacea canaliculata									25	25		
6	Parathelpusa sp.									25	25		
7	Ena sp										300		
8	Pila ampullacea sp										-		
9	Melanoides sp						1		-				5
Arthropoda													
Insecta													
Diptera													
1	Chironomiae						-	-	3	-			
2	Diptera (sp 1 larva)							1					
3	Diptera (sp 1 pupa)						-						
4	Diptera (sp 2 pupa)						1	1					
5	Diptera (sp 3 pupa)							-					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Coleopetra													
1	Elimiade						-	-					
2	Coleopatra sp 1						1	1					
3	Coleopatra sp 2						1	1					
Annelida													
Olygochaeta													
1	Olygochaeta sp						-						
2	Olygochaeta sp1							4					
3	Olygochaeta sp2							2					
Nemathelminthes													
1	Nematoda sp						2	4					
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp								-				
6	Tarebia sp.								-				
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
Benthos Sum													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2								42	175	475	25	8
2	ID Shannon & wienner benthos								0.994			1.609	0.6616
3	Jumlah Individu/L ; individu/sampel						6	14					
4	Jumlah Taxa						5	7		5	6		
5	Indeks Diversitas						2.2511	2.5207		1.475	1.202		
6	Shanon-Waeaver						-	-					
7	H-max						2.3219	2.8074		1.609	1.792		
8	Equitabilitas						0.9695	0.8979		0.916	0.671		
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
	MACROINVERTEBRATE												
1	Acreneuria sp.				-								
2	Berosus sp.				-								
3	Campolema sp.				-								
4	Cerithidae sp.				1								
5	Gonidae sp.				-								
6	Heisoma sp.				-								
7	Lymnaea sp.				6								-
8	Pleurocera sp.				13								
9	Pteronarcys sp.				-								
10	Stenelmis sp.				-								
11	Steronema sp.				-								
12	Tarebia sp.				-								
13	Thrassis pansus				-								
	MACROINVERTEBRATE SUM												
1	Number of Species				3								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				20								
3	Index Shannon-Wienner				0.79								
4	Index Simpson				0.49								

Table 55 Aquatic Biota in Upper Cisokan River at 2016 - 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.									-	
2	Tolypothrix sp.									-	
3	Actinastrum sp.									30	
4	Bacteriastrum sp.									-	
5	Ceratium sp.									30	
6	Craticula sp.		-								
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									-	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										
23	hyalotheca sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
24	tribonema sp									-	
25	Chlorella sp										
26	Coscinodiscus sp				30						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		60								
32	Polycystis sp.		-								
33	Rivularia sp.		60								
Bacillariophyceae											
1	Closterium sp.										
Chyanopyta											
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.				-	30	60	90	180	-	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		30								
8	Sprulina										
Chrysophyta											
1	Amphora sp					30	-	30	30		
2	Achanthes sp1										
3	Achanthes sp2										
4	Cocconeis sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	Chymbella sp		120	90	-	90	60	90	30	60	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			-		60	60	30	30		
9	Diatoma vulgaris		60								
10	Fragilaria sp.		-	-		30	60	180	120	90	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				-						
14	Frustulia sp										
15	Gomphonema sp		30	90		-	-	-			
16	Navicula sp			-	-	-	-	60	30	30	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		60								
22	Navicula cryptocephala		60								
23	Nitzschia sigma										
24	Nitzschia sp			150	-	150	120	90	90	90	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea										
28	Pinnularia sp					-	30	30	30		
29	Pinnularia sp1										
30	Pinnularia sp2										
31	Pleurosigma sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				-	30	30	30	-		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				-					60	
40	Synedro ulna										
41	Cladophora sp.			30	40	30	-	30	30	-	
42	Gyrosigma sp		210	30	-	30	60	30	30	-	
43	Gyrosigma sp (Perifiton)		30								
44	Lemanea sp.			30	40	30	-	90	150	90	
45	Lyngbya sp.			30	-	30	30	30	30	30	
46	Microspora sp		90	60	40	60	30	-	-	60	
47	Mougeotia sp.		90	60		60	90	-	-		
48	Oedogonium sp		30	30		-	30				
49	Stanieria sp.			120	210	210	90	120	210	-	
50	Stauroneis sp		-	-		-	60				
51	Stigeoclonium sp		180	60		30	-	-			
52	Ulothrix sp		30	90		60	60				
53	Vaucheria sp										
54	Chaetophora sp.				-						
55	Chamaesiphon sp.				40						
56	Licmophora sp.				40						
57	Melosira sp.				-						
58	Melosira moniliformis		-								

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
59	Phormodium sp.				-	-	-	30	30	-	
60	Rhizosolenia sp.				-						
61	Spirogyra				-					-	
62	Stigonema sp				-						
63	Tablelaria flocculosa				-			30			
64	Thallasionema sp.							30	30		
65	Aulacoseria sp.		210			-	30				
Chlorophyta											
1	Closterium sp				-	60	30	60	60	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				40						
9	Pediastrum duplex										
10	Pediastrum sp					-		-	-	-	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							-	-		
15	Scenedesmus sp1										
16	Scenedesmus sp2										
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
Euglenophyta											
1	Euglena acus										
2	Euglena sp		150	120		60	30	30	30	-	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		60			90	120	30	-	30	
6	Audouinella sp		120								
Perifiton											
1	Total Perifiton		450								
2	ID Simpson		0.938								
Pyhtoplankton Sum											
1	Total Phytoplankton		1230	1050	480	1170	1080	1140	1140	630	
2	ID Simpson		0.873	0.914	0.763	0.918	0.935	0.93	0.9	0.893	
3	ID Shannon Wienner						2.922	2.79	2.52		
4	Indeks Kemerataan (E)							0.93	0.89	0.99	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.45	
8	Shanon-Waeaver										
9	H-max										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		-	-	-	30	-	60	30		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				-					0	
7	Paramaecium sp.									-	
8	Plumatella sp.									-	
9	Polychaeta sp.									-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Macrothrix sp.										
11	Cyprya sp.										
	Rhizopoda										
1	Arcella Sp				-	30	30	30	30	-	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							30	30	-	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
	Flagellata										
1	Anisonema										
2	Peranema sp									60	
	Trochelmintes										
	Rotifera										
1	Asphlanca sp		30								
2	Brachionus sp.		-		40	-	-	-	-		
3	Keratella sp										
4	Copepoda										
	Rotatoria										
1	Licone sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
2	Monostyla sp				-					30	
3	Epistylis sp									-	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									30	
8	Acanthocyclops sp.		-	-		30	30	30	30		
9	Chydorus sp.		30	60		-	30				
10	Notholca sp.		90	60	40	30	-	-	-	30	
11	Phylodina sp.		60	30		30	30	30	30	-	
12	Thermocyclops sp		30	-							
13	Bryocamptus sp				30						
14	C. aculeata				40						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				-						
19	Cypridiopsis sp				-						
20	Horaella sp				40						
21	Leucosolenia sp				-						
22	Microstella sp				-						
23	Macrostella sp.									30	
24	Nauplii				-			30	30	30	
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.									-	
28	Spirostomum sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
29	Cephalodella sp.							30			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				40						
33	Rhabdolaimus sp.				-						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				90						
37	Sacamoeba sp				90					30	
	Zooplankton Sum										
1	Jumlah Individu/L		240	210	410	150	120	240	180	180	
2	Jumlah Taxa										
3	Indeks Diversitas									1.79	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.75	0.735	0.851	0.8	0.75	0.84	0.83	0.878	
8	Indeks Dominansi Shanon Wienner						1.386	1.91	1.79		
9	Indeks Kemerataan (E)							0.94	1	0.92	
	Plankton Sum										
1	Jumlah Individu/L		1470	1260	890	1320	1200	1380	1320	810	
2	Jumlah Taxa										
3	Indeks Diversitas									2.85	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Indeks Dominansi Simpson (C)		0.905	0.067	0.1	0.067	0.055		0.92	0.927	
8	Indeks Dominansi Shanon Wienner			2.816	2.566	2.953	3.046	1.91	2.73		
9	Indeks Kemerataan (E)			0.956	0.926	0.929	0.958	0.98	0.87	0.97	
10	Indeks Diversitas Simpson plankton			0.953	0.899	0.933	0.945	0.94			
BENTHOS											
1	Baetis sp.									-	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp										
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		5							-	
18	Wattebledia sp		5								
Bivalia											
1	Carbicula javanica										
2	Plisbryoconcaha exilis										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
	Grastropoda										
1	Lymnaea sp									-	
2	Physa sp.									5	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		5	5	-	10	10	-	10	5	
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae									10	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
	Coleopetra										
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										
1	Olygochaeta sp										
2	Olygochaeta sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Olygochaeta sp2										
Nemathelminthes											
1	Nematoda sp										
2	Bellamya sp		15	5	-	5	10	-	-		
3	Bythinia sp		5	5		5	5	5			
4	Operculina sp.		15	-							
5	Pomacea sp		5	5		-	-	-	-		
6	Tarebia sp.			-	10	-	5	5	5	-	
7	Nereis sp.			5		5	5	5	5		
8	Lumbriculus sp.							-	-		
9	Balanus				10						
10	Cellanea sp				10						
11	Cheritidae sp				-						
12	Gafrarium sp				10						
13	Nassarium sp				-						
14	Placamen sp.				-						
Benthos Sum											
1	Total mikrozoobenthos ; /m2		60	25	40	25	35	15	20	10	
2	ID Shannon & wienner benthos		1.82	1.609	1.386	1.332	1.55	1.1	1.04		
3	Jumlah Individu/L ; individu/sampel										
4	Jumlah Taxa										
5	Indeks Diversitas									0.693	
6	Shanon-Waeaver										
7	H-max										
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.2	0.25	0.28	0.776	0.33	0.38	0.5	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Indeks Kemerataan (E)			1	1	0.961	0.963	1	0.65	1	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 56 Aquatic Biota in Lower Cisokan River at 2001, 2007, 2012 – 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachelomonas sp.								33				
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.								-				
8	Microcrcys sp.								-				
9	Eunotia sp										-		
10	stephanodiscus sp										-		
11	Chroococcus sp										-		
12	Lyngbya sp										45		
13	Gomphosphaeria sp.										-		
14	Microcystis sp										45		
15	calanus sp.										-		
16	pleurothaenium sp											-	
17	zygogonium											-	
18	chlamydomonan sp											-	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				-							-	
25	Chlorella sp												30
26	Coscinodiscus sp												-
27	Cyclotella sp												20
28	Hemidiscus sp												-
29	Oocystis sp												10
30	Protococcus sp												30
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
	Bacillariophyceae												
1	Closterium sp.										30		
	Chyanopyta												
1	Aphanocapsa sp						3						
2	Merismopedia sp						-						
3	Oscilatoria sp.				100					60	15	-	120
4	Oscillatoria sp1						-	-					
5	Oscillatoria sp2						-						
6	zygnema sp									-	-		
7	Anabaena sp							-					
8	Sprulina							-					
	Chrysophyta												
1	Amphora sp						-						-
2	Achanthes sp1							2					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2							-					
4	Cocconeis sp				-		-					-	
5	Chymbella sp						6	5				60	10
6	Coscinodicus sp1						-						
7	Coscinodicus sp2						-						
8	Diatoma sp						-	-				-	
9	Diatoma vulgaris												
10	Fragilaria sp.								495		45		
11	Fragillaria sp1						15	31					
12	Fragillaria sp2						12	19					
13	Fragilaria copucina											30	
14	Frustulia sp						1	1					
15	Gomphonema sp						5	5		-	-	-	
16	Navicula sp				-				66	-	-	30	20
17	Navicula sp1						4	7					
18	Navicula sp2						-	-					
19	Navicula sp3						4	1					
20	Navicula sp4						-						
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma						2	11					
24	Nitzschia sp							8			-	-	10
25	Nitzschia sp1						10						
26	Nitzschia sp2						4						
27	Nitzchia palea												
28	Pinnularia sp							2				30	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1						-						
30	Pinnularia sp2						-						
31	Pleurosigma sp1						5	4					
32	Pleurosigma sp2						-	2					
33	Pleurosigma sp3						1						
34	Surirela sp								99				
35	Surirella sp1						3	12					
36	Surirella sp2						3	14					
37	Surirella sp3						2	4					
38	Surirella elegans											60	
39	Synedra sp.								33			-	10
40	Synedro ulna						-	5				-	
41	Cladophora sp.								33			-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											30	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.								561			4410	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				50						30		
53	Vaucheria sp				-								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											-	
58	Melosira moniliformis												
59	Phormodium sp.								-			330	50
60	Rhizosolenia sp.												
61	Spirogyra								33	20	180		
62	Stigonema sp												
63	Tablelaria flocculosa								33			-	
64	Thallasionema sp.												
65	Aulacoseria sp.												
	Chlorophyta												
1	Closterium sp						1		33	-	-	-	10
2	Closterium sp1							1					
3	Closterium sp2							2					
4	Closterium setaceum								33				
5	Coelastrum sp						1						
6	Cosmarium sp						-	1					
7	Euastrum sp						-						
8	Pediastrum simplex							**1**	33				
9	Pediastrum duplex						1	3					
10	Pediastrum sp							2				-	
11	Pediastrum sp1						1						
12	Pediastrum sp2						1						
13	Pleototanium sp						-						
14	Scenedesmus sp						-					-	-

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1							2					
16	Scenedesmus sp2							-					
17	Scenedesmus sp3							2					
18	Scenedesmus guadricouda						2						
19	Scenedesmus ellipsoideus						1						
20	Scenedesmus ermotus						1						
21	Scenedesmus longispina						1						
22	Scenedesmus dimorphus						-						
23	Scenedesmus ecuminatus						-						
24	Tetmemorius sp						1						
Euglenophyta													
1	Euglena acus							-					
2	Euglena sp						-						
3	phacus ionicauda							1					
4	phacus undulatus							2					
5	phacus sp							-					
6	Audouinella sp												
Perifiton													
1	Total Perifiton												
2	ID Simpson												
Pyhtoplankton Sum													
1	Total Phytoplankton								1485			4980	320
2	ID Simpson								0.74			0.215	0.8047
3	ID Shannon Wienner												1.9898
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)						92	150					
6	Jumlah Taxa						27	27					
7	Indeks Diversitas						4.2605	3.9963					
8	Shanon-Waeaver						-	-					
9	H-max						4.7549	4.7549					
10	Equitabilitas						0.896	0.8405					
	ZOOPLANKTON												
	Mollusca												
1	Larva Molusca									20			
	Artropoda												
	Crustaceae												
1	Larva kepiting									30			
2	Larva udang									20	15		
	Branciopoda												
1	Branciopoda sp						-						
	Copepoda												
1	Cyelops sp						-	-			-	-	30
	Protozoa												
	Dinophyceae												
1	Peridinium sp									40			
	Ciliata												
1	Colpoda sp						3	3					-
2	Didinium sp						5						
3	Glaucoma sp						4	4					
4	Lionclus sp						-						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp						-						
6	Vorticella sp.							-					
7	Paramaecium sp.				50							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											-	
	Rhizopoda												
1	Arcella Sp								33			30	-
2	Arcella discoides						2	11					
3	Arcella viilgaris						-	2					
4	Amoeba sp						-						
5	Centropyxis sp.								66			90	
6	Centropyxis acureata						1	2					
7	Spirozona sp.								-				
8	Diffugia sp						-	-				60	
9	Panagrolaimus sp.											-	
10	Euglypha sp							3				-	
11	Euglypha sp1						2						
12	Euglypha sp2						1						
	Flagellata												
1	Anisonema							-					
2	Peranema sp						-	-					
	Trochelmintes												
	Rotifera												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									-			
2	Brachionus sp.									-	-		
3	Keratella sp										-		
4	Copepoda									50	-		
Rotatoria													
1	Licone sp							1					
2	Monostyla sp						1	2				30	
3	Epistylis sp											60	
4	Loxofillum sp											-	
5	Chilodonella sp											-	
6	Ichtydium sp											-	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.						1	2	66			-	
11	Phylodina sp.							-				-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											30	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Macrostella sp.												
23	Microstella sp												
24	Nauplii											-	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											-	
28	Spirostomum sp.											30	
29	Cephalodella sp.											-	10
30	Bursaria sp.											-	
31	Psilotricha sp.											30	
32	Platyas sp												
33	Rhabdolaimus sp.								-				10
34	Diaptomus sp.								-		45		
35	Tintinnopsis sp.												10
36	Rotifera sp												
37	Sacamoeba sp												
	Zooplankton Sum												
1	Jumlah Individu/L						20	30	198			360	60
2	Jumlah Taxa						9	9					
3	Indeks Diversitas						2.903	2.6122					
4	Shanon-Waeaver						-	-					
5	H-max						3.1699	3.1699					
6	Equitabilitas						0.9158	0.8241					
7	Indeks Dominansi Simpson (C)								0.72			0.847	0.6667
8	Indeks Dominansi Shanon Wienner												1.2424
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
	Plankton Sum												
1	Jumlah Individu/L				200					260	450	5340	380
2	Jumlah Taxa				3					8	9		
3	Indeks Diversitas												
4	Shanon-Waeaver										-		
5	H-max									2.079	2.197		
6	Equitabilitas									0.953	0.853		
7	Indeks Dominansi Simpson (C)				0.63							0.317	0.147
8	Indeks Dominansi Shanon Wienner				1.04					1.982	1.875		2.308
9	Indeks Kemerataan (E)												0.852
10	Indeks Diversitas Simpson plankton												0.8532
	BENTHOS												
1	Baetis sp.								21				
2	Tiara sp.								3				
3	Hydrophyceae sp.								12				
4	Planaria sp								-				
5	Enalagma sp								-				
6	Helobdella sp								-				
7	Sulcospira sp.								-				3
8	Anadara sp											5	
9	Bursa sp											-	
10	Cerithideopsilla sp.											5	
11	Conus sp											5	
12	Corbicula sp											-	
13	Littorina sp											-	
14	Tellina sp											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											5	
16	Trochus sp.											5	
17	Tubifex sp												
18	Wattebledia sp												
Bivalia													
1	Carbicula javanica									50	50		
2	Plisbryoconcaha exilis										-		
Grastropoda													
1	Lymnaea sp									50	50		-
2	Physa sp.												
3	Goniobasis livescen									25	25		
4	Campeloma sp.									-	-		
5	Pomacea canaliculata									-	-		
6	Parathelpusa sp.									50	50		
7	Ena sp										125		
8	Pila ampullacea sp										50		
9	Melanoides sp						2		24				5
Arthropoda													
Insecta													
Diptera													
1	Chironomiae						-	-	6	-			
2	Diptera (sp 1 larva)							-					
3	Diptera (sp 1 pupa)						1						
4	Diptera (sp 2 pupa)						-	1					
5	Diptera (sp 3 pupa)							1					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Coleopetra													
1	Elimiade						-	-					
2	Coleopatra sp 1						-	1					
3	Coleopatra sp 2						1	-					
Annelida													
Olygochaeta													
1	Olygochaeta sp						-						
2	Olygochaeta sp1							2					
3	Olygochaeta sp2							1					
Nemathelminthes													
1	Nematoda sp						3	3					
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp								-				
6	Tarebia sp.								-				
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
Benthos Sum													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2								66	175	350	25	8
2	ID Shannon & wienner benthos								1.401			1.609	0.6616
3	Jumlah Individu/L ; individu/sampel						7	9					
4	Jumlah Taxa						4	6		4	6		
5	Indeks Diversitas						1.8419	2.4188		1.352	1.668		
6	Shanon-Waeaver						-	-					
7	H-max						2	2.585		1.386	1.792		
8	Equitabilitas						0.921	0.9357		0.975	0.931		
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
MACROINVERTEBRATE													
1	Acreneuria sp.				-								
2	Berosus sp.				-								
3	Campolema sp.				-								
4	Cerithidae sp.				-								
5	Gonidae sp.				1								
6	Heisoma sp.				-								
7	Lymnaea sp.				-								-
8	Pleurocera sp.				-								
9	Pteronarcys sp.				-								
10	Stenelmis sp.				-								
11	Steronema sp.				-								
12	Tarebia sp.				-								
13	Thrassis pansus				1								
MACROINVERTEBRATE SUM													
1	Number of Species				2								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				2								
3	Index Shannon-Wienner				0.69								
4	Index Simpson				0.5								

Table 57 Aquatic Biota in Lower Cisokan River at 2016 – 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.									-	
2	Tolypothrix sp.									30	
3	Actinastrum sp.									30	
4	Bacteriastrum sp.									30	
5	Ceratium sp.									-	
6	Craticula sp.		-								
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									30	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										
23	hyalotheca sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
24	tribonema sp									-	
25	Chlorella sp										
26	Coscinodiscus sp				40						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		30								
32	Polycystis sp.		60								
33	Rivularia sp.		-								
Bacillariophyceae											
1	Closterium sp.										
Chyanopyta											
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.		30		-	30	60	60	540	120	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		30								
8	Sprulina										
Chrysophyta											
1	Amphora sp					30	-	30	30		
2	Achanthes sp1										
3	Achanthes sp2										
4	Cocconeis sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	Chymbella sp		90	90	-	60	30	120	60	30	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			120		90	90	30	30		
9	Diatoma vulgaris		30								
10	Fragilaria sp.		-	-		90	30	210	240	120	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				-						
14	Frustulia sp										
15	Gomphonema sp		-	60		-	-	-			
16	Navicula sp			-	-	-	-	60	180	30	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		-								
22	Navicula cryptocephala		30								
23	Nitzschia sigma										
24	Nitzschia sp			60	-	210	240	120	180	-	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea		-								
28	Pinnularia sp					-	30	30	30		
29	Pinnularia sp1										
30	Pinnularia sp2										
31	Pleurosigma sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				-	-	-	30	30		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				-					-	
40	Synedro ulna										
41	Cladophora sp.			30	40	30	-	30	30	-	
42	Gyrosigma sp		30	30	-	30	60	30	60	-	
43	Gyrosigma sp (Perifiton)		30								
44	Lemanea sp.			90	-	60	-	60	210	60	
45	Lyngbya sp.			30	40	30	30	30	30	30	
46	Microspora sp		30	30	40	30	-	-	30	-	
47	Mougeotia sp.		-	-		-	60	30	30		
48	Oedogonium sp		30	-		-	30				
49	Stanieria sp.			-	30	270	360	210	480	360	
50	Stauroneis sp		180	90		90	-				
51	Stigeoclonium sp		-	60		30	-	-			
52	Ulothrix sp		30	90		30	30				
53	Vaucheria sp										
54	Chaetophora sp.				-						
55	Chamaesiphon sp.				-						
56	Licmophora sp.				-						
57	Melosira sp.				-						
58	Melosira moniliformis		60								

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
59	Phormodium sp.				40	-	-	-	-	60	
60	Rhizosolenia sp.				40						
61	Spirogyra				-					-	
62	Stigonema sp				-						
63	Tablelaria flocculosa				-			30			
64	Thallasionema sp.							30	-		
65	Aulacoseria sp.		120			-	30				
Chlorophyta											
1	Closterium sp				40	60	30	30	30	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				-						
9	Pediastrum duplex										
10	Pediastrum sp					30	-	-	60	30	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							30	30		
15	Scenedesmus sp1										
16	Scenedesmus sp2										
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
	Euglenophyta										
1	Euglena acus										
2	Euglena sp		-	-		120	60	30	90	-	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		90			60	150	30	-	-	
6	Audouinella sp		-								
	Perifiton										
1	Total Perifiton		360								
2	ID Simpson		0.938								
	Pyhtoplankton Sum										
1	Total Phytoplankton		540	810	310	1350	1410	1260	2400	930	
2	ID Simpson		0.778	0.905	0.874	0.903	0.873	0.91	0.88	0.801	
3	ID Shannon Wienner						2.257	2.73	2.44		
4	Indeks Kemerataan (E)							0.9	0.81	0.85	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.25	
8	Shanon-Waeaver										
9	H-max										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		90	90	-	60	-	-	30		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				-					30	
7	Paramaecium sp.									-	
8	Plumatella sp.									-	
9	Polychaeta sp.									-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Macrothrix sp.										
11	Cyprya sp.										
	Rhizopoda										
1	Arcella Sp				-	30	30	30	90	90	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							30	-	30	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
	Flagellata										
1	Anisonema										
2	Peranema sp									30	
	Trochelmintes										
	Rotifera										
1	Asphlanca sp		-								
2	Brachionus sp.				40	-	-	-	-		
3	Keratella sp										
4	Copepoda										
	Rotatoria										
1	Licone sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
2	Monostyla sp				-					-	
3	Epistylis sp									-	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									-	
8	Acanthocyclops sp.		90	60		60	30	60	60		
9	Chydorus sp.		-	-		-	30				
10	Notholca sp.		60	30	-	30	-	-	-	-	
11	Phylodina sp.		-	-		30	60	60	30	30	
12	Thermocyclops sp		-	-							
13	Bryocamptus sp				40						
14	C. aculeata				-						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				-						
19	Cypridiopsis sp				-						
20	Horaella sp				40						
21	Leucosolenia sp				40						
22	Macrostella sp.										
23	Microstella sp				40					-	
24	Nauplii				-			-	-	30	
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.									-	
28	Spirostomum sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
29	Cephalodella sp.							-			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				60						
33	Rhabdolaimus sp.				-						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				60						
37	Sacamoeba sp				40					-	
Zooplankton Sum											
1	Jumlah Individu/L		330	240	360	210	150	180	210	210	
2	Jumlah Taxa										
3	Indeks Diversitas									1.48	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.744	0.75	0.87	0.776	0.997	0.99	1	0.639	
8	Indeks Dominansi Shanon Wienner						1.332	1.33	1.28		
9	Indeks Kemerataan (E)							0.96	0.92	0.92	
Plankton Sum											
1	Jumlah Individu/L		870	1050	670	1560	1560	1440	2610	1140	
2	Jumlah Taxa										
3	Indeks Diversitas									2.59	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Indeks Dominansi Simpson (C)		0.878	0.931	0.064	0.077	0.107		0.89	0.919	
8	Indeks Dominansi Shanon Wienner			2.768	2.759	2.852	2.571	2.93	2.57		
9	Indeks Kemerataan (E)			0.958	0.995	0.91	0.858	0.91	0.81	0.88	
10	Indeks Diversitas Simpson plankton			0.069	0.936	0.923	0.893	0.93			
BENTHOS											
1	Baetis sp.									-	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp		-								
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		10							25	
18	Wattebledia sp		-								
Bivalia											
1	Carbicula javanica										
2	Plisbryoconcaha exilis										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
	Grastropoda										
1	Lymnaea sp									-	
2	Physa sp.									5	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		-	10	-	5	10	5	5	-	
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae									-	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
	Coleopetra										
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										
1	Olygochaeta sp										
2	Olygochaeta sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Olygochaeta sp2										
Nemathelminthes											
1	Nematoda sp										
2	Bellamya sp		5	-	-	10	5	-	-		
3	Bythinia sp		-	-		-	5	-			
4	Operculina sp.		-	-							
5	Pomacea sp		10	10		5	5	5	5		
6	Tarebia sp.			-	10	-	-	-	-	5	
7	Nereis sp.			10		-	5	5	5		
8	Lumbriculus sp.							-	-		
9	Balanus				10						
10	Cellanea sp				-						
11	Cheritidae sp				10						
12	Gafrarium sp				-						
13	Nassarium sp				10						
14	Placamen sp.				10						
Benthos Sum											
1	Total mikrozoobenthos ; /m2		25	30	50	20	30	15	15	35	
2	ID Shannon & wienner benthos		1.055	1.099	1.609	1.04	1.561	1.1	1.1		
3	Jumlah Individu/L ; individu/sampel										
4	Jumlah Taxa										
5	Indeks Diversitas									0.796	
6	Shanon-Waeaver										
7	H-max										
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.333	0.2	0.375	0.778	0.33	0.33	0.55	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Indeks Kemerataan (E)			1	1	0.946	0.97	1	0.68	0.72	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 58 Aquatic Biota in Upper Cirumamis River at 1998, 2001, 2007, 2012 – 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachelomonas sp.								33				
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.								-				
8	Microcrcys sp.								-				
9	Eunotia sp										-		
10	stephanodiscus sp										45		
11	Chroococcus sp										30		
12	Lyngbya sp										-		
13	Gomphosphaeria sp.										-		
14	Microcystis sp										-		
15	calanus sp.										-		
16	pleurothaenium sp											-	
17	zygogonium											-	
18	chlamydomonan sp											1	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				-							1	
25	Chlorella sp												-
26	Coscinodiscus sp												10
27	Cyclotella sp												20
28	Hemidiscus sp												20
29	Oocystis sp												20
30	Protococcus sp												-
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
Bacillariophyceae													
1	Closterium sp.										45		
Chyanopyta													
1	Aphanocapsa sp						6						
2	Merismopedia sp						1						
3	Oscilatoria sp.				150					20	-	2	100
4	Oscillatoria sp1						2	-					
5	Oscillatoria sp2						-						
6	zygnema sp									-	30		
7	Anabaena sp							-					
8	Sprulina							-					
Chrysophyta													
1	Amphora sp						-						10
2	Achanthes sp1							1					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2							-					
4	Cocconeis sp				-		-					-	
5	Chymbella sp						3	1	33			-	-
6	Coscinodicus sp1						2						
7	Coscinodicus sp2						-						
8	Diatoma sp						2	1				-	
9	Diatoma vulgaris												
10	Fragilaria sp.								99		-		
11	Fragillaria sp1						12	6					
12	Fragillaria sp2						6	5					
13	Fragilaria copucina											2	
14	Frustulia sp						-	-					
15	Gomphonema sp						2	-		-	-	1	
16	Navicula sp				600				-	-	-	-	50
17	Navicula sp1						3	2					
18	Navicula sp2						1	1					
19	Navicula sp3						-	-					
20	Navicula sp4						1						
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma						2	4					
24	Nitzschia sp							2			-	-	20
25	Nitzschia sp1						3						
26	Nitzschia sp2						-						
27	Nitzchia palea												
28	Pinnularia sp							-				-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1						1						
30	Pinnularia sp2						1						
31	Pleurosigma sp1						-	2					
32	Pleurosigma sp2						-	-					
33	Pleurosigma sp3						-						
34	Surirela sp								-				
35	Surirella sp1						1	4					
36	Surirella sp2						2	5					
37	Surirella sp3						-	1					
38	Surirella elegans											-	
39	Synedra sp.								-			2	-
40	Synedro ulna						1	2				2	
41	Cladophora sp.								-			-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											1	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.								297			102	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				50					-	-		
53	Vaucheria sp				-								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											3	
58	Melosira moniliformis												
59	Phormodium sp.								33			5	10
60	Rhizosolenia sp.												
61	Spirogyra								-	50	90		
62	Stigonema sp												
63	Tablelaria flocculosa								66			-	
64	Thallasionema sp.												
65	Aulacoseria sp.												
Chlorophyta													
1	Closterium sp						1		-	-	-	1	10
2	Closterium sp1							-					
3	Closterium sp2							-					
4	Closterium setaceum								-				
5	Coelastrum sp						-						
6	Cosmarium sp						1	1					
7	Euastrum sp						2						
8	Pediastrum simplex							-	-				
9	Pediastrum duplex						-	-					
10	Pediastrum sp							-				-	
11	Pediastrum sp1						-						
12	Pediastrum sp2						-						
13	Pleototanium sp						-						
14	Scenedesmus sp											-	20

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1							-					
16	Scenedesmus sp2							-					
17	Scenedesmus sp3							-					
18	Scenedesmus guadricouda						-						
19	Scenedesmus ellipsoideus						-						
20	Scenedesmus ermotus						-						
21	Scenedesmus longispina						-						
22	Scenedesmus dimorphus						-						
23	Scenedesmus ecuminatus						-						
24	Tetmemorius sp						-						
	Euglenophyta												
1	Euglena acus							-					
2	Euglena sp						1	1					
3	phacus ionicauda												
4	phacus undulatus												
5	phacus sp							3					
6	Audouinella sp												
	Perifiton												
1	Total Perifiton												
2	ID Simpson												
	Pyhtoplankton Sum												
1	Total Phytoplankton								561			123	290
2	ID Simpson								0.66			0.31	0.8228
3	ID Shannon Wienner												2.0568
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)						57	42					
6	Jumlah Taxa						23	17					
7	Indeks Diversitas						4.0322	3.784					
8	Shanon-Waeaver						-	-					
9	H-max						4.5236	4.0875					
10	Equitabilitas						0.8914	0.9258					
ZOOPLANKTON													
Mollusca													
1	Larva Molusca									-			
Artropoda													
Crustaceae													
1	Larva kepiting									-			
2	Larva udang									-	15		
Branciopoda													
1	Branciopoda sp						-						
Copepoda													
1	Cyelops sp							1			-	1	30
Protozoa													
Dinophyceae													
1	Peridinium sp									-			
Ciliata													
1	Colpoda sp						5	-					-
2	Didinium sp						4						
3	Glaucoma sp						6	-					
4	Lionclus sp						-						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp						-						
6	Vorticella sp.							-				-	
7	Paramaecium sp.				-							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											-	
Rhizopoda													
1	Arcella Sp								-			35	-
2	Arcella discoides						8	7					
3	Arcella viilgaris						2	-					
4	Amoeba sp						-						
5	Centropyxis sp.								33			5	
6	Centropyxis acureata						2	-					
7	Spirozona sp.								-				
8	Diffugia sp						-	-				-	
9	Panagrolaimus sp.											-	
10	Euglypha sp							-				2	
11	Euglypha sp1						1						
12	Euglypha sp2						-						
Flagellata													
1	Anisonema							2					
2	Peranema sp						1	2					
Trochelmintes													
Rotifera													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									80	15		
2	Brachionus sp.									-	-		
3	Keratella sp										15		
4	Copepoda									30	-		
Rotatoria													
1	Licone sp							-					
2	Monostyla sp						-	1				-	
3	Epistylis sp											-	
4	Loxofillum sp											-	
5	Chilodonella sp											-	
6	Ichtydium sp											1	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.						1	-	-			-	
11	Phylodina sp.							3	-			-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											35	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp												
23	Macrostella sp.												
24	Nauplii											1	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											-	
28	Spirostomum sp.											-	
29	Cephalodella sp.											-	10
30	Bursaria sp.											1	
31	Psilotricha sp.											-	
32	Platyas sp												
33	Rhabdolaimus sp.								33				10
34	Diaptomus sp.								-		-		
35	Tintinnopsis sp.												-
36	Rotifera sp												
37	Sacamoeba sp												
Zooplankton Sum													
1	Jumlah Individu/L						31	16	66			82	50
2	Jumlah Taxa						10	6					
3	Indeks Diversitas						2.9166	2.2245					
4	Shanon-Waeaver						-	-					
5	H-max						3.3219	2.585					
6	Equitabilitas						0.878	0.8606					
7	Indeks Dominansi Simpson (C)								0.5			0.631	0.56
8	Indeks Dominansi Shanon Wienner												0.9503
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Plankton Sum													
1	Jumlah Individu/L				800					180	360	205	340
2	Jumlah Taxa				3					4	9		
3	Indeks Diversitas												
4	Shanon-Waeaver										-		
5	H-max									1.386	2.197		
6	Equitabilitas									0.908	0.913		
7	Indeks Dominansi Simpson (C)				0.4							0.693	0.138
8	Indeks Dominansi Shanon Wienner				0.7					1.259	2.005		2.3116
9	Indeks Kemerataan (E)												0.876
10	Indeks Diversitas Simpson plankton												0.8616
BENTHOS													
1	Baetis sp.								3				
2	Tiara sp.								-				
3	Hydrophyceae sp.								18				
4	Planaria sp								3				
5	Enalagma sp								12				
6	Helobdella sp								-				
7	Sulcospira sp.								-				3
8	Anadara sp											5	
9	Bursa sp											-	
10	Cerithideopsilla sp.											5	
11	Conus sp											5	
12	Corbicula sp											-	
13	Littorina sp											5	
14	Tellina sp											5	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											-	
16	Trochus sp.											5	
17	Tubifex sp												
18	Wattebledia sp												
	Bivalia												
1	Carbicula javanica									-	25		
2	Plisbryoconcaha exilis										-		
	Grastropoda												
1	Lymnaea sp									50	25		3
2	Physa sp.												
3	Goniobasis livescen									-	-		
4	Campeloma sp.									-	-		
5	Pomacea canaliculata									50	75		
6	Parathelpusa sp.									75	25		
7	Ena sp										225		
8	Pila ampullacea sp										25		
9	Melanoides sp						-		24				3
	Arthropoda												
	Insecta												
	Diptera												
1	Chironomiae						1	-	3	50			
2	Diptera (sp 1 larva)							-					
3	Diptera (sp 1 pupa)						1						
4	Diptera (sp 2 pupa)						-	-					
5	Diptera (sp 3 pupa)							2					

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Coleopetra													
1	Elimiade						-	1					
2	Coleopatra sp 1						2	-					
3	Coleopatra sp 2						-	1					
Annelida													
Olygochaeta													
1	Olygochaeta sp						1						
2	Olygochaeta sp1							-					
3	Olygochaeta sp2							2					
Nemathelminthes													
1	Nematoda sp						-	4					
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp								-				
6	Tarebia sp.								-				
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
Benthos Sum													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2								63	225	400	30	9
2	ID Shannon & wienner benthos								1.476			1.792	1.0986
3	Jumlah Individu/L ; individu/sampel						5	10					
4	Jumlah Taxa						4	5		4	6		
5	Indeks Diversitas						1.9246	2.1215		1.369	1.331		
6	Shanon-Waeaver						-	-					
7	H-max						2	2.3219		1.386	1.792		
8	Equitabilitas						0.9608	0.9137		0.988	0.743		
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
MACROINVERTEBRATE													
1	Acreneuria sp.				1								
2	Berosus sp.				1								
3	Campolema sp.				-								
4	Cerithidae sp.				-								
5	Gonidae sp.				-								
6	Heisoma sp.				-								
7	Lymnaea sp.				-								-
8	Pleurocera sp.				-								
9	Pteronarcys sp.				1								
10	Stenelmis sp.				-								
11	Steronema sp.				-								
12	Tarebia sp.				-								
13	Thrassis pansus				-								
MACROINVERTEBRATE SUM													
1	Number of Species				3								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				3								
3	Index Shannon-Wienner				1.1								
4	Index Simpson				0.67								

Table 59 Aquatic Biota in Upper Cirumamis River at 2016 – 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.									-	
2	Tolypothrix sp.									30	
3	Actinastrum sp.									-	
4	Bacteriastrum sp.									-	
5	Ceratium sp.									30	
6	Craticula sp.		-								
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									-	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										
23	hyalotheca sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
24	tribonema sp									30	
25	Chlorella sp										
26	Coscinodiscus sp				-						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		30								
32	Polycystis sp.		30								
33	Rivularia sp.		-								
Bacillariophyceae											
1	Closterium sp.										
Chyanopyta											
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.		30		-	60	30	30	300	60	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		30								
8	Sprulina										
Chrysophyta											
1	Amphora sp					-	30	-	30		
2	Achanthes sp1										
3	Achanthes sp2										
4	Cocconeis sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	Chymbella sp		60	60	30	60	90	90	30	-	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			210		60	60	30	30		
9	Diatoma vulgaris		30								
10	Fragilaria sp.		-	-		30	30	120	120	-	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				-						
14	Frustulia sp										
15	Gomphonema sp		30	90		-	-	-			
16	Navicula sp			-	30	-	-	-	30	60	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		-								
22	Navicula cryptocephala		60								
23	Nitzschia sigma										
24	Nitzschia sp			30	30	120	150	210	120	-	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea		-								
28	Pinnularia sp					30	-	-	-		
29	Pinnularia sp1										
30	Pinnularia sp2										
31	Pleurosigma sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				-	30	30	30	-		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				-					-	
40	Synedro ulna										
41	Cladophora sp.			30	60	-	30	-	-	-	
42	Gyrosigma sp		120	60	40	60	30	30	30	-	
43	Gyrosigma sp (Perifiton)		60								
44	Lemanea sp.			-	40	-	30	60	150	30	
45	Lyngbya sp.			30	40	30	30	30	30	30	
46	Microspora sp		60	-	-	30	60	60	-	-	
47	Mougeotia sp.		90	90		90	60	-	-		
48	Oedogonium sp		60	30		30	-				
49	Stanieria sp.			-	390	90	210	240	180	90	
50	Stauroneis sp		60	60		60	-				
51	Stigeoclonium sp		-	-		-	30	30			
52	Ulothrix sp		30	60		60	60				
53	Vaucheria sp										
54	Chaetophora sp.				-						
55	Chamaesiphon sp.				-						
56	Licmophora sp.				-						
57	Melosira sp.				-						
58	Melosira moniliformis		30								

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
59	Phormodium sp.				120	-	-	-	-	90	
60	Rhizosolenia sp.				-						
61	Spirogyra				40					-	
62	Stigonema sp				40						
63	Tablelaria flocculosa				-			60			
64	Thallasionema sp.							60	30		
65	Aulacoseria sp.		90			30	-				
Chlorophyta											
1	Closterium sp				40	30	60	60	60	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				-						
9	Pediastrum duplex										
10	Pediastrum sp					30	-	-	-	-	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							-	-		
15	Scenedesmus sp1										
16	Scenedesmus sp2										
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
Euglenophyta											
1	Euglena acus										
2	Euglena sp		-			30	60	30	30	-	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		210			120	90	30	30	-	
6	Audouinella sp		-								
Perifiton											
1	Total Perifiton		420								
2	ID Simpson		0.939								
Pyhtoplankton Sum											
1	Total Phytoplankton		690	930	900	1080	1170	1200	1200	420	
2	ID Simpson		0.82	0.872	0.775	0.935	0.918	0.9	0.87	0.842	
3	ID Shannon Wienner						2.726	2.54	2.33		
4	Indeks Kemerataan (E)							0.9	0.86	0.98	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.16	
8	Shanon-Waeaver										
9	H-max										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		60	-	40	-	-	60	30		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				-					-	
7	Paramaecium sp.									-	
8	Plumatella sp.									-	
9	Polychaeta sp.									-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Macrothrix sp.										
11	Cyprya sp.										
	Rhizopoda										
1	Arcella Sp				-	30	30	30	60	30	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							-	-	30	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
	Flagellata										
1	Anisonema										
2	Peranema sp									-	
	Trochelmintes										
	Rotifera										
1	Asphlanca sp		60								
2	Brachionus sp.		-		-	-	-	-	30		
3	Keratella sp										
4	Copepoda										
	Rotatoria										
1	Licone sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
2	Monostyla sp				40					-	
3	Epistylis sp									-	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									-	
8	Acanthocyclops sp.		60	30		30	30	30	30		
9	Chydorus sp.		60	30		30	-				
10	Notholca sp.		-	-	40	-	30	-	-	30	
11	Phylodina sp.		30	60		30	30	30	30	30	
12	Thermocyclops sp		-	30							
13	Bryocamptus sp				-						
14	C. aculeata				-						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				40						
19	Cypridiopsis sp				-						
20	Horaella sp				-						
21	Leucosolenia sp				-						
22	Microstella sp				-						
23	Macrostella sp.									-	
24	Nauplii				60			30	30	-	
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.									-	
28	Spirostomum sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
29	Cephalodella sp.							30			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				-						
33	Rhabdolaimus sp.				60						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				-						
37	Sacamoeba sp				-					-	
Zooplankton Sum											
1	Jumlah Individu/L		210	180	280	120	150	210	210	120	
2	Jumlah Taxa										
3	Indeks Diversitas									1.39	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.735	0.778	0.827	0.75	0.8	0.82	0.82	0.938	
8	Indeks Dominansi Shanon Wienner						1.288	1.75	1.75		
9	Indeks Kemerataan (E)							0.98	0.98	1	
Plankton Sum											
1	Jumlah Individu/L		900	1110	1180	1200	1320	1410	1410	540	
2	Jumlah Taxa										
3	Indeks Diversitas									2.53	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
7	Indeks Dominansi Simpson (C)		0.88	0.096	0.141	0.055	0.067		0.9	0.898	
8	Indeks Dominansi Shanon Wienner			2.587	2.48	3.039	2.956	2.84	2.58		
9	Indeks Kemerataan (E)			0.913	0.858	0.956	0.943	0.91	0.85	0.99	
10	Indeks Diversitas Simpson plankton			0.904	0.859	0.945	0.933	0.92			
BENTHOS											
1	Baetis sp.									5	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp										
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		5							10	
18	Wattebledia sp		-								
Bivalia											
1	Carbicula javanica										
2	Plisbryoconcaha exilis										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
	Grastropoda										
1	Lymnaea sp									5	
2	Physa sp.									-	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		5	5	10	10	10	-	10	-	
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae									-	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
	Coleopetra										
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										
1	Olygochaeta sp										
2	Olygochaeta sp1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Olygochaeta sp2										
Nemathelminthes											
1	Nematoda sp										
2	Bellamya sp		10	10	-	10	5	5	5		
3	Bythinia sp		5	10		5	5	5			
4	Operculina sp.		5	-							
5	Pomacea sp		5	-		-	-	-	-		
6	Tarebia sp.			5	-	5	-	-	-	-	
7	Nereis sp.			5		5	5	5	5		
8	Lumbriculus sp.							-	-		
9	Balanus				10						
10	Cellanea sp				-						
11	Cheritidae sp				-						
12	Gafrarium sp				-						
13	Nassarium sp				-						
14	Placamen sp.				-						
Benthos Sum											
1	Total mikrozoobenthos ; /m2		40	35	20	35	25	15	20	20	
2	ID Shannon & wienner benthos		1.906	1.55	0.693	1.55	1.332	1.1	1.04		
3	Jumlah Individu/L ; individu/sampel										
4	Jumlah Taxa										
5	Indeks Diversitas									1.04	
6	Shanon-Waeaver										
7	H-max										
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.224	0.5	0.224	0.72	0.33	0.38	0.38	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
10	Indeks Kemerataan (E)			0.963	1	0.963	0.961	1	0.65	0.95	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 60 Aquatic Biota in Lower Cirumamis River at 2001, 2007, 2013 – 2015

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA													
PYHTOPLANKTON													
1	Trachelomonas sp.								-				
2	Tolypothrix sp.												
3	Actinastrum sp.												
4	Bacteriastrum sp.												
5	Ceratium sp.												
6	Craticula sp.												
7	Bulbochaete sp.								33				
8	Microcrcys sp.								33				
9	Eunotia sp										-		
10	stephanodiscus sp										30		
11	Chroococcus sp										225		
12	Lyngbya sp										-		
13	Gomphosphaeria sp.										-		
14	Microcystis sp										-		
15	calanus sp.										15		
16	pleurothaenium sp											-	
17	zygogonium											-	
18	chlamydomonan sp											-	
19	achnantheis sp											-	
20	epithemia											-	
21	denticula sp											-	
22	rhopadolia											-	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp											-	
24	tribonema sp				-							-	
25	Chlorella sp												120
26	Coscinodiscus sp												-
27	Cyclotella sp												-
28	Hemidiscus sp												20
29	Oocystis sp												-
30	Protococcus sp												40
31	Nostoc sp.												
32	Polycystis sp.												
33	Rivularia sp.												
	Bacillariophyceae												
1	Closterium sp.										-		
	Chyanopyta												
1	Aphanocapsa sp												
2	Merismopedia sp												
3	Oscilatoria sp.				100					20	-	-	240
4	Oscillatoria sp1												
5	Oscillatoria sp2												
6	zygnema sp									-	-		
7	Anabaena sp												
8	Sprulina												
	Chrysophyta												
1	Amphora sp												-
2	Achanthes sp1												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2												
4	Cocconeis sp				-							-	
5	Chymbella sp								-			-	-
6	Coscinodicus sp1												
7	Coscinodicus sp2												
8	Diatoma sp											-	
9	Diatoma vulgaris												
10	Fragilaria sp.								66		-		
11	Fragillaria sp1												
12	Fragillaria sp2												
13	Fragilaria copucina											9	
14	Frustulia sp												
15	Gomphonema sp									-	30	-	
16	Navicula sp				-				-	30	-	2	40
17	Navicula sp1												
18	Navicula sp2												
19	Navicula sp3												
20	Navicula sp4												
21	Navicula atomus												
22	Navicula cryptocephala												
23	Nitzschia sigma												
24	Nitzschia sp										15	1	10
25	Nitzschia sp1												
26	Nitzschia sp2												
27	Nitzchia palea												
28	Pinnularia sp											1	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1												
30	Pinnularia sp2												
31	Pleurosigma sp1												
32	Pleurosigma sp2												
33	Pleurosigma sp3												
34	Surirela sp								66				
35	Surirella sp1												
36	Surirella sp2												
37	Surirella sp3												
38	Surirella elegans											4	
39	Synedra sp.								-			3	-
40	Synedro ulna											-	
41	Cladophora sp.								-			-	
42	Gyrosigma sp												
43	Gyrosigma sp (Perifiton)												
44	Lemanea sp.											-	
45	Lyngbya sp.												
46	Microspora sp												
47	Mougeotia sp.												
48	Oedogonium sp												
49	Stanieria sp.								396			85	
50	Stauroneis sp												
51	Stigeoclonium sp												
52	Ulothrix sp				50					-	-		
53	Vaucheria sp				-								
54	Chaetophora sp.												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.												
56	Licmophora sp.												
57	Melosira sp.											1	
58	Melosira moniliformis												
59	Phormodium sp.								-			31	100
60	Rhizosolenia sp.												
61	Spirogyra								33	80	60		
62	Stigonema sp												
63	Tablelaria flocculosa								33			2	
64	Thallasionema sp.												
65	Aulacoseria sp.												
Chlorophyta													
1	Closterium sp								-	-	15	1	-
2	Closterium sp1												
3	Closterium sp2												
4	Closterium setaceum								-				
5	Coelastrum sp												
6	Cosmarium sp												
7	Euastrum sp												
8	Pediastrum simplex								-				
9	Pediastrum duplex												
10	Pediastrum sp											2	
11	Pediastrum sp1												
12	Pediastrum sp2												
13	Pleototanium sp												
14	Scenedesmus sp											1	-

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1												
16	Scenedesmus sp2												
17	Scenedesmus sp3												
18	Scenedesmus guadricouda												
19	Scenedesmus ellipsoideus												
20	Scenedesmus ermotus												
21	Scenedesmus longispina												
22	Scenedesmus dimorphus												
23	Scenedesmus ecuminatus												
24	Tetmemorius sp												
	Euglenophyta												
1	Euglena acus												
2	Euglena sp											-	
3	phacus ionicauda												
4	phacus undulatus												
5	phacus sp												
6	Audouinella sp												
	Perifiton												
1	Total Perifiton												
2	ID Simpson												
	Pyhtoplankton Sum												
1	Total Phytoplankton								660			143	570
2	ID Simpson								0.61			0.594	0.7362
3	ID Shannon Wienner												1.5589
4	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)												
6	Jumlah Taxa												
7	Indeks Diversitas												
8	Shanon-Waeaver												
9	H-max												
10	Equitabilitas												
ZOOPLANKTON													
Mollusca													
1	Larva Molusca									-			
Artropoda													
Crustaceae													
1	Larva kepiting									40			
2	Larva udang									40	-		
Branciopoda													
1	Branciopoda sp												
Copepoda													
1	Cyelops sp										15	-	-
Protozoa													
Dinophyceae													
1	Peridinium sp									-	-		
Ciliata													
1	Colpoda sp												-
2	Didinium sp												
3	Glaucoma sp											-	
4	Lionclus sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp												
6	Vorticella sp.											-	
7	Paramaecium sp.				-							-	
8	Plumatella sp.												
9	Polychaeta sp.												
10	Macrothrix sp.											-	
11	Cyprya sp.											-	
Rhizopoda													
1	Arcella Sp								33			7	30
2	Arcella discoides												
3	Arcella viilgaris												
4	Amoeba sp												
5	Centropyxis sp.								-			10	
6	Centropyxis acureata												
7	Spirozona sp.								-				
8	Panagrolaimus sp.											1	
9	Diffugia sp											10	
10	Euglypha sp											-	
11	Euglypha sp1												
12	Euglypha sp2												
Flagellata													
1	Anisonema												
2	Peranema sp												
Trochelmintes													
Rotifera													

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									-	-		
2	Brachionus sp.									-	15		
3	Keratella sp.										-		
4	Copepoda									50	-		
Rotatoria													
1	Licone sp												
2	Monostyla sp											-	
3	Epistylis sp											-	
4	Loxofillum sp											-	
5	Chilodonella sp											-	
6	Ichtydium sp											-	
7	Acanthocystis sp.												
8	Acanthocyclops sp.												
9	Chydorus sp.												
10	Notholca sp.								-			-	
11	Phylodina sp.								33			-	
12	Thermocyclops sp												
13	Bryocamptus sp												
14	C. aculeata											3	
15	Chaos sp											-	
16	Lionotus sp											-	
17	Coleps sp											-	
18	Cladoera sp												
19	Cypridiopsis sp												
20	Horaella sp												
21	Leucosolenia sp												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp												
23	Macrostella sp.												
24	Nauplii											2	
25	Boomina sp.											-	
26	Plamatella sp.											-	
27	Moina sp.											-	
28	Spirostomum sp.											-	
29	Cephalodella sp.											1	-
30	Bursaria sp.											1	
31	Psilotricha sp.											-	
32	Platyas sp												
33	Rhabdolaimus sp.								-				-
34	Diaptomus sp.								33		-		
35	Tintinnopsis sp.												20
36	Rotifera sp												
37	Sacamoeba sp												
Zooplankton Sum													
1	Jumlah Individu/L								99			35	50
2	Jumlah Taxa												
3	Indeks Diversitas												
4	Shanon-Waeaver												
5	H-max												
6	Equitabilitas												
7	Indeks Dominansi Simpson (C)								0.67			0.784	0.48
8	Indeks Dominansi Shanon Wienner												0.673
9	Indeks Kemerataan (E)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
	Plankton Sum												
1	Jumlah Individu/L				150				759	260	435	178	620
2	Jumlah Taxa				2					6	9		
3	Indeks Diversitas												
4	Shanon-Waeaver										-		
5	H-max									1.792	2.197		
6	Equitabilitas									0.92	0.765		
7	Indeks Dominansi Simpson (C)				0.44				0.7			0.729	0.226
8	Indeks Dominansi Shanon Wienner				0.64					1.702	1.68		1.7678
9	Indeks Kemerataan (E)												0.768
10	Indeks Diversitas Simpson plankton												0.7737
	BENTHOS												
1	Baetis sp.								15				
2	Tiara sp.								-				
3	Hydrophyceae sp.								15				
4	Planaria sp								-				
5	Enalagma sp								-				
6	Helobdella sp								6				
7	Sulcospira sp.								18				-
8	Anadara sp											-	
9	Bursa sp											-	
10	Cerithideopsilla sp.											-	
11	Conus sp											5	
12	Corbicula sp											5	
13	Littorina sp											5	
14	Tellina sp											5	

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp											-	
16	Trochus sp.											-	
17	Tubifex sp												
18	Wattebledia sp												
	Bivalia												
1	Carbicula javanica									25	-		
2	Plisbryoconcaha exilis										-		
	Grastropoda												
1	Lymnaea sp									25	50		3
2	Physa sp.												
3	Goniobasis livescen									-	-		
4	Campeloma sp.									-	-		
5	Pomacea canaliculata									75	50		
6	Parathelpusa sp.									25	25		
7	Ena sp										75		
8	Pila ampullacea sp										-		
9	Melanoides sp								-				-
	Arthropoda												
	Insecta												
	Diptera												
1	Chironomiae								-	-			
2	Diptera (sp 1 larva)												
3	Diptera (sp 1 pupa)												
4	Diptera (sp 2 pupa)												
5	Diptera (sp 3 pupa)												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
	Coleopetra												
1	Elimiade												
2	Coleopatra sp 1												
3	Coleopatra sp 2												
	Annelida												
	Olygochaeta												
1	Olygochaeta sp												
2	Olygochaeta sp1												
3	Olygochaeta sp2												
	Nemathelminthes												
1	Nematoda sp												
2	Bellamya sp												
3	Bythinia sp												
4	Operculina sp.												
5	Pomacea sp								-				
6	Tarebia sp.								9				
7	Nereis sp.												
8	Lumbriculus sp.												
9	Balanus												
10	Cellanea sp												
11	Cheritidae sp												
12	Gafrarium sp												
13	Nassarium sp												
14	Placamen sp.												
	Benthos Sum												

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2								63	150	200	20	3
2	ID Shannon & wienner benthos								1.543			1.386	0
3	Jumlah Individu/L												
4	Jumlah Taxa									4	4		
5	Indeks Diversitas									1.242	1.321		
6	Shanon-Waeaver												
7	H-max									1.386	1.386		
8	Equitabilitas									0.896	0.953		
9	Indeks Dominansi Simpson (C)												
10	Indeks Kemerataan (E)												
	MACROINVERTEBRATE												
1	Acreneuria sp.				-								
2	Berosus sp.				-								
3	Campolema sp.				6								
4	Cerithidae sp.				1								
5	Gonidae sp.				1								
6	Heisoma sp.				1								
7	Lymnaea sp.				-								-
8	Pleurocera sp.				23								
9	Pteronarcys sp.				-								
10	Stenelmis sp.				-								
11	Steronema sp.				-								
12	Tarebia sp.				-								
13	Thrassis pansus				1								
	MACROINVERTEBRATE SUM												
1	Number of Species				6								

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014		2015	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual				33								
3	Index Shannon-Wienner				0.99								
4	Index Simpson				0.48								

Table 61 Aquatic Biota in Lower Cirumamis River at 2016 – 2020

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.									-	
2	Tolypothrix sp.									30	
3	Actinastrum sp.									-	
4	Bacteriastrum sp.									60	
5	Ceratium sp.									30	
6	Craticula sp.		-								
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp									-	
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										
23	hyalotheca sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
24	tribonema sp									-	
25	Chlorella sp										
26	Coscinodiscus sp				30						
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.		30								
32	Polycystis sp.		30								
33	Rivularia sp.		-								
	Bacillariophyceae										
1	Closterium sp.										
	Chyanopyta										
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.		30		-	60	30	30	720	60	
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp		30								
8	Sprulina										
	Chrysophyta										
1	Amphora sp					-	30	-	30		
2	Achanthes sp1										
3	Achanthes sp2										
4	Cocconeis sp										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	Chymbella sp		30	30	30	30	60	120	90	-	
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp			150		90	90	90	60		
9	Diatoma vulgaris		30								
10	Fragilaria sp.		-	-		60	90	90	420	30	
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina				-						
14	Frustulia sp										
15	Gomphonema sp		-	60		-	-	-			
16	Navicula sp			-	30	-	-	-	210	30	
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus		-								
22	Navicula cryptocephala		30								
23	Nitzschia sigma										
24	Nitzschia sp			60	30	240	210	180	330	30	
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea		-								
28	Pinnularia sp					30	-	-	-		
29	Pinnularia sp1										
30	Pinnularia sp2										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
31	Pleurosigma sp1										
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp				-	-	-	-	30		
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.				-					-	
40	Synedro ulna										
41	Cladophora sp.			30	-	-	30	-	-	-	
42	Gyrosigma sp		-	60	-	60	30	30	90	30	
43	Gyrosigma sp (Perifiton)		60								
44	Lemanea sp.			-	40	-	60	30	360	-	
45	Lyngbya sp.			60	-	30	30	30	30	-	
46	Microspora sp		60	60	-	-	-	-	30	-	
47	Mougeotia sp.		-	60		60	-	30	30		
48	Oedogonium sp		60	30		30	-				
49	Stanieria sp.			-	330	360	270	240	900	90	
50	Stauroneis sp		90	-		-	90				
51	Stigeoclonium sp		-	-		-	30	30			
52	Ulothrix sp		30	30		30	30				
53	Vaucheria sp										
54	Chaetophora sp.				40						
55	Chamaesiphon sp.				-						
56	Licmophora sp.				-						

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
57	Melosira sp.				-						
58	Melosira moniliformis		30								
59	Phormodium sp.				120	-	-	-	-	30	
60	Rhizosolenia sp.				-						
61	Spirogyra				-					-	
62	Stigonema sp				-						
63	Tablelaria flocculosa				-			-			
64	Thallasionema sp.							30	-		
65	Aulacoseria sp.		60			30	-				
	Chlorophyta										
1	Closterium sp				40	30	60	60	30	-	
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex				-						
9	Pediastrum duplex										
10	Pediastrum sp					-	30	30	60	-	
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp							30	60		
15	Scenedesmus sp1										
16	Scenedesmus sp2										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
	Euglenophyta										
1	Euglena acus										
2	Euglena sp		-	-		120	120	90	120	30	
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp		180			150	60	30	30	-	
6	Audouinella sp		-								
	Perifiton										
1	Total Perifiton		360								
2	ID Simpson		0.938								
	Pyhtoplankton Sum										
1	Total Phytoplankton		420	750	690	1410	1350	1320	3630	360	
2	ID Simpson		0.724	0.89	0.723	0.873	0.903	0.92	0.86	0.826	
3	ID Shannon Wienner						2.598	2.75	2.31		
4	Indeks Kemerataan (E)							0.9	0.78	1.08	
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas									2.6	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Shanon-Waeaver										
9	H-max										
10	Equitabilitas										
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca										
	Artropoda										
	Crustaceae										
1	Larva kepiting										
2	Larva udang										
	Branciopoda										
1	Branciopoda sp										
	Copepoda										
1	Cyelops sp		90	-	-	-	60	30	120		
	Protozoa										
	Dinophyceae										
1	Peridinium sp										
	Ciliata										
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.				40					-	
7	Paramaecium sp.									-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
8	Plumatella sp.									-	
9	Polychaeta sp.									-	
10	Macrothrix sp.										
11	Cyprya sp.										
	Rhizopoda										
1	Arcella Sp				40	30	30	30	120	30	
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.							-	30	60	
6	Centropyxis acureata										
7	Spirozona sp.										
8	Panagrolaimus sp.										
9	Diffugia sp										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
	Flagellata										
1	Anisonema										
2	Peranema sp									-	
	Trochelmintes										
	Rotifera										
1	Asphlanca sp		-								
2	Brachionus sp.		60		-	-	-	-	90		
3	Keratella sp.										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
4	Copepoda										
	Rotatoria										
1	Licone sp										
2	Monostyla sp				-					-	
3	Epistylis sp									30	
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.									30	
8	Acanthocyclops sp.		30	30		30	60	60	90		
9	Chydorus sp.		-	30		30	-				
10	Notholca sp.		60	-	40	-	30	-	-	-	
11	Phylodina sp.		-	60		60	30	30	60	60	
12	Thermocyclops sp		-	30							
13	Bryocamptus sp				-						
14	C. aculeata				-						
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp				40						
19	Cypridiopsis sp				-						
20	Horaella sp				-						
21	Leucosolenia sp				-						
22	Microstella sp				-						
23	Macrostella sp.									-	
24	Nauplii				40			-	-	-	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.									-	
28	Spirostomum sp.										
29	Cephalodella sp.							-			
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp				-						
33	Rhabdolaimus sp.				60						
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp				-						
37	Sacamoeba sp				-					30	
Zooplankton Sum											
1	Jumlah Individu/L		240	180	260	150	210	150	510	240	
2	Jumlah Taxa										
3	Indeks Diversitas									1.73	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.719	0.778	0.828	0.72	0.776	0.72	0.81	0.922	
8	Indeks Dominansi Shanon Wienner							1.33	1.71		
9	Indeks Kemerataan (E)							0.96	0.96	0.97	
Plankton Sum											
1	Jumlah Individu/L		660	930	950	1560	1560	1320	4140	600	
2	Jumlah Taxa										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Indeks Diversitas									3	
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)		0.851	0.08	0.159	0.107	0.077		0.89	0.925	
8	Indeks Dominansi Shanon Wienner			2.682	2.307	2.6	2.888	2.75	2.54		
9	Indeks Kemerataan (E)			0.947	0.852	0.868	0.921	0.9	0.79	1	
10	Indeks Diversitas Simpson plankton			0.92	0.841	0.893	0.923	0.92			
	BENTHOS										
1	Baetis sp.									5	
2	Tiara sp.									-	
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp		-								
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp		15							25	

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
18	Wattebledia sp		-								
Bivalia											
1	Carbicula javanica										
2	Plisbryoconcaha exilis										
Grastropoda											
1	Lymnaea sp									-	
2	Physa sp.									-	
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp		-	10	-	10	5	5	5	-	
Arthropoda											
Insecta											
Diptera											
1	Chironomiae									10	
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
Coleopetra											
1	Elimiade										
2	Coleopatra sp 1										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										
1	Olygochaeta sp										
2	Olygochaeta sp1										
3	Olygochaeta sp2										
	Nemathelminthes										
1	Nematoda sp										
2	Bellamya sp		5	5	10	5	10	-	-		
3	Bythinia sp		-	5		5	-	-			
4	Operculina sp.		-	-							
5	Pomacea sp		10	5		5	5	5	5		
6	Tarebia sp.			-	-	-	-	-	-	-	
7	Nereis sp.			5		5	-	-	-		
8	Lumbriculus sp.							-	5		
9	Balanus				10						
10	Cellanea sp				-						
11	Cheritidae sp				-						
12	Gafrarium sp				-						
13	Nassarium sp				-						
14	Placamen sp.				-						
	Benthos Sum										
1	Total mikrozoobenthos ; /m2		30	30	20	30	20	10	15	40	
2	ID Shannon & wienner benthos		1.011	1.561	0.693	1.561	1.04	0.69	1.1		
3	Jumlah Individu/L										
4	Jumlah Taxa										

No.	Parameter	Unit	2016		2017		2018		2019		2020
			Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Mar
5	Indeks Diversitas									0.9	
6	Shanon-Waeaver										
7	H-max										
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)			0.222	0.5	0.222	0.625	0.5	0.33	0.47	
10	Indeks Kemerataan (E)			0.97	1	0.97	0.947	1	0.68	0.82	
MACROINVERTEBRATE											
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
MACROINVERTEBRATE SUM											
1	Number of Species										
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 62 Aquatic Biota in Bojongsalam at 1998, 2012, 2013, 2014

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.										
2	Tolypothrix sp.										
3	Actinastrum sp.										
4	Bacteriastrum sp.										
5	Ceratium sp.										
6	Craticula sp.										
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										15
10	stephanodiscus sp										-
11	Chroococcus sp										-
12	Lyngbya sp										30
13	Gomphosphaeria sp.										-
14	Microcystis sp										-
15	calanus sp.										15
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
23	hyalotheca sp										
24	tribonema sp										
25	Chlorella sp										
26	Coscinodiscus sp										
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.										
32	Polycystis sp.										
33	Rivularia sp.										
	Bacillariophyceae										
1	Closterium sp.										-
	Chyanopyta										
1	Aphanocapsa sp						3				
2	Merismopedia sp						-				
3	Oscilatoria sp.									50	-
4	Oscillatoria sp1						1	1			
5	Oscillatoria sp2						-				
6	zygnema sp									40	-
7	Anabaena sp							1			
8	Sprulina							-			
	Chrysophyta										
1	Amphora sp						-				
2	Achanthes sp1							3			

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Achanthes sp2							1			
4	Cocconeis sp						-				
5	Chymbella sp						3	2			
6	Coscinodicus sp1						-				
7	Coscinodicus sp2						-				
8	Diatoma sp						-	1			
9	Diatoma vulgaris										
10	Fragilaria sp.										30
11	Fragillaria sp1						8	26			
12	Fragillaria sp2						5	15			
13	Fragilaria copucina										
14	Frustulia sp						-	-			
15	Gomphonema sp						-	-		-	45
16	Navicula sp									-	-
17	Navicula sp1						5	4			
18	Navicula sp2						2	-			
19	Navicula sp3						4	-			
20	Navicula sp4						-				
21	Navicula atomus										
22	Navicula cryptocephala										
23	Nitzschia sigma						1	8			
24	Nitzschia sp							7			-
25	Nitzschia sp1						8				
26	Nitzschia sp2						-				
27	Nitzchia palea										
28	Pinnularia sp							1			

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
29	Pinnularia sp1						-	2			
30	Pinnularia sp2						-	1			
31	Pleurosigma sp1						9				
32	Pleurosigma sp2						-				
33	Pleurosigma sp3						-				
34	Surirela sp										
35	Surirella sp1						1	13			
36	Surirella sp2						3	11			
37	Surirella sp3						-	2			
38	Surirella elegans										
39	Synedra sp.										
40	Synedro ulna						3	3			
41	Cladophora sp.										
42	Gyrosigma sp										
43	Gyrosigma sp (Perifiton)										
44	Lemanea sp.										
45	Lyngbya sp.										
46	Microspora sp										
47	Mougeotia sp.										
48	Oedogonium sp										
49	Stanieria sp.										
50	Stauroneis sp										
51	Stigeoclonium sp										
52	Ulothrix sp									-	-
53	Vaucheria sp										
54	Chaetophora sp.										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
55	Chamaesiphon sp.										
56	Licmophora sp.										
57	Melosira sp.										
58	Melosira moniliformis										
59	Phormodium sp.										
60	Rhizosolenia sp.										
61	Spirogyra									50	75
62	Stigonema sp										
63	Tablelaria flocculosa										
64	Thallasionema sp.										
65	Aulacoseria sp.										
	Chlorophyta										
1	Closterium sp						-			-	-
2	Closterium sp1							1			
3	Closterium sp2							-			
4	Closterium setaceum										
5	Coelastrum sp						-				
6	Cosmarium sp						1	1			
7	Euastrum sp						7				
8	Pediastrum simplex							-			
9	Pediastrum duplex						1	-			
10	Pediastrum sp							-			
11	Pediastrum sp1						-				
12	Pediastrum sp2						-				
13	Pleototanium sp						-				
14	Scenedesmus sp										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Scenedesmus sp1							-			
16	Scenedesmus sp2							-			
17	Scenedesmus sp3							-			
18	Scenedesmus guadricouda						1				
19	Scenedesmus ellipsoideus						-				
20	Scenedesmus ermotus						-				
21	Scenedesmus longispina						-				
22	Scenedesmus dimorphus						1				
23	Scenedesmus ecuminatus						2				
24	Tetmemorius sp						-				
	Euglenophyta										
1	Euglena acus							-			
2	Euglena sp						-	-			
3	phacus ionicauda							-			
4	phacus undulatus							1			
5	phacus sp							-			
6	Audouinella sp										
	Perifiton										
1	Total Perifiton										
2	ID Simpson										
	Pyhtoplankton Sum										
1	Total Phytoplankton										
2	ID Simpson										
3	ID Shannon Wienner										
4	Indeks Kemerataan (E)										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Jumlah Individu (ml/sampel) ; (ind/L)						70	105			
6	Jumlah Taxa						20	21			
7	Indeks Diversitas						3.8942	3.5279			
8	Shanon-Waeaver						-	-			
9	H-max						4.3219	4.3923			
10	Equitabilitas						0.901	0.8032			
	ZOOPLANKTON										
	Mollusca										
1	Larva Molusca									-	
	Artropoda										
	Crustaceae										
1	Larva kepiting									40	
2	Larva udang									-	15
	Branciopoda										
1	Branciopoda sp						-				
	Copepoda										
1	Cyelops sp						-	-			-
	Protozoa										
	Dinophyceae										
1	Peridinium sp									-	
	Ciliata										
1	Colpoda sp						4	-			
2	Didinium sp						-				
3	Glaucoma sp						3	2			
4	Lionclus sp						1				

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Ciliata sp						-				
6	Vorticella sp.							-			
7	Paramaecium sp.										
8	Plumatella sp.										
9	Polychaeta sp.										
10	Macrothrix sp.										
11	Cyprya sp.										
Rhizopoda											
1	Arcella Sp										
2	Arcella discoides						1	10			
3	Arcella viilgaris						-	1			
4	Amoeba sp						-				
5	Centropyxis sp.										
6	Centropyxis acureata						1	3			
7	Spirozona sp.										
8	Diffugia sp						-	-			
9	Panagrolaimus sp.										
10	Euglypha sp							2			
11	Euglypha sp1						2				
12	Euglypha sp2						-				
Flagellata											
1	Anisonema							-			
2	Peranema sp						2	-			
Trochelmintes											
Rotifera											

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Asphlanca sp									30	-
2	Brachionus sp.									-	-
3	Keratella sp.										-
4	Copepoda									110	-
Rotatoria											
1	Licone sp							-			
2	Monostyla sp						2	2			
3	Epistylis sp										
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.										
8	Acanthocyclops sp.										
9	Chydorus sp.										
10	Notholca sp.						1	3			
11	Phylodina sp.							2			
12	Thermocyclops sp										
13	Bryocamptus sp										
14	C. aculeata										
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp										
19	Cypridiopsis sp										
20	Horaella sp										
21	Leucosolenia sp										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
22	Microstella sp										
23	Macrostella sp.										
24	Nauplii										
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.										
28	Spirostomum sp.										
29	Cephalodella sp.										
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp										
33	Rhabdolaimus sp.										
34	Diaptomus sp.										-
35	Tintinnopsis sp.										
36	Rotifera sp										
37	Sacamoeba sp										
Zooplankton Sum											
1	Jumlah Individu/L						17	25		210	
2	Jumlah Taxa						19	8		5	
3	Indeks Diversitas						2.9831	2.6144			
4	Shanon-Waeaver						-	-			
5	H-max						3.1699	3		1.609	
6	Equitabilitas						0.9411	0.8715		0.99	
7	Indeks Dominansi Simpson (C)										
8	Indeks Dominansi Shanon Wienner									1.593	
9	Indeks Kemerataan (E)										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Plankton Sum											
1	Jumlah Individu/L										405
2	Jumlah Taxa										8
3	Indeks Diversitas										
4	Shanon-Waeaver										-
5	H-max										2.079
6	Equitabilitas										0.859
7	Indeks Dominansi Simpson (C)										
8	Indeks Dominansi Shanon Wienner										1.786
9	Indeks Kemerataan (E)										
10	Indeks Diversitas Simpson plankton										
BENTHOS											
1	Baetis sp.										
2	Tiara sp.										
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp										
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp										
18	Wattebledia sp										
	Bivalia										
1	Carbicula javanica									25	-
2	Plisbryoconcaha exilis										-
	Grastropoda										
1	Lymnaea sp									50	50
2	Physa sp.										
3	Goniobasis livescen									-	-
4	Campeloma sp.									25	25
5	Pomacea canaliculata									25	25
6	Parathelpusa sp.									25	25
7	Ena sp										-
8	Pila ampullacea sp										25
9	Melanoides sp						-				
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae						2	-		-	
2	Diptera (sp 1 larva)							-			
3	Diptera (sp 1 pupa)						1				
4	Diptera (sp 2 pupa)						1	1			
5	Diptera (sp 3 pupa)							1			

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
	Coleopetra										
1	Elimiade						1	2			
2	Coleopatra sp 1							1			
3	Coleopatra sp 2						-	-			
	Annelida										
	Olygochaeta										
1	Olygochaeta sp						2				
2	Olygochaeta sp1							3			
3	Olygochaeta sp2							-			
	Nemathelminthes										
1	Nematoda sp						-	6			
2	Bellamya sp										
3	Bythinia sp										
4	Operculina sp.										
5	Pomacea sp										
6	Tarebia sp.										
7	Nereis sp.										
8	Lumbriculus sp.										
9	Balanus										
10	Cellanea sp										
11	Cheritidae sp										
12	Gafrarium sp										
13	Nassarium sp										
14	Placamen sp.										
	Benthos Sum										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Total mikrozoobenthos ; /m2									150	150
2	ID Shannon & wienner benthos										
3	Jumlah Individu/L ; individu/sampel						7	14			
4	Jumlah Taxa						5	6		4	5
5	Indeks Diversitas						2.2353	2.2162		1.332	1.561
6	Shanon-Waeaver						-	-			
7	H-max						2.3219	2.585		1.386	1.609
8	Equitabilitas						0.9627	0.8573		0.961	0.97
9	Indeks Dominansi Simpson (C)										
10	Indeks Kemerataan (E)										
	MACROINVERTEBRATE										
1	Acreneuria sp.										
2	Berosus sp.										
3	Campolema sp.										
4	Cerithidae sp.										
5	Gonidae sp.										
6	Heisoma sp.										
7	Lymnaea sp.										
8	Pleurocera sp.										
9	Pteronarcys sp.										
10	Stenelmis sp.										
11	Steronema sp.										
12	Tarebia sp.										
13	Thrassis pansus										
	MACROINVERTEBRATE SUM										
1	Number of Species										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
2	Number of Individual										
3	Index Shannon-Wienner										
4	Index Simpson										

Table 63 Aquatic Biota in Citapos River at 2007

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
AQUATIC BIOTA											
PYHTOPLANKTON											
1	Trachelomonas sp.										
2	Tolypothrix sp.										
3	Actinastrum sp.										
4	Bacteriastrum sp.										
5	Ceratium sp.										
6	Craticula sp.										
7	Bulbochaete sp.										
8	Microcrcys sp.										
9	Eunotia sp										
10	stephanodiscus sp										
11	Chroococcus sp										
12	Lyngbya sp										
13	Gomphosphaeria sp.										
14	Microcystis sp										
15	calanus sp.										
16	pleurothaenium sp										
17	zygogonium										
18	chlamydomonan sp										
19	achnantheis sp										
20	epithemia										
21	denticula sp										
22	rhopadolia										
23	hyalotheca sp										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
24	tribonema sp				-						
25	Chlorella sp										
26	Coscinodiscus sp										
27	Cyclotella sp										
28	Hemidiscus sp										
29	Oocystis sp										
30	Protococcus sp										
31	Nostoc sp.										
32	Polycystis sp.										
33	Rivularia sp.										
	Bacillariophyceae										
1	Closterium sp.										
	Chyanopyta										
1	Aphanocapsa sp										
2	Merismopedia sp										
3	Oscilatoria sp.				150						
4	Oscillatoria sp1										
5	Oscillatoria sp2										
6	zygnema sp										
7	Anabaena sp										
8	Sprulina										
	Chrysophyta										
1	Amphora sp										
2	Achanthes sp1										
3	Achanthes sp2										
4	Cocconeis sp				-						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
5	Chymbella sp										
6	Coscinodicus sp1										
7	Coscinodicus sp2										
8	Diatoma sp										
9	Diatoma vulgaris										
10	Fragilaria sp.										
11	Fragillaria sp1										
12	Fragillaria sp2										
13	Fragilaria copucina										
14	Frustulia sp										
15	Gomphonema sp										
16	Navicula sp				600						
17	Navicula sp1										
18	Navicula sp2										
19	Navicula sp3										
20	Navicula sp4										
21	Navicula atomus										
22	Navicula cryptocephala										
23	Nitzschia sigma										
24	Nitzschia sp										
25	Nitzschia sp1										
26	Nitzschia sp2										
27	Nitzchia palea										
28	Pinnularia sp										
29	Pinnularia sp1										
30	Pinnularia sp2										
31	Pleurosigma sp1										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
32	Pleurosigma sp2										
33	Pleurosigma sp3										
34	Surirela sp										
35	Surirella sp1										
36	Surirella sp2										
37	Surirella sp3										
38	Surirella elegans										
39	Synedra sp.										
40	Synedro ulna										
41	Cladophora sp.										
42	Gyrosigma sp										
43	Gyrosigma sp (Perifiton)										
44	Lemanea sp.										
45	Lyngbya sp.										
46	Microspora sp										
47	Mougeotia sp.										
48	Oedogonium sp										
49	Stanieria sp.										
50	Stauroneis sp										
51	Stigeoclonium sp										
52	Ulothrix sp				50						
53	Vaucheria sp				-						
54	Chaetophora sp.										
55	Chamaesiphon sp.										
56	Licmophora sp.										
57	Melosira sp.										
58	Melosira moniliformis										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
59	Phormodium sp.										
60	Rhizosolenia sp.										
61	Spirogyra										
62	Stigonema sp										
63	Tablelaria flocculosa										
64	Thallasionema sp.										
65	Aulacoseria sp.										
Chlorophyta											
1	Closterium sp										
2	Closterium sp1										
3	Closterium sp2										
4	Closterium setaceum										
5	Coelastrum sp										
6	Cosmarium sp										
7	Euastrum sp										
8	Pediastrum simplex										
9	Pediastrum duplex										
10	Pediastrum sp										
11	Pediastrum sp1										
12	Pediastrum sp2										
13	Pleototanium sp										
14	Scenedesmus sp										
15	Scenedesmus sp1										
16	Scenedesmus sp2										
17	Scenedesmus sp3										
18	Scenedesmus guadricouda										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
19	Scenedesmus ellipsoideus										
20	Scenedesmus ermotus										
21	Scenedesmus longispina										
22	Scenedesmus dimorphus										
23	Scenedesmus ecuminatus										
24	Tetmemorius sp										
Euglenophyta											
1	Euglena acus										
2	Euglena sp										
3	phacus ionicauda										
4	phacus undulatus										
5	phacus sp										
6	Audouinella sp										
Perifiton											
1	Total Perifiton										
2	ID Simpson										
Pyhtoplankton Sum											
1	Total Phytoplankton										
2	ID Simpson										
3	ID Shannon Wienner										
4	Indeks Kemerataan (E)										
5	Jumlah Individu (ml/sampel) ; (ind/L)										
6	Jumlah Taxa										
7	Indeks Diversitas										
8	Shanon-Waeaver										
9	H-max										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
10	Equitabilitas										
ZOOPLANKTON											
Mollusca											
1	Larva Molusca										
Artropoda											
Crustaceae											
1	Larva kepiting										
2	Larva udang										
Branciopoda											
1	Branciopoda sp										
Copepoda											
1	Cyelops sp										
Protozoa											
Dinophyceae											
1	Peridinium sp										
Ciliata											
1	Colpoda sp										
2	Didinium sp										
3	Glaucoma sp										
4	Lionclus sp										
5	Ciliata sp										
6	Vorticella sp.										
7	Paramaecium sp.				-						
8	Plumatella sp.										
9	Polychaeta sp.										
10	Macrothrix sp.										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
11	Cyprya sp.										
Rhizopoda											
1	Arcella Sp										
2	Arcella discoides										
3	Arcella viilgaris										
4	Amoeba sp										
5	Centropyxis sp.										
6	Centropyxis acureata										
7	Spirozona sp.										
8	Diffugia sp										
9	Panagrolaimus sp.										
10	Euglypha sp										
11	Euglypha sp1										
12	Euglypha sp2										
Flagellata											
1	Anisonema										
2	Peranema sp										
Trochelmintes Rotifera											
1	Asphlanca sp										
2	Brachionus sp.										
3	Keratella sp.										
4	Copepoda										
Rotatoria											
1	Licone sp										
2	Monostyla sp										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
3	Epistylis sp										
4	Loxofillum sp										
5	Chilodonella sp										
6	Ichtydium sp										
7	Acanthocystis sp.										
8	Acanthocyclops sp.										
9	Chydorus sp.										
10	Notholca sp.										
11	Phylodina sp.										
12	Thermocyclops sp										
13	Bryocamptus sp										
14	C. aculeata										
15	Chaos sp										
16	Lionotus sp										
17	Coleps sp										
18	Cladoera sp										
19	Cypridiopsis sp										
20	Horaella sp										
21	Leucosolenia sp										
22	Microstella sp										
23	Macrostella sp.										
24	Nauplii										
25	Boomina sp.										
26	Plamatella sp.										
27	Moina sp.										
28	Spirostomum sp.										
29	Cephalodella sp.										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
30	Bursaria sp.										
31	Psilotricha sp.										
32	Platyas sp										
33	Rhabdolaimus sp.										
34	Diaptomus sp.										
35	Tintinnopsis sp.										
36	Rotifera sp										
37	Sacamoeba sp										
Zooplankton Sum											
1	Jumlah Individu/L										
2	Jumlah Taxa										
3	Indeks Diversitas										
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)										
8	Indeks Dominansi Shanon Wienner										
9	Indeks Kemerataan (E)										
Plankton Sum											
1	Jumlah Individu/L				800						
2	Jumlah Taxa				3						
3	Indeks Diversitas										
4	Shanon-Waeaver										
5	H-max										
6	Equitabilitas										
7	Indeks Dominansi Simpson (C)				0.4						

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
8	Indeks Dominansi Shanon Wienner				0.7						
9	Indeks Kemerataan (E)										
10	Indeks Diversitas Simpson plankton										
BENTHOS											
1	Baetis sp.										
2	Tiara sp.										
3	Hydrophyceae sp.										
4	Planaria sp										
5	Enalagma sp										
6	Helobdella sp										
7	Sulcospira sp.										
8	Anadara sp										
9	Bursa sp										
10	Cerithideopsilla sp.										
11	Conus sp										
12	Corbicula sp										
13	Littorina sp										
14	Tellina sp										
15	Terebralia sp										
16	Trochus sp.										
17	Tubifex sp										
18	Wattebledia sp										
Bivalia											
1	Carbicula javanica										
2	Plisbryoconcaha exilis										
Grastropoda											

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
1	Lymnaea sp										
2	Physa sp.										
3	Goniobasis livescen										
4	Campeloma sp.										
5	Pomacea canaliculata										
6	Parathelpusa sp.										
7	Ena sp										
8	Pila ampullacea sp										
9	Melanoides sp										
	Arthropoda										
	Insecta										
	Diptera										
1	Chironomiae										
2	Diptera (sp 1 larva)										
3	Diptera (sp 1 pupa)										
4	Diptera (sp 2 pupa)										
5	Diptera (sp 3 pupa)										
	Coleopetra										
1	Elimiade										
2	Coleopatra sp 1										
3	Coleopatra sp 2										
	Annelida										
	Olygochaeta										
1	Olygochaeta sp										
2	Olygochaeta sp1										
3	Olygochaeta sp2										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
Nemathelminthes											
1	Nematoda sp										
2	Bellamya sp										
3	Bythinia sp										
4	Operculina sp.										
5	Pomacea sp										
6	Tarebia sp.										
7	Nereis sp.										
8	Lumbriculus sp.										
9	Balanus										
10	Cellanea sp										
11	Cheritidae sp										
12	Gafrarium sp										
13	Nassarium sp										
14	Placamen sp.										
Benthos Sum											
1	Total mikrozoobenthos ; /m2										
2	ID Shannon & wienner benthos										
3	Jumlah Individu/L ; individu/sampel										
4	Jumlah Taxa										
5	Indeks Diversitas										
6	Shanon-Waeaver										
7	H-max										
8	Equitabilitas										
9	Indeks Dominansi Simpson (C)										
10	Indeks Kemerataan (E)										

No.	Parameter	Unit	1998	2001	2007	2012		2013		2014	
			PT. PLN	PT. PLN	NewJec	Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2
MACROINVERTEBRATE											
1	Acreneuria sp.				-						
2	Berosus sp.				1						
3	Campolema sp.				-						
4	Cerithidae sp.				-						
5	Gonidae sp.				-						
6	Heisoma sp.				-						
7	Lymnaea sp.				-						
8	Pleurocera sp.				-						
9	Pteronarcys sp.				-						
10	Stenelmis sp.				1						
11	Steronema sp.				1						
12	Tarebia sp.				-						
13	Thrassis pansus				1						
MACROINVERTEBRATE SUM											
1	Number of Species				4						
2	Number of Individual				4						
3	Index Shannon-Wienner				1.39						
4	Index Simpson				0.75						

Appendix 14 WTP Education Level based on project location and land ownership

No	Lokasi	Status Lahan	Pendapatan/Kapita/Bulan dari WTP Setelah Kompensasi							
			Tidak sekolah	Tidak lulus SD	Lulus SD	Tidak lulus SMP	Lulus SMP	Lulus SMA	Sarjana	Total
1	Upper Reservoir	Land Owner without Certificate	1	12	18	0	2	0	0	33
		Tenant	0	1	5	0	0	0	0	6
		Land state tenants	0	2	10	0	0	0	0	12
		Land Owner without Certificate & Land state tenants	0	1	6	0	0	0	0	7
		Land Owner without Certificate & tenants	0	0	1	0	0	0	0	1
		Sub total	1	16	40	0	2	0	0	59
2	Lower Reservoir	Land Owner without Certificate	0	17	37	1	1	2	0	58
		Tenants	0	6	7	1	0	0	0	14
		Land state tenants	0	1	6	0	0	0	0	7
		Land owner without certificate and tenants	0	6	8	0	0	0	0	14
		Land owner without certificate, tenants, & land state tenants	0	1	1	0	0	0	0	2
		Land owner without certificate & land state tenants	0	0	1	0	0	0	0	1
		Tenants and land state tenants	0	1	5	0	0	0	0	6
		Sub total	0	32	65	2	1	2	0	102
3	New Road	Land Owner without Certificate	1	17	56	0	4	1	1	80
		Tenant	0	0	0	1	0	0	0	1
		Land state tenants	2	9	15	1	0	0	0	27
		Land Owner without Certificate & Land state tenants	0	1	5	0	0	0	0	6
		Sub total	3	27	76	2	4	1	1	114
4	Upper Reservoir dan New Road	Land ownership without certificate & land state tenant	1	1	2	0	0	0	0	4
		Sub total	1	1	2	0	0	0	0	4
TOTAL										279

Appendix 15 Quantity, Quality, and MCK (Toilets) Facilities Distance

Lokasi	Infrastructure	Quantity of MCK			Total	Quality of MCK			Total	Distance			Total
		Banyak	Cukup	Kurang		Baik	Sedang	Jelek		Dekat	Sedang	Jauh	
Upper Reservoir	Have a toilet inside the house	0	12	2	14	6	7	1	14	11	3	0	14
	Have a toilet outside the house	0	9	0	9	2	6	1	9	8	1	0	9
	In a neighbor house	0	2	2	4	1	3	0	4	3	1	0	4
	Public Toilet	1	6	4	11	1	8	2	11	11	0	0	11
	At the river	3	10	3	16	2	11	3	16	7	8	1	16
	At the pond	0	3	0	3	2	1	0	3	3	0	0	1
	At Mosque	0	1	0	1	1	0	0	1	0	1	0	1
	Sewers	0	1	0	1	0	1	0	1	1	0	0	1
	Sub total	4	44	11	59	15	37	7	59	44	14	1	59
Lower Reservoir	Have a toilet inside the house	4	47	1	52	28	24	0	52	33	15	4	52
	Have a toilet outside the house	0	23	4	27	7	20	0	27	21	5	1	27
	In a neighbor house	0	2	0	2	0	2	0	2	2	0	0	2
	Public Toilet	0	7	5	12	0	9	3	12	10	2	0	12
	At the river	0	5	1	6	1	3	2	6	3	3	0	3
	At the Pond	0	2	1	3	2	1	0	3	2	1	0	3
	Subtotal	4	86	12	102	38	59	5	102	71	26	5	102
New Road	Have a toilet inside the house	11	59	5	75	33	39	3	75	51	19	5	75
	Have a toilet outside the house	5	10	4	19	5	13	1	19	16	3	0	19
	In a neighbor house	0	4	0	4	2	1	1	4	4	0	0	4
	Public toilet	1	4	3	8	1	7	0	8	6	1	1	8
	At the river	0	5	1	6	2	2	2	6	3	3	0	6
	At the pond	0	1	0	1	0	1	0	1	1	0	0	1
	At mosque	0	0	1	1	0	1	0	1	0	1	0	1

Lokasi	Infrastructure	Quantity of MCK			Total	Quality of MCK			Total	Distance			Total
		Banyak	Cukup	Kurang		Baik	Sedang	Jelek		Dekat	Sedang	Jauh	
	Sub total	17	83	14	114	43	64	7	114	81	27	6	114
Upper Reservoir dan New Road	Have a toilet inside the house	0	1	0	1	1	0	0	1	1	0	0	1
	Have a toilet outside the house	0	1	0	1	0	1	0	1	1	0	0	1
	Public toilet	0	1	1	2	0	2	0	2	1	1	0	2
	Sub total	0	3	1	4	1	3	0	4	3	1	0	4
TOTAL		25	216	38	279	97	163	19	279	199	68	12	279

Source: Larap Midterm Report (2016)

Appendix 16 Respondents Based on Principal Work

No	Type of work/ livelihood	Number of Respondents (People)	Percentage (%)
1	Village officials	11	20
2	General employees	1	2
3	Farmers	22	39
4	Merchants	3	5
5	entrepreneur	3	5
6	Retired	1	2
7	Contractor		
	Security	2	27
	Driver	3	
	Operator	1	
	construction laborers	9	
Total		56	100

Source: RKL-RPL and EMP Documents UCPS Hydropower Development Semester 1 2019

Appendix 17 Number of Population Working as Migrant Workers by Gender and Village in West Bandung Regency in 2018

No	Village	Men Indonesian Labor	Women Indonesian Labor	Total	Most destination country
KABUPATEN BANDUNG BARAT					
I.	**Kecamatan Cipongkor**				
1.	Desa Karangsari	10	78	88	Saudi Arabia
2.	Desa Sirnagalih	31	26	57	Saudi Arabia
3.	Desa Cijambu	18	41	59	Saudi Arabia
4.	Desa Sarinagen	68	113	181	Saudi Arabia
II.	**Kecamatan Rongga**				
5.	Desa Bojongsalam	4	101	105	Timur Tengah
6.	Desa Cicadas	2	22	24	Timur Tengah
7.	Desa Sukaresmi	15	256	271	Saudi Arabia
8.	Desa Cibitung	134	133	267	Saudia Arabia
Total		282	770	1052	

Source: West Bandung Regency Development Database 2018

Appendix 18 Population Number According to Livelihoods and Villages in West Bandung Regency in 2018

No.	Villages	Population According to Livelihood													
		Agriculture	Mining	Industry	Electricity	PDAM	Gas	Trading	Transport	Bank/finance	Retiring/PNS	TNI (Military)	Polri/Police	Others	Not working
KABUPATEN BANDUNG BARAT															
I.	**Kecamatan Cipongkor**														
1.	Desa Karangsari	552	0	131	-	-	-	135	62	-	32	1	2	318	415
2.	Desa Sirnagalih	767	0	280	-	-	-	243	43	-	15	-	-	-	210
3.	Desa Cijambu	704	0	280	-	-	-	175	52	-	31	-	-	150	300
4.	Desa Sarinagen	295	0	102	-	-	-	231	84	-	88	1	1	-	216
II.	**Kecamatan Rongga**														
5	Desa Bojongsalam	1314	24	228	-	-	-	148	10	-	12	-	-	-	107
6.	Desa Cicadas	1386	0	140	-	-	-	19	21	-	10	-	-	-	1283
7.	Desa Sukaresmi	971	0	104	-	-	-	33	85	-	41	-	-	-	2226
8.	Desa Cibitung	1863	0	117	-	-	-	31	18	-	24	-	-	-	1416

Source: West Bandung Regency Development Database 2018

Appendix 19 List of Construction Workers

No.	Jabatan	Jumlah (Orang)	Pendidikan
I.	Tenaga Kerja Non Lokal		
1.	Project Manager	1	S1
2.	General Superintendent	1	S1
3.	Ahli Pelaksana Jalan	7	S1
4.	Ahli Pelaksana Jembatan	1	S1
5.	Ahli Pelaksana Geoteknik	8	S1/D3
6.	Quality Engineer	4	S1
7.	Quantity Engineer	6	S1
8.	Ahli K3 Konstruksi	4	S1
9.	CAD Operator	4	S1/D3
10.	Staff Administrasi	2	S1/D3
11.	Operator Alat Berat	9	SMP/SMA
12.	Supervisor	5	S1/D3
13.	Site coordinator	1	S1/D3
14.	Juru Ledak	2	S1/D3
15.	Anggota Tim Peledak	8	S1/D3
16.	Operator CRD	2	S1/D3
17.	Mandor	2	SMA
18.	Driver	3	SMP/SMA
19.	Welder	1	SMA
20.	Rigger	1	SMA
21.	Tukang Besi	5	SMA
22.	Pekerja	59	SMP/SMA
Jumlah I		**136 (59%)**	
1.	Flagman	20	SMP/SMA
2.	Driver	34	SMP/SMA
3.	Operator Alat Berat	19	SMP/SMA
4.	Pekerja	22	SMP/SMA
Jumlah II		**95(41%)**	
Total (I + II)		**231**	

Sumber: PT PLN (Persero) UIP JBT I, Juni 2019

No	Location	Land of Status	Income/Cap/Month of PAPs After Compensation				
			Increase	Percent	Increase	Percent	Total
1.	Upper Reservoir	Land owner without Certificate	20	60,61%	13	39,39%	33
		Tenants	4	66,67%	2	33,33%	6
		Land State tenants	6	50,00%	6	50,00%	12
		Land owner without certificate & land state tenants	6	85,71%	1	14,29%	7
		Land owner without certificate & tenants	1	100,00%	0	0,00%	1
		Sub Total	37	62,71%	22	37,29%	59
2.	Lower Reservoir	Land Owner without Certificate	36	62,07%	22	37,93%	58
		Land Owner without certificate & land state tenants	7	50,00%	7	50,00%	14
		Land owner without certificate, tenant & land state tenants	0	0,00%	2	100,00%	2
		Tenants	5	35,71%	9	64,29%	14
		Land state tenants	1	14,29%	6	85,71%	7
		Tenants and land state tenants	2	33,33%	4	66,67%	6
		Land owner without certificate and tenants	1	100,00%	0	0,00%	1
		Sub Total	52	50,98%	50	49,02%	102
3.	New Road	Land owner without certificate	37	46,25%	43	53,75%	80
		Tenants	1	100,00%	0	0,00%	1
		Land State Tenants	15	55,56%	12	44,44%	27
		Land Owner without certificate and land state tenants	2	33,33%	4	66,67%	6
		Sub Total	55	48,25%	59	51,75%	114
4.	Upper Reservoir and New Road	Land owner without certificate and land state tenants	2	50,00%	2	50,00%	4
		Sub total	2	50,00%	2	50,00%	4
Total			146	52,33%	133	47,67%	279

Appendix 20 PAPs Income After Compensation with Present Value (income affected by the project)

Appendix 21 Number of Health Facilities Around the Project Site

No	Village	Jumlah Sarana Kesehatan									
		Hospital	Maternal Hospital	policlinic	Puskesmas	Puskesmas Pembantu	Tempat Praktek Dokter	Tempat Praktek Bidan	Posyandu	Apotek	Herbal Shop
KABUPATEN BANDUNG BARAT											
I.	**Kecamatan Cipongkor**										
1	Karangsari								9		
2	Sirnagalih							1	10		
3	Cijambu							1	9		
4	Sarinagen				1		1	3	10	1	
II.	**Kecamatan Rongga**										
1	Bojongsalam					1			12		
2	Cicadas					1			16		
3	Sukaresmi					1			12		
4	Cibitung		1			1			12		

Source: West Bandung Regency Development Database 2018

Appendix 22 Top ten diseases list around the Project Location in 2012-2019

- 2012

• 2012						
Semester I	Semester II					
	Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber	
	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
Tidak ada data	Gastritis	13,33	ISPA	33,68	ISPA	33,75
	ISPA	12,97	Diare dan Gastroenteritis	12,92	Diare	24,72
	Influenza	11,8	Hipertensi primer (esensial)	11,77	Pebris	16,79
	Hipertensi	10,78	Demam yang tidak diketahui sebabnya	9,47	Gastritis	5,66
	Radang Paru	10,14	Gastroduodenitis not specific	8,71	Hipertensi	5,63
	Dermatitis	8,86	Dermatitis kontak	8,45	Influenza	5,58
	Stomatitis	7,41	Myalgia	7,88	Dermatitis kontak	3,38
	Conyuntivitis	5,94	Influenza	3,44	Conyungtivitis	1,89
	Diare dan Gastroenteritis	4,18	Dispepsia	2,36	Alergi.	1,48
	Gejala lain	14,59	Karies Toothace	1,31	Myalgia	1,13

Source: UCPS Annual Report 2012 RKL-RPL Implementation Report

- 2013

• 2013								
Semester I								Semester II
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	
ISPA	13,99	ISPA akut not specific	25,98	ISPA	20,05	Dermatitis	13,3	Tidak ada data
Gastritis	13,4	Hipertensi primer (esensial)	12,61	Gastritis	17,94	Infeksi Saluran Pernafasan Akut (ISPA	13,7	
Influenza	13,26	Diare dan Gastroenteris	10,61	Hipertensi	17,94	Gastritis	12,4	
Rematik	11,18	Gastroduodentis not specific	10,76	Influenza	16,63	Cephalgia	10,8	
Hipertensi	9,7	Myalgia	8,8	Diare	11,19	Penyakit Toothace	12,6	
Dermatitis	8,91	Demam	7,14	Faringitis	5,44	Rematik	8,6	
Conyuntivitis	7,47	Dermatitis kontak	6,72	Rematik	4,17	Myalgia	9,8	
Stomatitis	6,42	Dispepsia	5,55	Infeksi Kulit	2,58	Hipertensi	6,0	
Diare dan Gastroenteritis	3,2	Common Cold	7,14	Konjutivitis	2,61	Diare	5,7	
Gejala lain	12,48	Karies Toothace	4,69	Alergi	1,46	Common Cold (CC)	6,8	

Source: UCPS Annual Report 2013 RKL-RPL Implementation Report

- 2014

2014															
Semester I								Semester II							
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor	
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
ISPA	18,06	ISPA	20,22	ISPA	27,58	ISPA	15,47	Gejala Lain	17,83	ISPA Not specific	20,65	Hipertensi	22,17	ISPA	42,45
Gastritis	15,97	Hipertensi	17,82	Hipertensi	14,00	Dermatitis	15,08	Gastritis	12,31	Gastroduodentis Not specific	14,82	ISPA	16,76	Gastritis	12,13
Hipertensi	15,36	Gastritis	17,79	Demam	12,30	Penyakit Toothace	14,44	Influenza	12,13	Hipertensi Primer	11,01	Influenza	14,50	Penyakit Toothace	8,36
Influenza	13,13	Influenza	12,78	Gastroduodentis not specific	10,37	Gastritis	13,39	ISPA	11,71	Nasofaringitis Akuta (Common Cold)	10,10	Gastritis	14,11	Observasi Febris	8,15
Dermatitis	10,98	Diare	11,06	Diare dan Gastroenteritis	9,17	Myalgia	10,10	Hipertensi	11,42	Diare dan Gastroenteritis	8,93	Myalgia	8,79	Hipertensi	7,95
Reumatik	9,82	Myalgia	9,67	Myalgia	7,16	Cephalgia	9,40	Reumatik	9,53	Myalgia	8,41	Parangitis	8,38	Rematoid Artritis (Rematik)	5,66
Conjungtivitis	7,73	Faringitis	5,21	Common Cold	7,27	Rematik	9,23	Dermatitis	8,50	Dermatitis Lain, Not specific	7,34	Diare	7,02	Myalgia	5,39
Diare dan Gastroenteritis	6,20	Rematik	3,01	Dermatitis	4,52	Hipertensi	5,11	Conjungtivitis	6,94	Gejala dan tanda umum lainnya	6,91	Infeksi Kulit	3,28	Cepalgia	5,05
Myalgia	1,52	Konjungtivitis	2,16	Karies Toothace	3,85	Demam	4,76	Diare	5,79	Reumatisme Not specific	6,06	Konjungtivitis	2,72	Diare	2,76
Karies Toothace	1,24	Alergi	0,27	Dispepsia	3,78	Diare	3,03	Stomatitis	3,84	Demam Yang Tidak Diketahui Sebabnya	5,78	TB Paru	2,27	Asma Bronkial	2,09

Source: UCPS Annual Report 2014 RKL-RPL Implementation Report

• 2015

• 2015															
Semester I								Semester II							
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor	
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
Gastritis	12,77	Penyakit ISPA skut not specific	19,48	Penyakit ISPA akut not specific	19,48	ISPA	13,13	ISPA	15,74	ISPA	21,02	ISPA	18,43	ISPA	13,70
Influenza	11,91	Gastroduodenitis not specific	11,64	Tukak lambung	11,64	Gastritis	12,61	Hipertensi	16,75	Gastroduodenitis not specific	14,20	Diare	13,50	Toothace	12,05
ISPA	11,64	Hipertensi primer	11,45	Diare dan gastroenteritis	11,45	Dermatitis	12,30	Gastritis	12,73	Hipertensi primer	13,11	Gastritis	10,55	Dermatitis	11,71
Hipertensi	10,98	Dermatitis kontak	10,18	Myalgia	10,18	Myalgia	11,29	Dermatitis	10,97	Common Cold	10,60	Myalgia	9,54	Myalgia	10,77
Reumatoid artritis	9,68	Nasofaringitis akut	9,79	Dermatitia lain, not specific	9,79	Toothace	11,21	RA	10,17	Myalgia	10,47	Hipertensi	9,22	Gastritis	10,55
Dermatitis	8,57	Demam yang tidak diketahui sebabnya	9,66	Demam yang tidak diketahui sebabnya	9,66	Commond Cold	9,75	Influenza	8,41	Dermatitis lain not specific	9,52	Scabies	8,24	Cepalgia	10,17
Konjungtivitis	7,15	Myalgia	9,17	Hipertensi primer	9,17	Cepalgia	9,13	Diare	7,25	Demam yang tidak diketahui sebabnya	7,70	Demam	8,09	Hipertensi	9,35
Diare	5,32	Diare dan gastroenteritis	8,29	Skabies	8,29	Reumatik	7,77	Dispepsia	6,32	Diare dan gastroenteritis	7,09	Demam Typoid	8,06	Reumatik	8,83
Stomatitis	4,46	Reumatisme not specific	5,23	Karies Toothace	5,23	Diare	6,53	Conjungtivitis	6,27	Scabies	3,70	Abses	7,62	Commond Cold	7,49
Gejala lain	17,53	Dispepsia	5,10	Konjungtivitis dan penyakit mata lainnya	5,10	Hipertensi	6,26	Stomatitis	5,38	Reumatik not specific	2,61	Karies Toothace	6,75	Diare	5,38

Source: UCPS Annual Report 2015 RKL-RPL Implementation Report

• 2016

2016															
Semester I								Semester II							
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor	
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
Hipertensi esensial (primer)	15,60	ISPA not specific	21,52	ISPA	36,84	ISPA	11,72	Hipertensi esensial (primer)	18,16	ISPA not specific	21,52	ISPA	19,18	ISPA	11,91
ISPA	13,78	Hipertensi primer (esensial)	14,36	Diare	21,1	Mialgia	11,56	ISPA	17,55	Hipertensi primer (esensial)	14,36	Hipertensi Primer (essential)	17,23	Reumatik	10,91
Dispepsia	13, 24	Gastroduodenitis not specific	13,59	Gastritis	17,25	Toothace	10,89	Dispepsia	13,84	Gastroduodenitis not specific	13,59	Dispepsia	12,45	Cepalgia	10,81
Mialgia	11,86	Mialgia	11,03	Hipertensi Primer (essential)	7,23	Hipertensi	10,74	Mialgia	10,59	Mialgia	11,03	Mialgia	9,69	Dermatitis	10,21
Skabies	10,68	Dermatitis lain, not specific (eksema)	9,87	Mialgia	6,01	Gastritis	10,40	Skabies	9,50	Dermatitis lain, not specific (eksema)	9,87	Skabies	8,19	Gastritis	10,21
Stomatitis	8,73	Common cold	9,19	Pneumonia	3,35	Cepalgia	10,31	Demam, not specific	9,14	Common cold	9,19	Demam, not specific	7,93	Common cold	10,16
Common cold	8,50	Demam yang tidak diketahui sebabnya	7,18	Dermatitis lain, not specific (eksema)	3,21	Reumatik	10,15	Reumatisme artritis, not specific	7,75	Demam yang tidak diketahui sebabnya	7,18	Gastritis	6,86	Toothace	10,02
Reumatik artritis, not specific	7,60	Diarhea and gastroentritis	6,93	Scabies	1,98	Dermatitis	9,95	Gastritis, not specific	6,63	Diarhea and gastroentritis	6,93	Dermatitis, not specific	6,49	Mialgia	9,69
Faringitis akut, not specific	3,96	Skabies	3,44	Stomatitis	1,85	Common cold	8,79	Dermatitis, not specific	5,16	Skabies	3,44	Reumatisme artritis, not specific	6,19	Hipertensi	8,17
Gastritis, not specific	3,45	Migrain dan sindrom nyeri kepala lainnya	2,89	Abses	1,19	Diare	5,49	Common cold	5,07	Migrain dan sindrom nyeri kepala lainnya	2,89	Common cold	5,80	Diare	7,91

• Source: UCPS Annual Report 2016 RKL-RPL Implementation Report

- 2017

• 2017															
Semester I								Semester II							
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor	
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
Hipertensi esensial (primer)	16,32	Gastroduodenitis not specific	17,24	ISPA	45,64	ISPA	13,68	Hipertensi esensial (primer)	16,32	Gastroduodenitis not specific	20,95	ISPA	45,64	ISPA	13,68
ISPA	15,33	Hipertensi primer (esensial)	15,76	Diare	18,20	Dermatitis	12,94	ISPA	15,33	Hipertensi primer (esensial)	15,47	Diare	18,20	Dermatitis	12,94
Dispepsia	12,19	Myalgia	15,59	Gastritis Dispepsia	13,55	Common cold	10,86	Dispepsia	12,19	Myalgia	15,37	Gastritis Dispepsia	13,55	Common cold	10,86
Myalgia	11,49	ISPA not specific	13,54	Hipertensi Primer (essential)	7,87	Myalgia	10,37	Myalgia	11,49	Faringitis akuta	10,35	Hipertensi Primer (essential)	7,87	Myalgia	10,37
Scabies	11,08	Dermatitis lain, not specific (eksema)	9,75	Penyakit kulit	5,36	Hipertensi	10,08	Scabies	11,08	ISPA not specific	9,87	Penyakit kulit	5,36	Hipertensi	10,08
Reumatoid artritis, not specific	8,60	Common cold	7,39	Pneumonia	3,05	Reumatik	8,92	Reumatoid artritis, not specific	8,60	Dermatitis lain, not specific (eksema)	6,95	Pneumonia	3,05	Reumatik	8,92
Gastritis, not specific	8,38	Faringitis akuta	6,13	Diabetes melitus	2,62	Cepalgia	8,49	Gastritis, not specific	8,38	Common cold	5,81	Diabetes melitus	2,62	Cepalgia	8,49
Dermatitis, not specific	6,70	Diarhea and gastroentritis	5,82	Myalgia	2,00	Toothace	8,36	Dermatitis, not specific	6,70	Diarhea and gastroentritis	5,78	Myalgia	2,00	Toothace	8,36
Common cold	5,39	Demam yang tidak diketahui sebabnya	5,64	Disentri	0,88	Diare	8,26	Common cold	5,39	Scabies	5,28	Disentri	0,88	Diare	8,26
Sakit kepala	4,54	Scabies	3,15	Suspek Typoid	0,83	Gastritis	8,05	Sakit kepala	4,54	Fever with unknown causes	4,18	Suspek Typoid	0,83	Gastritis	8,05

Source: UCPS Annual Report 2017 RKL-RPL Implementation Report

- 2018

2018													
Semester I										Semester II			
Puskesmas Rongga		Puskesmas Campaka		Puskesmas Cibeber		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Cipongkor			
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)		
Hipertensi esensial (primer)	16,32	Gastroduodenitis not specific	20,95	ISPA	45,64	ISPA	13,68	ISPA	27,24	Essential (primary) hypertension 144	19,12		
ISPA	15,33	Hipertensi primer (esensial)	15,47	Diare	18,20	Dermatitis	12,94	Hipertensi	16,1	Myalgia	18,9		
Dispepsia	12,19	Myalgia	15,37	Gastritis Dispepsia	13,55	Common cold	10,86	Gastritis	13,72	Acute upper respiratory infection, unspecified	15,93		
Myalgia	11,49	Faringitis akuta	10,35	Hipertensi Primer (essential)	7,87	Myalgia	10,37	Myalgia	10,37	Dyspepsia	12,97		
Scabies	11,08	ISPA not specific	9,87	Penyakit kulit	5,36	Hipertensi	10,08	Dermatitis	8,1	Cough	9,12		
Reumatoid artritis, not specific	8,60	Dermatitis lain, not specific (eksema)	6,95	Pneumonia	3,05	Reumatik	8,92	Rematoid Arthritis	7,14	Atopic dermatitis, unspecified	6,54		
Gastritis, not specific	8,38	Common cold	5,81	Diabetes melitus	2,62	Cepalgia	8,49	Dispepsia	5,31	Pulpitis	6,48		
Dermatitis, not specific	6,70	Diarhea and gastroentritis	5,78	Myalgia	2,00	Toothache	8,36	Febris	4,6	Non-insulin-dependent diabetes melitus	4,51		
Common cold	5,39	Scabies	5,28	Disentri	0,88	Diare	8,26	Common Cold	4,5	Gatritis, unspecified	3,96		
Sakit kepala	4,54	Demam yang tidak diketahui sebabnya	4,18	Suspek Typoid	0,83	Gastritis	8,05	Necrosis Pulpa	2,89	Scabies	2,47		

Source: UCPS Annual Report 2018 RKL-RPL Implementation Report

- 2019

2019							
Semester I				Semester II			
Puskesmas Rongga		Puskesmas Cipongkor		Puskesmas Rongga		Puskesmas Cipongkor	
Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)	Disease	Percentage (%)
ISPA	25,6	ISPA	29,23	Hipertensi	24,75	Demam yang tidak diketahui sebabnya	44,26
Hipertensi	18,78	Hipertensi	17,6	ISPA	21,05	ISPA	17,72
Gastritis	16,31	Gastritis	15,31	Gastritis	14,35	Hipertensi	12,33
Cephalgia	7,07	Arthrosis	11,83	Myalgia	7,33	Arthrosis	7,18
Myalgia	6,71	Demam yang tidak diketahui sebabnya	8,35	Artralgia	7,04	Gastritis	7,06
Osteo Artritis	6,29	Non Insulin Dependent Diabetes Melitus	4,8	Demam not specific	5,99	Emcedded and Impected leeth	4,0
Dermatitis	5,95	Spontanecus Vertex Delivery	4,8	Dermatitis Atopik	5,41	Non Insulin Dependent Diabetes Melitus	3,59
Febris	5,03	Emcedded and Impected leeth	4,1	Diare	4,99	Spontanecus Vertex Delivery	2,33
Artralgia	4,76	Dermatitis Unspecified	2,43	Karies Dentin	4,73	Dermatitis Unspecified	0,78
Dermatitis Atopik	3,54	Dispepsia	1,5	Dyspepsia	4,36	Gangrene	0,74

Source: UCPS Annual Report 2019 RKL-RPL Implementation Report

Appendix 23 Positive and Negative Perceptions of CommunityAgainst UCPS Hydropower Activities

Positive Perception							
No.	Village	employment opportunities	Business Opportunities	Obtain better public facilities & social facilities	The surrounding area is growing	Easier road accessibility	Not yet affected
1.	Karangsari	2	-	1	-	-	-
2.	Sarinagen	2	-	2	-	1	-
3.	Cijambu	2	-	-	1	2	-
4.	Cibitung	2	-	-	1	2	-
5	Sirnagalih	2	1	1	-	3	-
6.	Sukaresmi	5	4	4	1	7	-
7.	Bojongsalam	-	1	1	-	-	1
8.	Cicadas	-	1	1	-	-	1
9.	Karangnunggal	1	2	2	-	2	-
10.	Girimulya	-	1	1	-	1	-
11.	Margaluyu	-	-	-	-	-	3
Total		**16**	**13**	**3**	**3**	**18**	5

Negative Perception										
No.	Village	Land Acquisition proccess	Labor Admission process	Drains that are cut off by the road not completely done yet	Explosion disturbance	There is no kWH yet mosque and wellbore	House crack	SPPT value is not appropriate with measurement	The remaining land has not been paid	None
1.	Karangsari	-	-	-	-	-	-	-	-	3
2.	Sarinagen	-	-	-	-	-	-	-	-	5
3.	Cijambu	-	-	-	-		-	-	-	5
4.	Sirnagalih	-	-	-	-	-	1	-	-	6
5	Cibitung	-	1	1	-	-	1	-	-	2
6.	Sukaresmi	1	1	3	2	1	2	1	-	6
7.	Bojongsalam	2	-	-	-	-	-	-		-
8.	Cicadas	1	-	-	-	-	-	-	-	1
9.	Karangnunggal	1	-	-	-	-	-	1	-	3
10.	Girimulya	-	-	-	-	-	-	-	1	1
11.	Margaluyu	-	-	-	-	-	-	-	2	1
Jumlah		**5**	**2**	**4**	**2**	**1**	**4**	**2**	**3**	**33**

Source: UCPS Annual Report 2019 RKL-RPL Implementation Report

Appendix 24 Community Perception on the Progress of Land Acquisition

No	Villages name	Community Perception (People)		
		Done Implemented	**Not Completed Completely Implemented**	**None**
1.	Karangsari	3	-	-
2.	Sarinagen	5	-	-
3.	Cijambu	4	1	-
4.	Cibitung	5	-	-
5.	Sirnagalih	6	1	-
6.	Sukaresmi	8	6	2
7.	Bojongsalam	-	2	-
8.	Cicadas	-	3	-
9.	Karangnunggal	2	2	-
10.	Girimulya	-	3	-
11.	Margaluyu	-	3	-
	Jumlah	33	21	2

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Are the facilities at your relocation site sufficient?

No	Response	Total (People)		Percentage (%)	
		Semester I	Semester II	Semester I	Semester II
1	Yes	2	5	33	83
2	No	4	1	67	17
	Total	6	6	100	100

Are residents satisfied with the relocation activities provided by PT. PLN

No	Tanggapan	Jumlah (Orang)		Percentage (%)	
		Semester I	Semester II	Semester I	Semester II
1	Yes	5	6	83	100
2	No	1	-	17	0
	Total	6	6	100	100

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Appendix 25 Hopes and Responses of the Community towards the Construction of the UCPS Hydropower Plant

No	Name of Village	Hopes and Responses
1.	Karangsari	1) Local residents can work again if there is an activity construction in our location 2) There is assistance / compensation for tenants 3) CSR in the form of road infrastructure
2.	Sarinagen	1) PT PLN always pays close attention to local residents terms of labor and welfare 2) Clean water needs are facilitated 3) Information about workforce needs please coordinated with Sarinagen village officials 4) Please note the security vulnerability point 5) There is coordination of each stage of the activity development 6) Prioritize local workforce, especially there are still many non-skilled workers who have not yet worked on the project (unemployed)
3.	Cijambu	1) The Contractor / PLN always coordinates with the authorities villages in each stage of development 2) Prioritize local workforce 3) Can work again at the operational stage at PT PLN 4) Compensation for noise, dust and vibration disturbances
4.	Cibitung	1) There is compensation for cracked houses 2) Many open jobs for local residents, so that the economy will improve and prosper 3) We are thankful for the CSR programs that have been provided by PLN, hopefully the program can sustainable

No	Name of Village	Hopes and Responses
5.	Sirnagalih	1) There is no significant disturbance to residents local construction process 2) More absorbed in the recruitment of workers local 3) Coordinate first when recruiting workers to local village officials 4) Be careful of the mobilization of trucks when crossing residential areas 5) Make sidewalks for pedestrians, because there are many children school 6) Subcontractors have not paid workers, rented rent houses and materials to some of our residents 7) PLN can help residents in business capital
6.	Sukaresmi	1) The community is more prosperous 2) More local workers are recruited by contractor / PLN 3) Can provide business opportunities for local residents 4) Can work again when operational 5) RT 02/01 area in Kp. Pasirlaja can have electric KWH Alone 6) In order to immediately electrified to Kp. Pasajaaja 7) Access road to resettlement in Pasirjegud (Kp. Tapos) hope to get it fixed 8) Improving piping of clean water sources from springs cibayanah, because in the rainy season the water becomes turbid (in the relocation of sandjegud) 9) Prioritizing the safety and comfort of local residents 10) PLN will immediately realize the village relocation plan Cilawang 11) Relocation for SDN Cilawang to the location of Perhutani's land close to Kp. Cilawang 12) Smoothness in resettlement of residents residing at Kp. Cilawang
7.	Bojongsalam	1) Roads repairing in Bojongsalam Village 2) The process of land acquisition must be completed immediately

No	Name of Village	Hopes and Responses
8.	Cicadas	1) Road repaired 2) Realization of CSR programs in the form of fasum and development social facilities, such as the provision of mosque facilities, public toilets and etcetera 3) The welfare of the community is increasing
9.	Karangnunggal	1) Community prosperity is increasing 2) Realization of business development programs in the form of business capital assistance 3) Clarity of 7,500,000 cooperative funds for residents affected
10.	Girimulya	1) Road repaired 2) The community is more prosperous 3) There is access road to the dam 4) Can absorb local labor
11.	Maragaluyu	1) Improving the economy and prosperity of the community around 2) Please access the warung gitung road to cisitu, please improve it 3) Please improve the village road in Margaluyu 4) Process the payment of the remaining land that is in the area plan puddle 5) PLN must provide solutions to residents' lands sandwiched between a puddle area and Perhutani soil 6) Can open jobs for local residents

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Appendix 26 Concerns About the 500 kV SUTET Activity Plan

No.	Village	Community perception					
		Health Disorders Due to Radiation	Tower Collapsed / Cable Disconnected	The price of land / buildings that are under the SUTET cable line will go down and hard to sell	There is a shift of the stakes along the tower, so that remains payment is a concern not as expected	Compensation For the plant does not according to expectations	None
1.	Sukarama	1	2	-	1	-	-
2.	Sukajaya	-	-	-	-	1	1
3.	Kemang	-	-	-	-	-	2
4.	Jatisari	1	1	-	1	-	2
5.	Cibarengkok	1	-	-	-	-	3
6.	Sukaratu	4	2	3	-	--	2
7.	Neglasari	1	-	2	-	-	-
8.	Sukatani	1	-	1	1	-	-
9.	Ramasari	1	-	1	-	-	1
10.	Haurwangi	1	-	1	1	-	1
11.	Sukaresmi	3	-	-	-	-	-
		14	5	8	4	1	12

Source: UCPS Annual Report SUTET 500KV Semester II 2019 RKL-RPL Implementation Report

Appendix 27 Road Capacity and Characteristics of Road Services (Simpang Cipari)

Semester I Tahun 2018

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke New Road	63	10 m	3638	0.017	A
2	Ke Saguling	63	10 m	3638	0.017	A
3	Ke Cijenuk/Gn. Karang	126	10 m	3638	0.035	A

Source: UCPS Annual Report Semester I 2018 RKL-RPL Implementation Report

Semester II Tahun 2018

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke New Road	172,9	10 m	3638	0,05	A
2	Ke Saguling	279,8	10 m	3638	0,10	A
3	Ke Cijenuk/Gn. Karang	381,4	10 m	3638	0,08	A

Source: UCPS Annual Report Semester II 2018 RKL-RPL Implementation Report

Semester I Tahun 2019

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke New Road	123	9 m	3274	0,05	A
2	Ke Saguling	413,8	7 m	2547	0,10	A
3	Ke Cijenuk/Gn. Karang	527,7	8 m	2910	0,08	A

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Semester II Tahun 2019

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke New Road	213,8	9 m	3274	0,07	A
2	Ke Saguling	368	7 m	2547	0,14	A
3	Ke Cijenuk/Gn. Karang	480,7	8 m	2910	0,17	A

Source: UCPS Annual Report Semester II 2019 RKL-RPL Implementation Report

Appendix 28 Road Capacity and Characteristics of Road Service Level (Simpang Bojong Loa)

Semester I Tahun 2018

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke Saguling	156	10 m	3638	0.043	A
2	Ke Cililin	134	5 m	2075	0.065	A
3	Ke Gunung Karang	143	10 m	3638	0.039	A

Source: UCPS Annual Report Semester I 2018 RKL-RPL Implementation Report

Semester II Tahun 2018

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke Saguling	522,3	10 m	3638	0,14	A
2	Ke Cililin	534,2	5 m	2075	0,26	A
3	Ke Gunung Karang	193,8	10 m	3638	0,05	A

Source: UCPS Annual Report Semester II 2018 RKL-RPL Implementation Report

Semester I Tahun 2019

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke Saguling	427,25	10 m	3638	0,14	A
2	Ke Cililin	413,95	5 m	2075	0,26	A
3	Ke Gunung Karang	149,45	10 m	3638	0,05	A

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Semester II Tahun 2019

No	Ruas	Volume (smp/jam)	Lebar Jalan	Kapasitas (smp/jam)	V/C	Tingkat Pelayanan
1	Ke Saguling	350,7	10 m	3638	0,10	A
2	Ke Cililin	347,8	5 m	2075	0,17	A
3	Ke Gunung Karang	103,8	10 m	3638	0,03	A

Source: UCPS Annual Report Semester II 2019 RKL-RPL Implementation Report

Appendix 29 Traffic Density Simpang Cipari

Semester I Tahun 2018

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.30 - 08.30 WIB			12.00 - 13.00 WIB			15.00 - 16.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/JAM	Unit	%	SMP/JAM	Unit	%	SMP/JAM
1	Sepeda Motor	415	87	207,5	391	85	195,5	157	88	78,5
2	Kendaraan Ringan	47	10	47	59	13	59	21	12	21
3	Kendaraan Berat	14	3	18,2	9	2	11,7	0	0	0
Jumlah		476	100	272,7	459	100	266,2	178	100	99,5
Perjam		57			37			52		
(V)		60			44			51		
(C)		2.900			2.900			2.900		
V/C*)		0,02			0,02			0,02		

Source: UCPS Annual Report Semester I 2018 RKL-RPL Implementation Report

Semester II Tahun 2018

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Sepeda Motor	681	79	170,3	566	75	141,5	892	82	223
2	Kendaraan Ringan	165	19	82,5	142	19	71	163	15	81,5
3	Kendaraan Berat	16	2	10,4	50	7	32,5	33	3	21,5
Jumlah		862	100	263,2	758	100	245	1088	100	326
(V)		263,2			245			326		
(C)		2900			2900			2900		
V/C*)		0,09			0,08			0,11		

Source: UCPS Annual Report Semester II 2018 RKL-RPL Implementation Report

Semester I Tahun 2019

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Sepeda Motor	927	89	231,8	923	81	230,8	1205	84	301,3
2	Kendaraan Ringan	84	8	42	180	16	90	175	12	87,5
3	Kendaraan Berat	31	3	20,2	36	3	23,4	58	4	37,7
Jumlah		1042	100	293,9	1139	100	344,2	1088	100	426,5
(V)		293,9			344,2			426,5		
(C)		2900			2900			2900		
V/C*)		0,10			0,12			0,15		

Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Semester II Tahun 2019

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Sepeda Motor	1096	87,9	274	896	82,4	224	602	87,2	300,8
2	Kendaraan Ringan	148	11,9	74	183	16,8	91,5	164	11,9	82
3	Kendaraan Berat	3	0,2	2	9	0,8	5,85	17	0,9	8,5
Jumlah		1247	100	350	1088	100	321,4	783	100	391,2
(V)		293,9			321,4			391,2		
(C)		2900			2900			2900		
V/C*)		0,12			0,11			0,13		

Source: UCPS Annual Report Semester II 2019 RKL-RPL Implementation Report

Appendix 30 Traffic Density at Simpang Bojong Loa

Semester I Tahun 2018

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.30 - 08.30 WIB			12.00 - 13.00 WIB			15.00 - 16.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/JAM	Unit	%	SMP/JAM	Unit	%	SMP/JAM
1	Sepeda Motor	639	91	319,5	556	85	278	616	90	308
2	Kendaraan Ringan	57	8	57	86	13	86	61	9	61
3	Kendaraan Berat	6	1	7,8	12	2	15,6	10	1	13
Jumlah		702	100	384,3	654	100	379,6	687		382
Perjam		135			87			64		
(V)		146			105,5			78		
(C)		2.900			2.900			2.900		
V/C*)		0,05			0,04			0,03		

Source: UCPS Annual Report Semester I 2018 RKL-RPL Implementation Report

Semester II Tahun 2018

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Sepeda Motor	1104	83%	276	1077	83	269,3	1313	85	328,3
2	Kendaraan Ringan	128	10%	64	167	13	83,5	179	12	89,5
3	Kendaraan Berat	105	8%	68,3	61	5	39,7	49	3	31,9
Jumlah		1337	100	408,3	1305	100	392,4	1541	100	449,6
(V)		408,3			392,4			449,6		
(C)		2900			2900			2900		
V/C*)		0,14			0,14			0,16		

Source: UCPS Annual Report Semester II 2018 RKL-RPL Implementation Report

Semester I Tahun 2019

No	Jenis Kendaraan	Ruas Jalan Baranangsiang - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Jumlah			Jumlah			Jumlah		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Sepeda Motor	958	85,2	239,5	879	93	219,8	987	85	246,8
2	Kendaraan Ringan	88	14,1	44	196	13	98	206	12	103
3	Kendaraan Berat	7	0,8	4,6	24	5	15,6	30	3	19,5
Jumlah		1053	100	288,1	833	100	333,4	1223	100	369,3
(V)		288,1			333,4			369,3		
(C)		2900			2900			2900		
V/C*)		0,10			0,11			0,13		

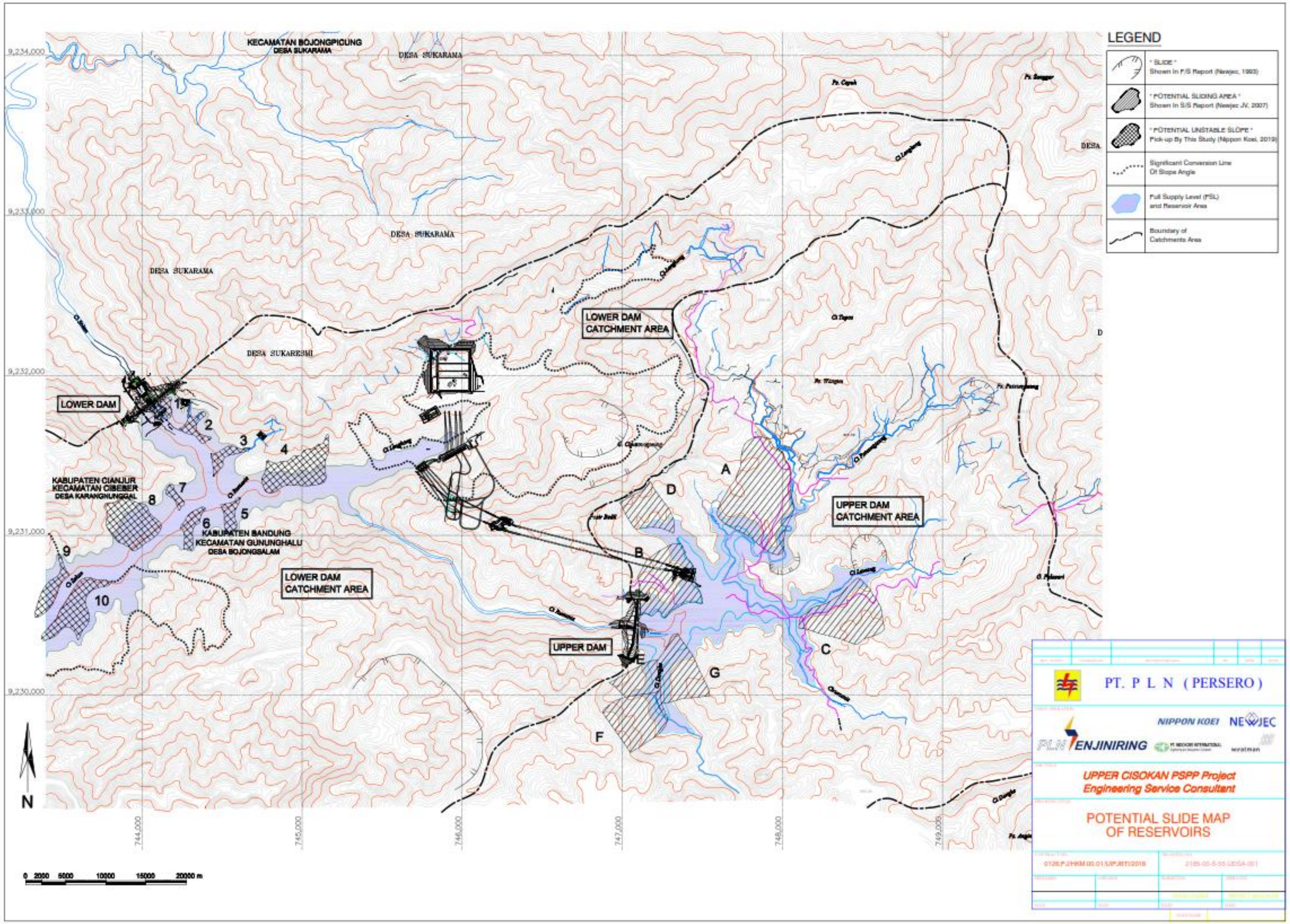
Source: UCPS Annual Report Semester I 2019 RKL-RPL Implementation Report

Semester II Tahun 2019

No	Transportation type	Baranangsiang Road - Karangsari (Quarry)								
		07.00-09.00 WIB			11.00-13.00 WIB			15.00-17.00 WIB		
		Total			Total			Total		
		Unit	%	SMP/Jam	Unit	%	SMP/Jam	Unit	%	SMP/Jam
1	Motorcycle	763	85,2	190,8	639	76,7	159,8	836	84,7	209
2	Light Vehicles	126	14,1	63	187	22,4	93,5	140	14,2	70
3	Heavy vehicle	7	0,8	4,6	7	0,8	4,6	11	1,1	7,2
Total		896	100	258,3	833	100	257,8	987	100	286,2
(V)		258,3			257,8			369,3		
(C)		2900			2900			2900		
V/C*)		0,09			0,09			0,10		

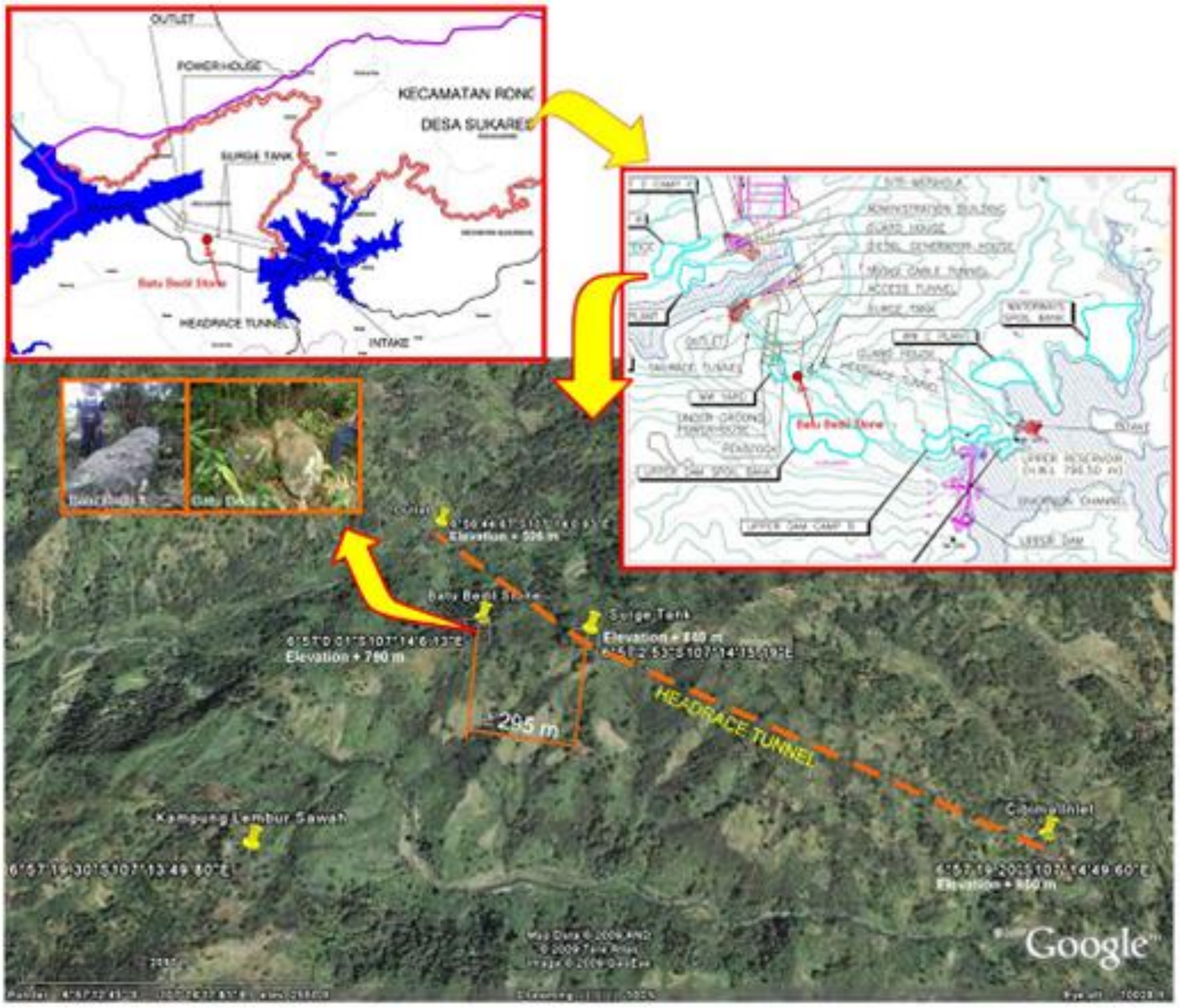
Source: UCPS Annual Report Semester II 2019 RKL-RPL Implementation Report

Appendix 31 Landslide Potential Map in the Project Area

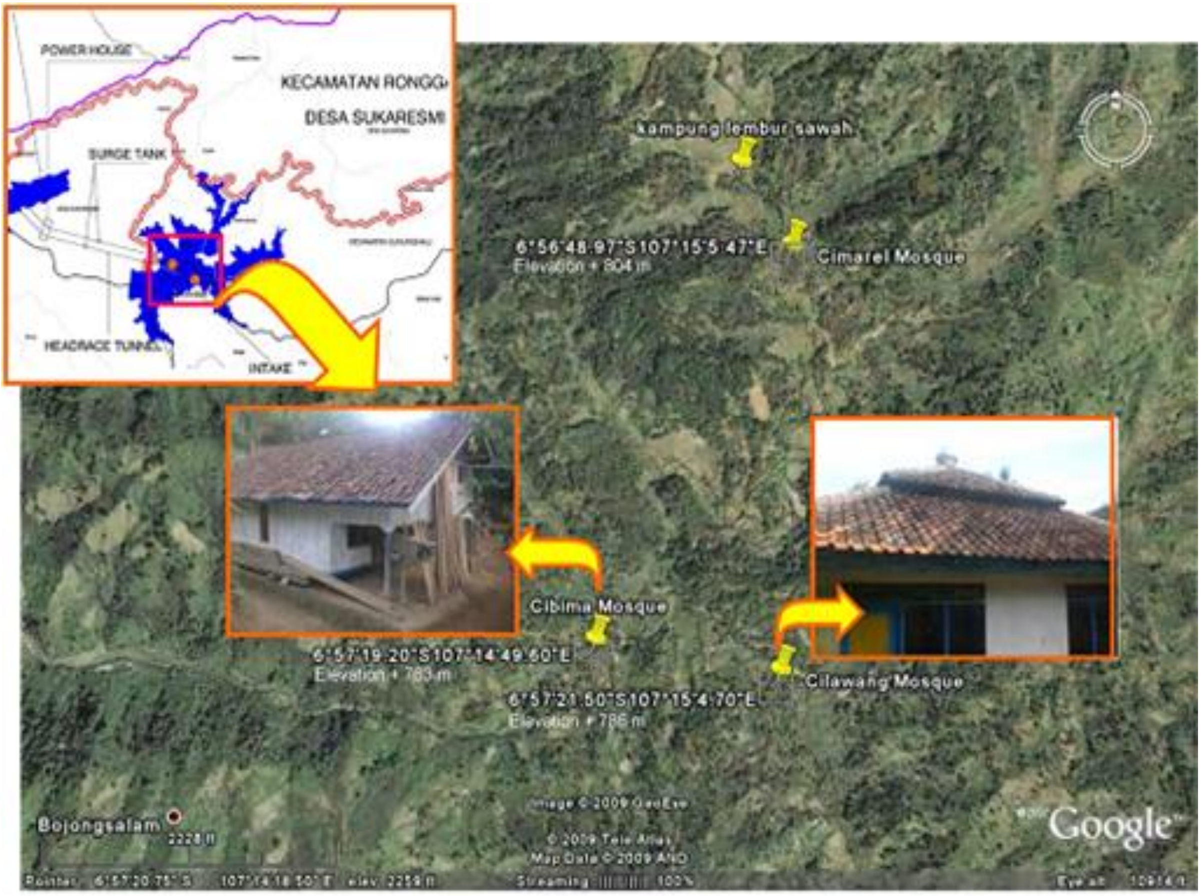


Appendix 32 Cultural Heritage Location

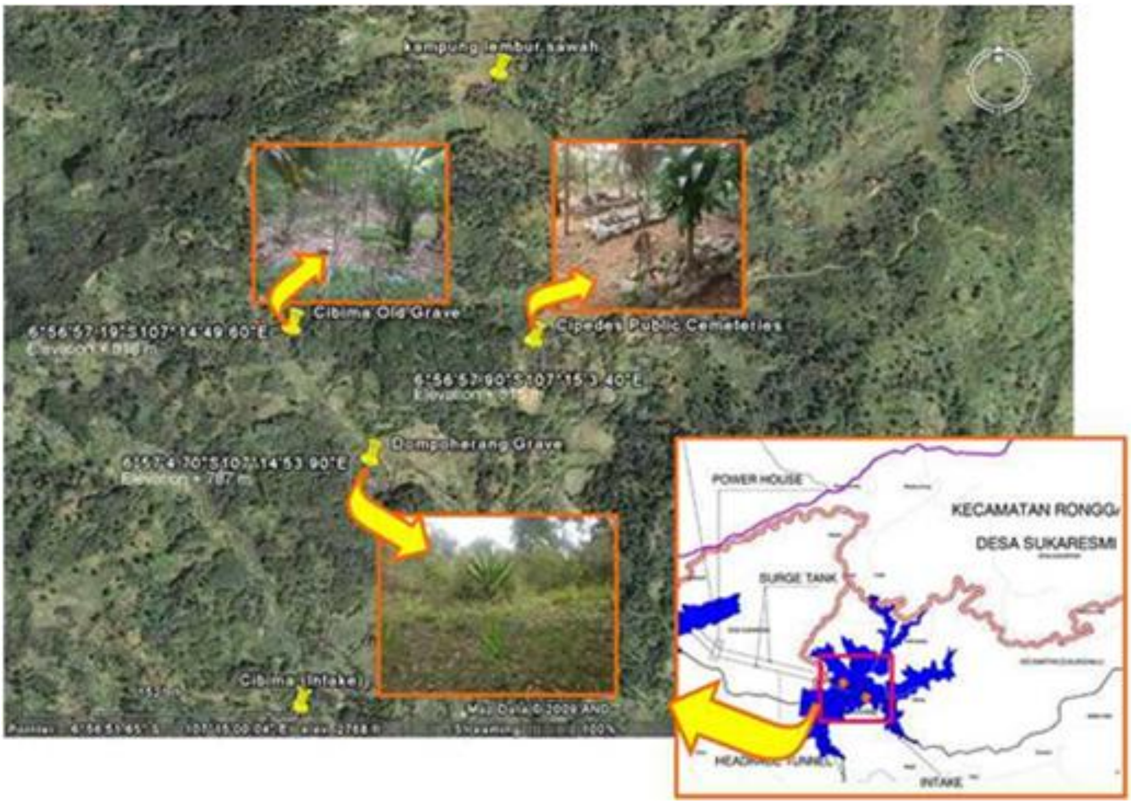
- Batu Bedil (Upper DAM)



- Mosque (Upper DAM)

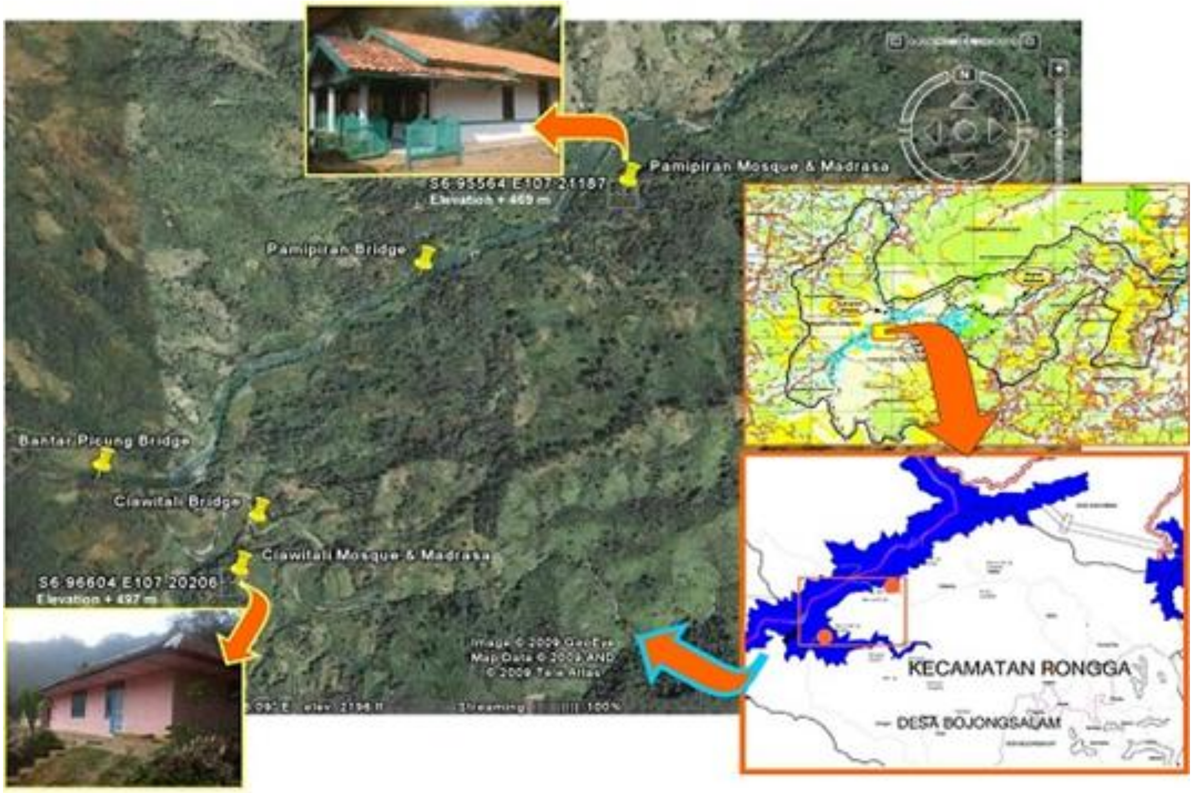


- Old Grave Public grave, Family grave (Upper Dam)

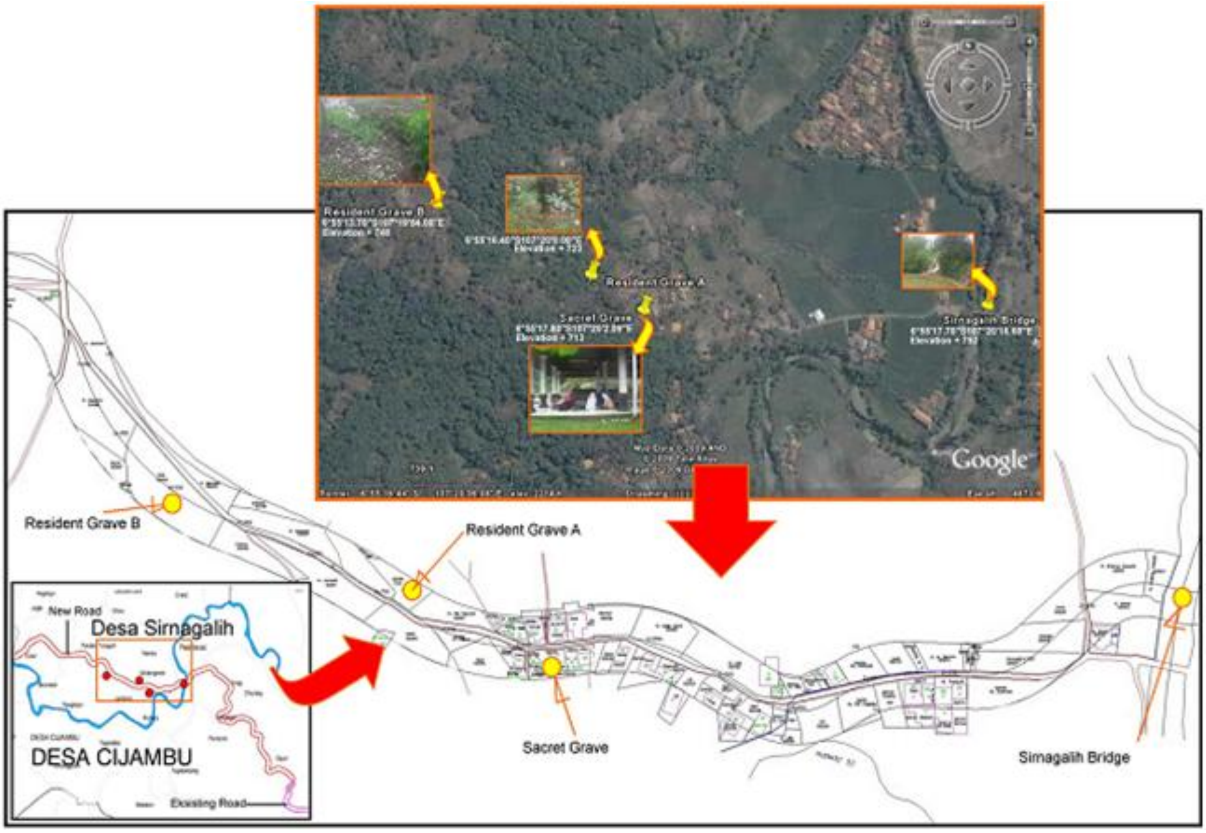


* Public Grave and Old Graves (Lower DAM)

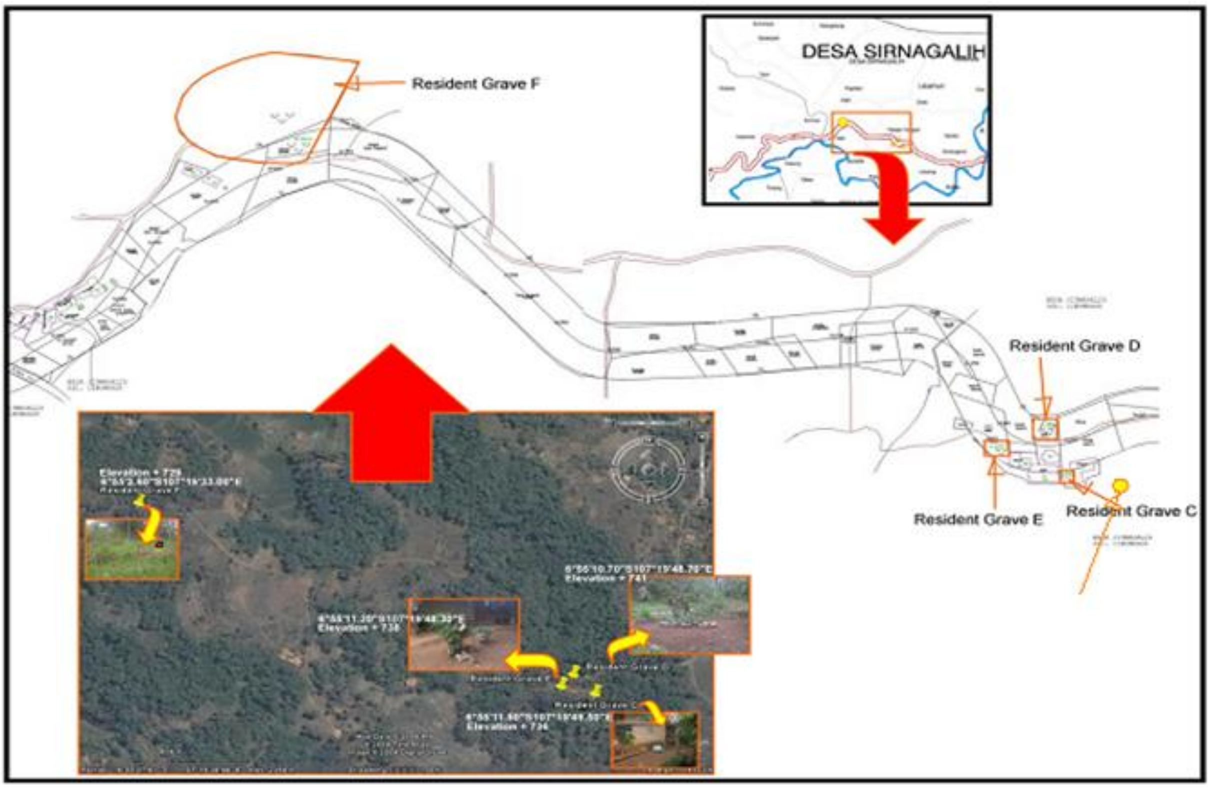
- Mosque dan Madrasah (Lower DAM)



- Graves and (Access Road and Basecamp)

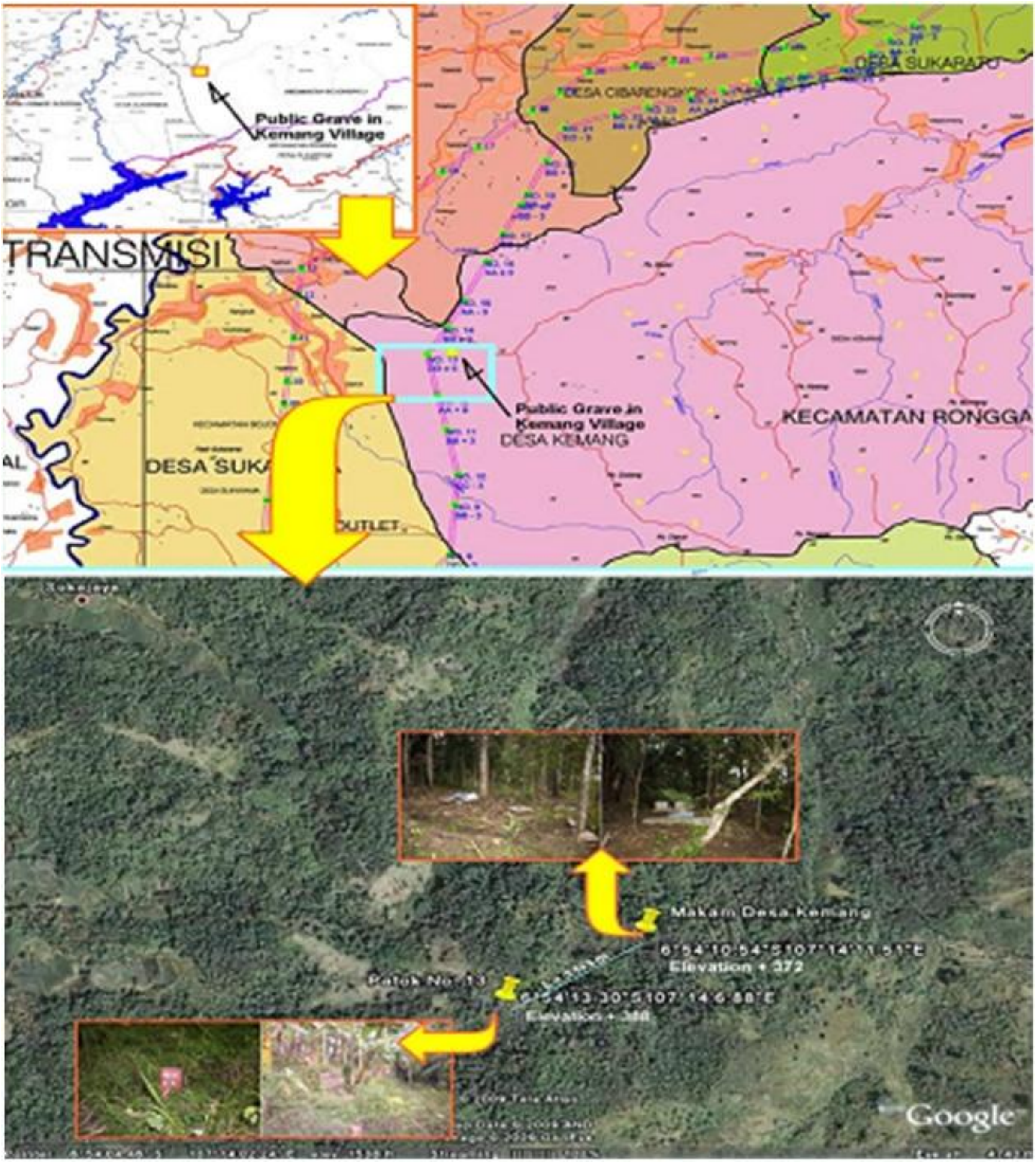


- Community's grave (Access Road and Basecamp Road)



- Mosque grave (Jalan Hantar dan Basecamp)

- General grave (Jalur Transmisi)



- Old grave and bridge (Jalur Transmisi)